Automatic Creation of TV Content to Integrate in Seniors Viewing Activities

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Abstract. The challenges and opportunities that arise with the increase of older populations are drawing the attention of several sectors of society, as is the case of the technological segment. The development of technical solutions to improve seniors' quality of life and promote their autonomous living is commonly found in the roadmap of research teams and companies. Reports and news show that the elderly feel several limitations and problems concerning the activities of finding and accessing credible information through technical solutions. Statistics and studies also reveal that older people have high levels of daily television consumption, which makes TV one of the ways with a lot of potential to inform seniors. Taking in consideration these two factors, it seems that information broadcast to elderly through television, without requiring a search activity, may be an idea with a lot of potential. In line with this, this paper reveals the process to define audio-visual content for seniors as well as a set of guidelines for the development of iTV platforms for this target group. Seniors' preferences concerning the sound and text elements were gathered in two different moments in two different Senior Universities in Portugal.

Keywords: Automatic · Interactive television · Design · Audio-visual content · Seniors

1 Introduction

The ageing population is one of the most successful human achievements that leads to a significant inversion of the ageing pyramid. Ageing is typically characterized by physical, psychological and social changes that can result in several problems [1, 2], but being old does not necessarily have to be synonymous of illness, disability, dependency, isolation and loneliness. The success of the ageing process is highly determined by intrinsic factors, individual determinants, income, economic security, health status, social services, participation and the surrounding environment [3, 4].

Maintaining social relationships and being alert of disadvantages and inequality situations is essential for a successful ageing process. However, accessing information concerning the world that surrounds us is mainly dependent on a proactive attitude of the individuals and the opportunities that the governments and societies create for them. Many seniors do not have the ability or the resources to search for information

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("pull-oriented" activity) available on sources like newspapers or the Internet, and also, a huge part of this population does not have the required literacy skills to perceive the information. This leads to a high informational dependence on their caregivers' network [5]. But, if the information was delivered in a simple way, with clear language, through a familiar device and without the need for search activities by the user ("push-oriented" activity), it can deeply ease this process and become a relevant solution to inform the elderly. Television is a transversal audio-visual media available in almost all homes, being an excellent information and entertainment medium for elderly people. Concerning this, developing a solution that combines the TV as a delivery medium and the ability to get information in several meaningful areas could represent a solution with great potential to promote seniors' autonomy, wellbeing and quality of life. In this context, the +TV4E project (Interactive Television as a support to information broadcast about social services for seniors) is being developed to promote the info-inclusion of Portuguese seniors through the transmission of video spots with informative content about social and public services. One of the key differentiating factors of +TV4E is the automatic video production based on web news.

In order to create a valuable product, easy-to-use and that fulfils seniors' needs, it is important to gather opinions from potential users through a participative design approach. This process includes, as an example, the definition of the preferred sound and visual elements that will be included in audio-visual content. This paper aims to propose guidelines to audio-visual content for seniors, as well as a set of strategies for developing Interactive Television (iTV) applications for this target group, resulting from participatory design sessions that may represent a support for further studies that involve the definition of digital platforms for seniors.

2 Theoretical Framework

The changes in the ageing pyramid have been greater as a consequence of the increase in the average life expectancy and the decrease in fertility rates [3]. In the 80's there were 378 million people with 60 years old or above all around the world. In 2010 there were 759 million people with 60 years old or above, and 901 million in 2015. It is projected that the percentage of elderly population growth will continue, reaching 1.4 billion in 2030, and nearly 2.1 billion by 2050 [6].

Portugal is not an exception and between 2001 and 2011 the percentage of Portuguese people with 65 years old and above increased from 16% to 19%. In 2015, the number of Portuguese inhabitants aged 65 or more surpassed the number of children and adolescents, which puts Portugal as one of the most aged countries in Europe [7].

The demographic changes require the attention of international organizations, governments and societies. The concept of "active ageing", defined in 2002, was one of the first manifestations showing the concern about the promotion of well-being for individuals in advanced life stages. World Health Organization (WHO) advocates that people living longer must be accompanied by continuous opportunities in 3 pillars: health, participation and security. WHO defines "active ageing" as the process of optimizing opportunities in those 3 pillars, in order to enhance quality of life of older people [4].

