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Iconography's development for a seniors' iTV informative platform

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Abstract

Technological solutions, namely interactive television (iTV) applications, have a lot of potential to deliver adapted solutions to wider audiences or to specific groups of users. Elderly can be one of these groups but require a special attention by specialists due to their specificities. One of the central questions to develop pleasant and usable technological solutions is the iconography used in the applications, as graphical interface elements. To make icons appealing and perceptible visual representations, with a high degree of iconicity ensured, it is important to design them taking end users' inputs into account. This paper reports on the iconographic design process and its results, carried out in the scope of an academic project that aims to develop an iTV platform for seniors. The purpose of the icons is to support users to perceive, visually, the area in which the information sent through this platform belongs to. After developing three icon proposals per each one of the seven areas of information, the proposals were presented to a group of 19 elderly people who, through election voting test, defined their preferred options. In this work it was also possible to validate a process that can be applied to similar studies.

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Keywords: iconography; design; elderly; interactive television applications.

1. Introduction

An icon is epistemologically defined as an image, but it has been becoming polysemic over time¹. With the technological advance in the last decades, the word “icon” gained three new dimensions, a technological, communicational and social one. The arising of graphical user interfaces led to the translation of digital information

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into visual language. In this process, the use of metaphors and associations based on communication is crucial, enabling an understanding of abstract concepts. This way of communicating is not entirely exclusive to digital contexts, it was implemented by various people over the course of history, in different ways and contexts¹. Icons have been an essential component to the desktop computer interaction paradigms, as well as on mobile devices and contemporary touch-based interfaces operation systems, like Apple iOS and Google Android, enhancing their dominance as a component in the majority of future user interfaces¹. In this line, icons are important graphic elements that possess communication potential, directly interfering in the interaction's quality and affecting the user's experience, becoming essential for both experienced users who use graphic interfaces daily as part of their routines and people with less knowledge about it (lower digital literacy) but could sporadically use it¹.

Due to technological globalization, some individual and collective's needs can be met through digital technologies, such as informational needs about available services. Concerning demographic trends verified in the last decades, older people are one of the groups that attracts enterprises, governments and societies' attention. In line with this, television (TV) is the most important audio-visual device in Portuguese seniors' daily life, and is considered to be an excellent information and entertainment medium². A decade ago, the European Commission recognized the important role that interactive television (iTV) could play, by providing public entities with the means to make Information Society services accessible to all citizens³. Combining the popularity of traditional TV among seniors with the personalization and communication capabilities of iTV, a technological basis with an enormous potential for the creation and application of gerontechnological solutions has been emerging.

Regarding the informational needs of seniors related to social and public services⁴, the +TV4E project (Interactive Television as a support to information broadcasting about social services for seniors) is being developed to promote the info-inclusion of Portuguese seniors with informative content in this field². The platform allows the enrichment of the television experience by interleaving the normal broadcast with informative video spots, which are automatically produced, with a user-centered approach featuring the integration of assistive technologies and multiple multimedia communication channels. The information presented in the videos is aggregated into seven macro-areas of interest, previously studied with experts in public health and public policies, as well as with a sample of Portuguese seniors, titled *Assistance Services of General Interest for Elderly (ASGIE)*⁵. These seven areas are: (1) health care and welfare services; (2) social services; (3) financial services; (4) culture, informal education and entertainment; (5) security services; (6) local authority services and (7) transport services. To allow users to quickly and easily identify the informational area in which the video presented belongs to, a specific icon associated with each ASGIE will be shown as an introduction to the video spots. In addition, each ASGIE will also have a unique background colour, that will help the viewer to develop anchor elements concerning the information areas. In the scope of this study, the terms ASGIE and macro-area of interest will be used with the same meaning.

Design techniques based on sessions with target users are essential to develop adapted and personalized projects since they involve and engage, from the beginning, potential final users in the construction of numerous interface components, ensuring that the final product meets the needs and expectations of individuals and consequently the quality and use of the product. Therefore, the present paper aims to report the design process and results that will represent each one of the macro-areas of information available in the iTV platform developed under +TV4E project. In addition to the present introduction, this article is organized in the following parts: section 2 presenting a theoretical framework regarding icons' design for digital platforms; section 3 which illustrates the methodological steps followed to define the icons that will identify each of the ASGIE; section 4, where the obtained results are presented in detail. Finally, section 5 presents a discussion of the obtained results as evidenced by some of the conclusions drawn from this study.

2. Theoretical Framework

To the senior population, the development and design of representative and efficient icons is of extreme importance due to normal declines related to the ageing process. These modifications should be taken into account when developing digital systems⁶. Since this paper focuses on designing and implementing iconography to distinguish different informative areas about public services, it seemed suitable to take visual age-related changes into account.