Older people should be encouraged to remain active in several life domains, like family, community, political, cultural and social [4]. In the last decades, television (TV) was one of the great discoveries and a change agent for societies. TV is the most used audio-visual media and reaches the podium in the list of preferences of Portuguese individuals [8, 9].

The latest data reveals that in 2010, the average daily consumption of television was 3 h and 29 min per each Portuguese viewer [10]. When analysing data disaggregated by age group, it is possible to see that people with more than 64 years old watch an average of 5 h and 8 min a day [10]. Considering this, TV is the device with greatest potential among elderly population, not only to enhance information acquisition and entertainment, but also to be used as an agent of socialization by promoting conversation between people [11].

Getting proper information may represent a key factor to face daily living challenges which is essential for an autonomous and independent ageing process, although, few recent studies have examined the information needs of the seniors [12]. The conducted surveys show that, in some countries, the needs of elderly citizens are essentially related to financial, housing, health, leisure opportunities, need for informational support on practical daily problems, security, transportation or affective issues [12–17].

Even though none of these studies focused on the informational needs of Portuguese seniors, in an empirical way, it seems to be a transversal trending that the elderly need information about health, finances, pensions and local policies. This information lack is influenced by the low literacy levels of aged Portuguese groups [18], as well as their low knowledge levels in fields such as health and finances [19, 20].

Regarding all these facts, in order to promote info-knowledge within the Portuguese elderly, an iTV platform is being developed by the +TV4E project [5]. This platform aims to disseminate information about public and social services for seniors, by interrupting the visualization of linear TV with audio-visual content about those services.

While developing a technology for seniors it is important to guarantee that the services and products are designed according to the concerns and expectations of the end user. Design iTV services, targeted to older people, granting high levels of accessibility and usability, is very important for the improvement of television "viewing" experience.

In this way, participatory design methodologies are appropriated to this context as they guarantee the commitment and empowerment of users in the definition of technological solutions [21].

The most evident characteristic of senior population is their multidimensional and distinctive way of ageing. As people age they face some degradation regarding visual, hearing and cognitive skills [5, 22] with heterogeneous tendency that enhances the importance of consider them in the design of any application or service oriented to a public with these characteristics. These age-related changes contribute to a decrease of comprehension of the surrounding world, due to the central nervous system becoming slower at processing information captured by the sensorial channels, which causes some loss of information [23]. An interactive system for seniors should be designed taking these factors into account, to become valuable to them [24]. The design of a certain iTV product should consider the target population's perspectives and needs based on their everyday life and how age-related impairments will affect its usage [25–27].

2.1 Hearing Perception Changes

By age 60, there is a 25% loss in ability to process and understand conversational speech due to auditory acuity decreasing [28, 29]. The supporting walls of the external ear canal show signs of atrophy and become weaker in later life, leading to a reduction of the "pre-amplification" effects which causes the seniors to receive sound signals in a relatively lower volume [28]. Czaja and Sharit [30] summarize the age-related changes in hearing: loss of sensibility to pure tones, especially high frequency tones; difficulty in understanding speech; sound localization problems; problems in binaural audition and higher sensibility to loudness. The authors also state that older adults take more time to process audio information [30].

2.2 Visual Perception Changes

Another important change related with the ageing process occurs in the visual abilities, with individuals facing modifications in the eye structure. The decreasing of the pupil diameter limits the amount of light entering the eye and increases the need for luminosity to have a better perception and visual acuity [23, 29, 31, 32]. Older people also experience a decline in adaptability, meaning that the eye's ability to adjust to different viewing distances and places with different lighting levels decreases [30]. Adjusting to near vision also becomes difficult because of the lens rigidity's increase [28, 33]. Also, the loss of contrast sensibility and chromatic distinction, especially violet, blue and green tones [29] and susceptibility to brightness are some of other visual age-related impairments pointed out by the same authors. These are changes that clearly bring some implications in designing an iTV interface as well as presenting information using audio-visual content.