2.1. *Changes in visual perception*

An important change related with the ageing process occurs in the visual abilities, since individuals are faced with 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 in order to have a better perception and visual acuity^{8,9,11}. 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; adjusting to near vision also becomes difficult as a result of the lens rigidity's increase^{12,13}. Also, the loss of contrast sensibility and chromatic distinction, especially violet, blue and green tones⁹ 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.

2.2. *Icons guidelines*

Icons can be used to help users represent visual and spatial concepts, to save space, for immediate recognition or better recall, so that users do not have to read, among other reasons referred by Horton¹⁴. The author also states that an icon can be used anywhere a word label would be used, whether to activate menus or perform actions and select tools. An icon can transcend the language barrier and represent meanings in a synthesized and condensed way¹.

Some of the guidelines for iconography design gathered by Cardoso¹ were based on recommendations given by Human-Computer Interface authors and on norms from International Organization for Standardization about icons for interfaces. To summarize these guidelines, a set of icons should be coherent and consistent, displaying a similar graphic style; the icons should be able to adapt to different display screens and resolutions, controlling the other visual elements and concerning the context they will be appearing; their comprehension must be simplified, meaning that an efficient icon should be unequivocal, distinct, memorable, coherent, familiar, legible, compact and appealing, in order to avoid misinterpretations; textual elements should be used as an accompanying component; in case of animating an icon, the animation should not reduce its comprehension; the use of colours should not be the only distinguishable element and testing the icons with final users is the last recommendation referred (as referred by Cardoso and colleagues¹).

Pereira's⁶ study concerning design guidelines and principles for iTV interfaces oriented to Portuguese seniors, supports that the iconicity level of an icon is essential for its comprehension. Iconicity level indicates the similarity between something and how it is represented, a property that determines an icon's communication efficiency. In the older users' case, the declining of age-related cognitive abilities and their low familiarity with digital systems⁶, is a variable that reveals in the importance of conceiving representative and efficient icons. This information is complemented with Carmichael's⁸ point of view who defends the benefit of figurative icons' in contrast with abstract ones, referring to icons that more visually and more accurately embody the object they intend to represent.

On the other hand, Rice & Alm conducted a study, in 2008, in which seniors dealt better with textual icons rather than with pictorial icons (as referred by Pereira⁶). However, textual icons don't guarantee total efficiency for senior users, and so, the combined use of text and image minimizes difficulties related to written language that some of these users face due to their low literacy levels, resulting in an understandable icon^{1,16}.

Pereira's⁶ study concluded that abstract iconography should be avoided, as well as graphic conceptions associated with recent digital technologies such as computers, smartphones or software apps. Other highlighted principles are based on adopting figurative iconography with the highest iconicity level possible, not withdrawing either image or text, and an efficient distinction between the icons⁶.

2.3. *The need to test icons*

The designing of easily understandable icons that represent what it intends to communicate is fundamental when developing platforms with high levels of comprehension. The fact that icons communicate actions and represent concepts in a visual way makes designing them a complex process. For senior population, the development and conception of representative and efficient icons is very important considering the cognitive capacities' decline, such as memory, associated with low familiarity with digital systems⁶.

Although the literature approaches icons as action buttons, which consist in graphic and visual concepts associated with some sort of interaction and images that trigger a certain behavior on a system, in this project context they are important, not as action callers, but as a way to conceive identity to each one of the seven ASGIE: health care and welfare services; social services; financial services; culture, informal education and entertainment; security services; local authority services and transport services.

The use of icons (along with base colours) to distinguish the type of informative content reveals itself to be essential to the visual aspect of the platform when it comes to introducing and presenting the informational videos. Also, in the video library feature, the user can associate the icon on the video thumbnail to the respective ASGIE. Even though the icons were not designed to become buttons, they are useful by making the platform more dynamic and appealing, as well as contributing to its overall organization.

Even though icons are presented as a universal language, this can be a controversial point of view. Some authors defend that an icon's efficiency is influenced by context and different populations can have diverse expectations about an icon, because of cultural, educational and environmental backgrounds¹⁷. According to Horton, to communicate complex meanings through icons, the viewer must be exposed to a collection of symbols and each one of them must trigger the intended idea, evoking the desired meaning in the viewer's thought¹⁴.

The understanding of icon language is optimized when the system designer and the user associate the same meaning to the image transmitted by the icon. However, the user and the designer can have different perspectives concerning the system where the icon will be implemented¹⁷.

In the context of the project, in order to evaluate the icons that symbolize each of the ASGIE, a test was conducted as explained in the following section. This data collection moment aimed to analyze the relevance and perception of each of the proposed icons for the seven ASGIE to be adopted in the iTV application.