The impairment of hearing and visual abilities profoundly marks the elderly overall performance [28, 33], and consequently affects their interaction with the surrounding environment. In general, for each impairment function there are several studies that define guidelines for the interfaces' design, as will be presented following.

3 Guidelines for Designing Audio-Visual Content

Seniors are willing to use technological systems, however, there are some barriers that can cause resistance, including lack of access, lack of knowledge about its potential benefits, lack of technical support, costs, fear of failure, complexity of the interface or interfaces that were, probably, designed and developed without considering their needs [27, 30].

As previously referred, there are biological and cognitive changes that occur as people experience the ageing process. Considering the goals of this study, visual and hearing impairments were given more focus. In this context, some design guidelines will be approached in this section, based on existent studies on web design and iTV's design for seniors. To simplify the audio-visual content creation process and later

implementation of the informative videos, it is important to collect design guidelines and later recommendations already tested and validated in previous studies within this scientific area.

3.1 Typography and Text

According to a BBC study, text is an element that brings challenges when used in the television screen due to, for example, screen resolution, brightness and also because users are not familiar with reading static text blocks on a screen. The exhibition quality of still images on television is poor, thus challenging also the audio-visual content creation [34].

To determine a minimum font size and taking in account that there are different screen sizes and resolutions as well as visual angles and distances from the viewer's side, the tasks reveals to be very challenging. However, the same author recommends that, given the age-related visual impairments in this public, the bigger the font the better [28]. In a more specific level, some authors state that the minimum body text should be around 12 pts [29, 35]. In contrast, Hansen [34] refers that typically body text, in any given circumstance, should be no less than 18 pts and Nunes, Kerwin and Silva [24] tested text's legibility through different sizes and consequently concluded that font size should be presented in a minimum of 40 pts for it to be accessible to the majority of senior users. Although Pereira [36] verifies on his study that most of the participants did not have any difficulties reading text with 15/16 pts size, the author recommends, if possible, a value between 17 and 18 pts since it's a safer option to apply.

Analysing all these standpoints, it is notable the lack of agreement between authors about what font size should be the most suitable or what size should be considered the minimum to be comfortably legible for seniors. Nevertheless, it is important to emphasize that some of these authors, specifically Farage [29], Fisk et al. [35] and Carmichael [28], based their conclusions in design studies for seniors but applicable to a diverse set of contexts of use which includes web, television or printed documents. On the other hand, Hansen [34], Nunes et al. [24] and Pereira [36] define design guidelines to television context. There are some factors like viewing distance, visibility's conditions and cognitive skills associated to sight that lead to a variability of opinions between researchers, which reveals the pertinence and importance in studying and testing this specific element.

In contrast, the font type is a variable with a much bigger confluence between studies. In general, decorative, cursive or serif fonts should be avoided due to being difficult to read and to understand [28–36]. Because of the age-related vision impairments these font types gain imprecise outlines generating blur-type effects that accentuate with the loss of visual acuity [28]. Pereira [36] also recommends avoiding typography that is too light or too thin as well as implementing two different font types at the same time. The recommended criteria can be verified on certain typefaces like Arial, Helvetica or Century Gothic. Authors also advise Tiresias Screenfont as it was specifically developed and designed for television display taking users with visual difficulties into account, including seniors [34, 36].

Beside font size and type, text blocks' distribution and visual configuration are another important element to keep in mind when defining audio-visual informative content for seniors. Pereira [36] highlights that spacing between characters should be around 30% more than the default value and text should be aligned to the left [24, 36]. Morrell e Echt [37] also suggests the use of short line lengths and left justified text. Spaces between text lines cannot be too narrow or else it can break the reading flow, so it is recommended to leave some space between lines and this way the adjacent lines do not interfere with the current line that the user is reading [34, 36]. Another component associated with text blocks, and important to highlight in order to assist the seniors' cognitive skills, is the amount of information displayed on the screen. Carmichael [28] establishes guidelines about the extension and the quantity of text blocks per page. The exhibited text must be as short and succinct as possible, since visual simplicity is fundamental. Confusion and information overload should be avoided so the content should be distributed through various pages if it is necessary [28, 29]. Beside these points, Pereira [36] also adds that a single page should not exceed a maximum of 90 words and recommends dividing the text into small fragments to be easy to read it.

Lastly, on the typography side, contrast is also an important element. The relation between text and the background is an indispensable variable on audio-visual content creation as well as on the information perception. From the analysed literature, the majority of authors do not disagree on their opinions. Generally, a high contrast (50:1) on the screen is advised (for example, white text on black background or vice versa) in order to increase legibility [29, 32]. High levels of contrast turn the interfaces more easily discernible for seniors with colour distinction problems and it compensates the lack of visual acuity, accentuating text legibility [24, 28, 36].

3.2 Iconography

Pereira [36] says that the iconicity's level is crucial for its comprehension. Iconicity's level refers to the relationship of resemblance or similarity between the representation of something and what is being represented, meaning that this is a property that determines the communication's efficiency of an icon. In the case of senior users, due to the age-related decline of cognitive skills like memory and the lack of familiarity with digital systems [37], this is an important variable to study in order to design representative and efficient icons. This information complements with Carmichael's [29] point of view who defends the benefit of figurative icons in contrast with abstract icons.

On the other side, seniors deal better with textual icons instead of pictorial icons as depicted in a study conducted by Rice and Alm and analysed by Pereira [36]. However, textual icons do not necessarily guarantee total efficiency for senior users, and so, the combined use of text and image minimizes possible difficulties related to written language caused by low literacy levels. Therefore, icons should not discard a written mention [38]. Text and image combination results in an understandable icon [24, 39]. Pereira [36] recommends that while designing an interface for an iTV application specifically for seniors, abstract iconography should be avoided as well as graphic associations of recent digital technologies like computers, smartphones, informatics applications or even the Internet. Using figurative iconography with the highest

iconicity level possible, not withdrawing either image or text and, finally, an efficient distinction between different icons are other design principles regarding iconography pointed out by the same author [36].

3.3 Colour

Colours play a fundamental role both for aesthetical and communicational purposes. Not only they complement orientation, structure and clarification of different visual elements but also facilitate the comprehension of information.

In general, television screens have a more limited chromatic spectrum and higher luminosity levels (gamma) than computer screens. This results in higher contrast and saturation levels during information/content display [34]. To achieve parity in terms of colour intensity, exhibited images should be darker and less saturated when passed from computer to television screen. Warm tones like intense reds and oranges can cause colour distortion when presented in TV screens.

RGB (the colour system used in televisions) values consist of three channels that vary from 0 to 255; pure white translates into 255/255/255 and pure black into 0/0/0. Hansen [34] recommends avoiding pure whites and blacks and thus the strongest white tone that should be used on television is around 95% or 240/240/240 in RGB. The same thing is recommended in black tones that should be around 5% or 16/16/16 in RGB gamma [34]. Like Hansen [34] and Lu [40] refer, to avoid colour associated distortions on television, these cannot be too bright nor too dark nor too saturated and should not exceed 85% in saturation and luminosity [40].

3.4 Sound

Carmichael [28] defends that using sound could be beneficial for seniors' perception of the information. Yet, as it was already said, natural changes that occur in the ageing process related to hearing lead to a need for considering specific cares when adding an audio layer to video.

Frequencies between 500 and 2000 Hz are preferable, according to Farage et al. [29]. High sound frequencies must be avoided in both speech and non-speech information and sound signals with at least 60 dB are enough to reach senior's ear [29]. Carmichael [28] states that, dealing with senior users, volume should be slightly higher than normal, yet not so loud that it can cause discomfort or annoyance to some users. The ideal is to set sounds in a higher volume than what is established to younger populations, but without causing discomfort to older people [28, 29].

Considering speech and discourse and based on literature, it is possible to argue that verbal information should have a predictable linguistic pattern with expected pauses at grammatical boundaries and a slow but respectful communication pace for an effective informational delivery to the senior [29]. Converging with this idea, clear and independent vocalizations should be used while assuring speech pauses [35]. Sound overlaps like the presence of background music, may interfere with the seniors' ability to hear and distinguish vocalizations. A significant difference between sound and noise

is necessary, so the message needs to be at a considerable volume with the background kept at a minimum. Also the volume should be adjustable [29].