3. Methodology

The present study is being developed under a larger on-going academic research project. +TV4E project proposes an iTV platform that delivers personalized informative contents, through video spots, about social and public information for Portuguese seniors. All videos, regardless the macro-area of interest information (ASGIE), have a similar structure, typically composed by five components (see Fig. 1). The system checks regularly if there is new informational content on the sources that feed the platform, generating new high-valued informative videos. These are then injected into the linear television presentation flow. At this moment, the regular TV broadcast is locally paused and resumed after the presentation of the informative video concludes. As the linear television flow is interrupted, the informative video playback starts with the following ordered sections: (1) intro card with +TV4E logo animation, with a plain colour background; (2) card with the logo and a conforming colour background that identifies the ASGIE targeted by the video; (3) video with the corresponding title, description and background images, specific to the macro-area of information; (4) project logo with one of the ASGIE related background images and (5) a final card (project logo with a plain colour background) to end the video.

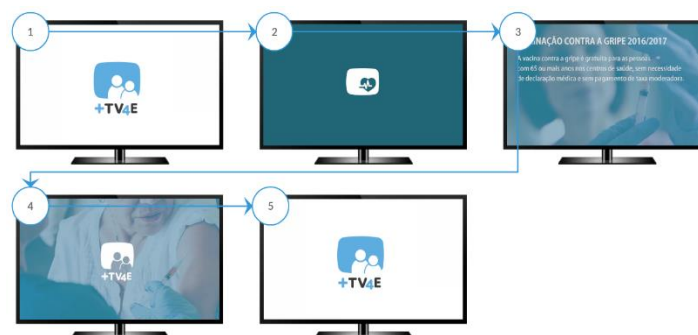











Fig. 1. Components of the informative video structure.













The present paper shows the iconography design process for the videos displayed under the +TV4E project. To achieve this, three key moments were held: (1) literature review on icons’ design guidelines and criteria for an interface for older people; (2) drawing a set of three suggested icons for each one of the seven ASGIE; (3) design sessions with a group of seniors to check the preferred icon for each ASGIE.

After carrying the literature review under the icon designing process for interfaces targeted for older people, one of the research team members, with experience and sensitivity in visual and design issues, developed three icon proposals for each one of the specific macro-area of information. During the icons’ design process, as mentioned in the literature, non-abstract icons were developed, with real and common elements of citizens' everyday life⁶, as well as distinguishable alternatives for each ASGIE. For example, for the health services area, three elements easily associated with the medical area were considered (a stethoscope, a writing board and a heart with a vital sign), although they have different concepts and can be visually distinctive. Therefore, as previously mentioned, it was considered essential to present the developed icons to a group of seniors, potential users of the +TV4E platform, to check which icon better represented the ASGIE in analysis. Considering the time constraints inherent to project deadlines, a convenience sample was selected through a non-probabilistic sampling technique. A formal invitation was sent to several Senior Universities, in Aveiro and neighboring cities, for their students to integrate this sample. The selection of these places for data collection guaranteed easy access to a considerable number of seniors with knowledge in information and communication technologies, due to their attendance in Information and Communications Technology classes, which assured the collection of structured and informed opinion. Later, the research team held a session to present the project to two Senior Universities’ students who agreed to collaborate in the study and were, then, invited to participate in subsequent design sessions for the definition of interface elements. Everyone who was in this presentation moment accepted to participate in the design sessions. Along with this process, other sessions were promoted, namely, to test sound (background music and gender of the voice-over), textual (font type and font size) and interaction elements in the iTV platform. During these trials, the need to validate a specific icon to identify each ASGIE occurred and, at this point, individuals were already fully familiar with the project and with the research team elements.

The icon design process includes several steps, procedures and techniques that according to Horton, as referred in the study of Cardoso and Ramalho¹⁸, should be set in an iterative and cyclic process developed in cycles. However, this process requires a continuous involvement with several end users. In the context of the +TV4E project, and considering that all elements presented in the platform are designed and tested with potential end users, not all phases recommended by Horton were followed, as referred by Cardoso and Ramalho¹⁸. Hence, an Election Test was used concerning the icon definition, where the participants selected, individually, the icon that, between a range of alternatives, seemed to be the best representation of the concept¹⁸. In this way, to define the icons for each macro-area of interest, two design sessions were held with a group of senior students from both Senior University of Curia and Senior University of Cacia. The participants were presented, on a TV screen, with a set of three icons for each one of the seven ASGIE (see Table 1), previously elaborated and established.

Table 1. Proposed icons for each ASGIE.