Concerning the guidelines previously mentioned, there are several situations in which the authors do not agree. In these cases, the IT developer should choose and define an implementation strategy that can be preceded or followed by tests with the target audience. These tests help to gather opinions that can support the readjustment of the solution. Beside the concerns with the development of a platform that answers seniors' needs (mostly in result of physical impairments) the narration of the information content is also a worry of +TV4E's research team. In line with this, the use of a TTS tool is discussed below.

3.5 Automatic Audio-Visual Creation Supported by TTS Tools

The +TV4E goal of broadcasting informative content about social and public services to older people relies on video creation based on the design guidelines previously referred as well as in the results of participatory design sessions with seniors. However, these videos will be automatically generated by an algorithm that selects content from different web sources and builds audio-visual pieces on its own.

As the study main goal is to reach the best audio-visual approach to informative content, its conclusions will be extracted and used for the algorithm's development that will allow the automatic content generation to be viewed on seniors' televisions. Based on this idea, it is important to analyse some of the existent technological solutions that would contribute for the project's implementation. One of them is the use of a text-to-speech tool, enhancing the autonomous nature of this platform.

A text-to-speech system (TTS) converts written text into human voice. According to Oliveira [41], normal textual language is converted to artificial speech, implying that, before creating the artificial speech, the received text has to be analysed and transformed by the system into a phonetic transcription [41]. This is a tool that appears to be a good option regarding automatic content creation.

Between a diversified list of TTS applications, the research team selected a set as possible options for the +TV4E platform's implementation. Through a comparative analysis between different TTS applications, a selection process for the best and most suitable TTS tool was carried out, without forgetting the target population's needs. Among the tools, three of them were selected to possibly be the most suitable. The list includes Ivona[1] (affiliated to Amazon), ReadSpeaker[2] and Watson[3] (the IBM's solution). After carrying the analysis, Watson was quickly excluded since it did not offer Portuguese language from Portugal, therefore not being suitable for a system targeted to the portuguese senior population. ReadSpeaker and Ivona presented similar advantages and features, but the team concluded into a preference for Ivona. Despite detecting a lack of diction on some words with Ivona, ReadSpeaker's showed other

[1] https://www.ivona.com/us/about-us/company/.

[2] http://www.readspeaker.com/pt-pt.

[3] http://www.ibm.com/watson/developercloud/doc/text-to-speech/.

limitations that included lack of rhythm, reading and cadence which could possibly bring comprehension problems to older people. Plus, Ivona's speech sounded much more natural comparing to the other tools. Therefore Ivona was the selected tool due to its natural sounding speech and the offer of both male and female voices. Despite all the data gathered concerning the design guidelines the team decided to enrich it with the target population's opinions and preferences. The project aims to guarantee a positive and comfortable experience to seniors, and therefore having older people participating in collaborative design sessions to analyse and evaluate different audio-visual approaches was thought to be essential.

4 Methodology

To create a valuable service, a participatory design approach with seniors has the potential of contributing to simplify the future integration and use of that service in older people's house. Based on different video content definition ideas, with some auditory and visual elements already pre-defined, participatory design sessions were held in collaboration with a group of senior students from both Senior University of Curia and Senior University of Cacia. The participants were invited to give their opinions about the audio-visual elements proposed and thus contributing to its design's improvement. For the setup of these sessions, a preparatory work was done with a group of four specialists in the technologies and iTV fields to define the functionalities that should be present in the +TV4E platform. The process with the target audience consisted of four key moments: two group sessions that aimed to collect information about sound elements, and another two in order to gather data regarding textual elements. The sessions that analysed the sound elements addressed a total of 22 elements (11 from each University), and the other sessions that evaluated the text component included a total of 19 participants. Details on the participants are presented on Table 1.

The order for the data collection moments was established according to the Universities and students' availability, and resulted on the following alignment: (1) Focus Group (FG) with specialists in iTV (n = 4); (2) group sessions with seniors (Curia) for sound evaluation (n = 11); (3) group sessions with seniors (Cacia) for sound evaluation (n = 11); (4) group sessions with seniors (Cacia) for text evaluation

Table 1. Participants distribution, n (%)

	Sound group session		Text group session	
	SU CURIA	SU CACIA	SU CURIA	SU CACIA
Male	2 (18%)	4 (36,4%)	1 (83.3)	2 (15.4)
Female	9 (82%)	7 (63,6%)	5 (16.7)	11 (84.6)
Total	11	11	6	13

(n = 6); and (5) group sessions with seniors (Curia) for text evaluation (n = 13). The use of two different places for data collection ensured a greater number of opinions and

the diversification of the participants considering different influences of the surrounding environment.

4.1 The Evaluation of Sound Elements

The two first moments were focused in testing sound elements, firstly with seniors of Curia and then with seniors of Cacia. Each moment was structured to consider two variables, specifically gender of the voice-over and the use of background music. Firstly, two approaches were presented to seniors: one with a male voice and the second with a female voice, both generated by Ivona's TTS tool. After the participants' contact with the two samples, they were asked about their preferences. Their answers were collected through a method of symbolic voting (raising hands) and consequently registered by the researchers. Secondly, to test the use of background music, seniors were again presented with two different options: one video playing an instrumental background music with a relatively low volume while the voice-over was reading the informative content in a higher volume, and the second example without any music whatsoever, being the voice-over the only sound element. The same method of symbolic voting was used to inquire seniors about which option they thought would be the best.

4.2 The Evaluation of Text Elements

Regarding audio-visual presentation of textual information, font type and font size were selected as the variables to test.

In the first group session, held at the Senior University of Cacia, the participants were presented with three different font faces, previously selected based on the design guidelines gathered in literature review: Arial, Helvetica and Tiresias Screenfont. Each font was complemented with short sentences applied in both dark and bright backgrounds as well as coloured background. This time, they were inquired through individual questionnaires (supported in paper) asking them to choose one font type concerning the reading difficulty, its appropriateness to the video's context and finally, they were asked to choose the best font type globally. The same method was used in order to collect data about font size.

In the literature review there was little convergence between authors in establishing a minimum font size, concluding that this depended on contexts of use, different viewing distances or visibility's conditions. So, the font size was considered important to test in the project's context. The participants were presented with five different font sizes, on a range between 40 and 60 pts [24], so that they could choose on the questionnaire which one was easiest to read and which one was most suitable to the video context.

Despite the data collection approach used at University of Cacia, this proved not to be as effective as the previous method used in the sound testing sessions, the voting by symbolic process. There was some difficulty for the participants to answer the questionnaires individually without monitoring. Plus, right after the answering process, when asked for an opinion, a lack of coherence between opinions was noted.

Fig. 1. Group session for text elements evaluation

In line with this, the research team decided that in the second moment regarding font type and size held at the Senior University of Curia (see Fig. 1), the data collection should be done with the voting by symbolic process.

This fourth and last moment in collaboration with Curia's senior students, the same options presented in Cacia were presented to them regarding font size and type. Still this time, the three different font types (Arial, Helvetica and Tiresias Screenfont) were followed by an example sentence on a single coloured background only. Regarding font type, and unlike in Cacia, the participants were only asked which one was the easiest for them to read. The font size, instead of the questions made in Cacia, they were only asked the minimum size they could read without making any effort.

5 Results and Discussion

In this section, will be presented the achieved results as well as will be discussed the outcomes.

5.1 Sound Elements

A total of 22 individuals participated in the group session that analysed the sound elements, namely the voice-over gender and background music. Regarding the voice-over gender, the individuals were invited to answer the question "Which voice gender did you find most appealing?". Most of the individuals (n = 15), around 68.2%, chose the female voice. No references were found in the literature concerning this topic, which makes this decision dependent on the sensitivity and preference for each one.