ASGIE	Option 1	Option 2	Option 3
Health Care and Welfare Services			
Financial Services			
Social Services			
















Culture, Informal Education and Entertainment			
Local Authority Services			
Security Services			
Transport Services			












Afterwards, participants were individually invited to select their favorite icon for each ASGIE in a paper supported survey. It should be noted that the presented icon alternatives, both on TV screen and on paper support, were arranged in a circular form to avoid influencing the participants opinions, which tends to occur when the possibilities are provided in a linear way. It should also be referred that the specific ASGIE was identified and the seniors had to select only one icon from the three options. The test was carried out in this manner instead of asking the seniors to identify the ASGIE and the correspondent icon to simplify the process. These sessions regarding icon elements occurred in March 2017 and, in total, addressed a sample of 19 elements (11 from Senior University of Curia and 8 from Senior University of Cacia), where 13 individuals were female (68%) and 6 were male (32%) with an average age of 67,2. The following section presents the results that fundament the icon choice for each macro-area of interest on public and social services.

4. Results

The design sessions reported in this article aimed to define the icon that, in the opinion of a seniors group, better represented each ASGIE in the +TV4E platform. In the cases where there was no clear positive feedback, users were able to suggest alternatives. Accordingly, in this chapter, the results of the two sessions for iconography design will be presented, through a descriptive analysis that accounts with a total sample of 19 participants (Table 2).

Table 2. Descriptive results for each proposed icon by ASGIE (n (%)).

ASGIE	Option 1 n (%)	Option 2 n (%)	Option 3 n (%)	Proposed Option A n (%)	Proposed Option B n (%)	Proposed Option C n (%)	Abstention n (%)
Health Care and Welfare Services	 5 (26.3)	 2 (10.5)	 12 (63.2)	---	---	---	
Financial Services	 1 (5.3)	 18 (94.7)	 0 (0.0)	---	---	---	
Social Services	 0 (0.0)	 11 (57.9)	 8 (42.1)	---	---	---	
Culture, Informal Education and Entertainment	 0 (0.0)	 8 (42.1)	 2 (10.5)	 3 (15.8)	 4 (21.1)	 1 (5.3)	1 (5.3)

Local Authority Services	 6 (31.6)	 4 (21.1)	 1 (5.3)	 8 (42.1)	---	---	
Security Services	 9 (47.4)	 7 (36.8)	 1 (5.3)	 1 (5.3)	---	---	1 (5.3)
Transport Services	 7 (36.8)	 11 (57.9)	 1 (5.3)	---	---	---	

From the results on Table 2, it is noticeable that in all the ASGIE, more than 40% of the sample agreed with one of the icons' suggestions. Generally, the obtained values indicate that the developed icons can be used to represent the areas.

The icons that most pleased the participants were the ones regarding Financial Services, gathering almost 95% of the votes, followed by Health Care and Welfare Services (63.2%), Social Services and Transport Services, both with 57.9%. Although, in some macro-areas of interest such as Culture, Informal Education and Entertainment, Local Authority Services and Security Services, some participants recommended combining two of the proposed icons to better represent the mentioned ASGIE. For example, in the Local Authorities Services, 8 individuals (42.1%) suggested that the final icon should merge the parliament design with the flag one.

Concerning the collected data from the design sessions, small reformulations in some of the selected icons will be implemented, considering the gathered seniors' opinions.

5. Discussion and Conclusions

Developing a certain product for a digital medium directed to a specific target group of users, implies to worry about their needs and optimize the interface based on evaluation and tests, in order to create a good quality system as a whole.

Despite the guidelines evidenced in literature for icon construction, sometimes the elements displayed on digital interfaces divide opinions among final users. Each person has different ideas about the aspects that surround him/her and visual representation creators/designers have the challenging task to develop icons that are self-explanatory, easily perceived and unambiguous¹. The evaluation of these components focuses on visual appearance¹ which is strongly influenced by personal factors, however this step should not be overlooked, especially when the users are seniors.

Relatively to the chosen icons to be effective on the +TV4E platform associated to a specific ASGIE, it was observed that at least one of the three options presented was easily perceived by elderly participants. The icon that could represent the macro-area of Culture, Informal Education and Entertainment was the hardest to chose, with about 42% of the sample suggesting new combinations and 5.3% (n=1) saying that none of the icon proposals were adequate enough. The same happened with two other macro-areas (Local Authority and Security Services), although with less frequency. In these three cases, the research team is currently working on the process of improving these elements as suggested by the elderly.

The lack of representativeness of the sample is recognized, however, it seems that the achieved results are concordant. The approach used in the present study to define a set of icons was considered appropriate for both the target audience and the kind of project in question. The simplicity in the presented iconography, the flexibility and empathy in sessions with seniors and the presentation of icons for each ASGIE in a circular distribution, were key aspects that determined the quality of the achieved results and should be taken into account by other researchers that aim to define icons to be used in similar contexts. As future work, appropriate reformulations are expected to be made in some of the selected icons that will be implemented, and after that, the reformulated and final icons should be presented to the same participants in new design sessions.

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