The background music in the informational video spot was the second sound element targeted. The video spot's exhibition without background music was the chosen scenario by the majority of the inquired seniors (63.6%). Two of the total respondents (9.1%) had not been able to define a position concerning this feature. These results corroborate the design guidelines defined by Farage and colleagues [28] who suggest that the use of overlapping sounds can interfere with the seniors' speech comprehension. Despite seniors' preference to eliminate the background music on video spots, this element seemed to lend credibility to the voice-over. Concerning this, and considering the design guidelines in literature [29], the research team decided to maintain the background music in the minimum volume and increase the volume of the main message voice (to create a more appealing video).

5.2 Text Elements

The evaluation of text elements was focused on the font type and size. As referred, the analysis of this feature was followed using different methodologies (through inquired and symbolic voting process). Nevertheless, it was guaranteed the match between the questions presented to the participants.

Tiresias was the preferred font type, with 52.6% of the votes, in a sample of 19 participants. Helvetica collected five votes (26.3%), followed by Arial with only four (21.1%). These results are congruent with the guidelines found in literature that suggested the use of sans-serif fonts. The results are in line with the argued by the authors that referred Tiresias as one of the most suitable font types to people with visual impairments [34, 38].

The opinions concerning font size were sparse. It should be noted that in Cacia's University the seniors answered two questions "The easiest-to-read font size was…" and "The font size that best fit the video was…". In Curia's University, the seniors were invited to answer the question "What is the smallest font size you are able to read without effort?". With 5 votes each were 40, 50 and 55 pts, followed by 45 pts with 4 votes. Taking all participant's comments into account as well as their reactions pointed out in the fieldwork, the research team decided to implement 55 pts to the font size in the video spots. This option will be later tested in real context with seniors.

6 Conclusions and Future Work

The co-creation process enhances the possibility that a technological solution in development process answers the needs and expectations of end-users. It is very important to promote the engagement of possible end users since the initial stages of a product's development, namely in the definition of technical requirements, available functionalities and in the design (which includes, for example, sound and graphic elements). To assure a positive and comfortable experience when receiving information about social and public services through iTV, participatory design sessions were held, with a sample of Portuguese seniors.

From the four moments that aimed to define the preferred sound and text elements' use it was possible to get the following results: preference for a female voice, for an instrumental background music with a relatively low volume while the voice-over is reading the informative content in a higher volume and use of Tiresias Screenfont at 55 pts. After the definition of these elements, other variables will be further tested in order to set the complete group of guidelines for building audio-visual content to +TV4E project context. Concerning this, tests are planned to analyse the use of a background image, use of colour to distinguish the different informational main areas (for example, social, health, finances, etc.), iconography and speech speed. Afterwards, in the +TV4E platform development's context, the next step will be testing and evaluating the developed prototype with seniors, in real context. Therefore, a set-top-box with the +TV4E application will be installed in the seniors' home, but allowing them to watch television without disturbances in their usual routines. This platform will provide the six TV channels available in the Digital Terrestrial Television system in Portugal. This process will not involve any financial costs for the participants.

One interesting conclusion that resulted from this work was the need to adapt the data collection approach used with seniors. It was notorious that what the researchers considered to be the most adequate method, based on the literature, was not the most efficient with the population. Thus, changing from the questionnaire approach to the method of symbolic voting was one of the adaptations required. It is not possible to predict the reaction of the participants to different methods of data collection, however the ability to adapt the process in order to obtain data with quality in the simplest way is desirable.

It has also been observed that older participants show increased difficulties in focusing attention on the subject under analysis and are easily distracted by unimportant information and get tired quickly. In this way, it is essential to prepare fast and concise sessions for data collection. The researcher promoting the evaluation must also be able to adapt and manage the dynamics effectively, without losing the purpose of the session.

The reduced sample is one of the limitations of this study. This is due to the difficulties in recruiting elderly individuals to participate in the study mainly regarding to limitations in time frame of the project. It is assumed that this fact inevitably affects the achieved results, however it is expected that this will be attenuated with the planned future work.

As future steps, the research team intends to test the videos (created considering the audio-visual elements detailed in this study) delivering it through the +TV4E platform. These tests will allow refining video elements according to the seniors' inputs. Afterwards, cultural probes will be held with potential final users, recruited in another context, during a certain period of time (further defined). The inputs gathered in this phase will be essential to readjust the studied aspects (text and sound) in the final informational videos format.

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