

Inclusive Participatory Workshop: Accessible Iconography Design

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ABSTRACT

The World Report on Disability, produced jointly by the World Health Organization and the World Bank [1], states that about 15% of the world's population experiences some form of disability. This represents approximately 1 billion people who struggle with the lack of services and face many obstacles in their daily activities, including those related to the access and use of ICTs (Information and Communication Technologies), drastically enlarging the “digitally excluded” population. To help address the digital divide, a Brazilian electric utility company is designing and deploying a high-tech, user-friendly, inclusive customer service facility aimed at rendering a wide range of services by means of several gadgets such as interactive panels, tables, tablets, and ATMs (Automated Teller Machines). For doing so, the applications to be developed and run on those devices and terminals will need to be carefully studied and previously tested in order to meet the needs and expectations of the target audience. This paper describes an interactive and participatory workshop to carry out a collaborative icon creation process for the interfaces of such applications, thus contributing for a better navigation experience.

KEYWORDS

Participatory design, icons, iconography, accessibility, digital inclusion

1 INTRODUCTION

According to the studies of the World Health Organization and the World Bank [1], about 15% of the world's population lives with some form of physical or sensory disability. This means that approximately 1 billion people suffer from some kind of impairment, which is likely to hinder their access to information and communication technologies.

Considering this scenario, one of the largest electric utility companies in Brazil¹ is carrying out, in partnership with the Telecommunications Research and Development Center – CPqD, a project to create and develop innovative user-friendly solutions to serve all kinds of users. The target audience includes people with some of the most common forms of disability, such as visual, hearing or motor impairments, as well as individuals with temporary mobility impairment and age-related disabilities, and even those with difficulties caused by insufficient literacy skills.

The project's main goal is to design and deploy a walk-in customer service facility that will enable users (included in the priority plan or not) to autonomously interact with devices and request services with little or no assistance from a facilitator. It is expected that they will be able to use multimodal devices such as interactive panels and tables, tablets and ATMs.

The rationale of this study is that the use of well-designed and functional icons can enhance the overall usability and intelligibility of customer services based on self-service kiosks and other technological gadgets, making customer service more inclusive and effective [2].

According to Nadin [3], icons are the interface elements with which users can directly interact (when used with other elements, such as buttons, for instance).

In the late 80s, the theory of action from Donald Norman [4] presented the so-called gulfs of interaction, which correspond to hypothetical depictions that create bottlenecks between mental models of users and designers. In other words, they occur when the real interaction does not correspond to the user's expectations. The presence of gulfs damages the intelligibility of

¹ Companhia Energética de Minas Gerais - Cemig

interfaces and systems as a whole. In this sense, Norman emphasizes the need of shortening these gulfs, figuratively putting the systems closer to the mental model of the users. This requires the construction of interfaces that meet the expectations of the target audience.

Mental models can be understood as how individuals form models of systems. The singular nature of each individual affects how an interface is perceived. According to Nielsen [5]:

“What users believe they know about a UI strongly impacts how they use it. Mismatched mental models are common, especially with designs that try something new”

That is why it is important to build user interfaces that satisfactorily meet the target audience's expectations, bridging the gaps between users and designers' mental models. These efforts result in enhanced interaction experience and satisfaction, positively contributing to lower rejection rates of a given system.

It is important to emphasize the importance of participatory workshops involving the target audience, bringing the actual users into the design process and using their feedback to guide the interface development process.

User interface icons affect different aspects of HCI (Human-Computer Interaction) and must be carefully studied and designed [17], [18]. This is particularly true in the case of representations that are supposed to replicate real-world concepts. In the scope of this study, icons should guide users, especially low-literacy populations, navigating through multiple steps or pages. Thus, effective icons must replicate real-life aspects and the elements of each service as they are perceived by typical users. Such combination requires a comprehensive understanding of the services made available by the electric utility and the users' mental models.

Given this context, the aim of this paper is to report an interactive and participatory workshop carried out to enrich the design of UI (User Interface) icons. The involvement of users from diverse backgrounds was a strategic differential, once the more heterogeneous the group of users is

the more reliable the collected results tend to be, allowing a more comprehensive assessment of the problem.

We discuss below the main results of the workshop, as well as some of the lessons learned.

2 USABILITY AND ACCESSIBILITY

Usability can be defined as a quality attribute used to measure the quality of UIs [6]. Usability aspects include efficiency of use, memorability, learnability, errors, and satisfaction.

Efficiency refers to the users' proficiency level in using and learning a system for the first time, once some systems can be so complex that users do not reach any significant level of usage proficiency even after using them for years.

Memorability evaluates how occasionally users can remember how to use a system without having to start from scratch each time. Regarding this, when it comes to interfaces, Nielsen [7] states that it is always better to promote recognition over remembering:

“Showing users things they can recognize improves usability over needing to recall items from scratch because the extra context helps users retrieve information from memory”

Errors can be defined as problems that occur when tasks are being performed. In such situations, applications must deal well with incorrect behaviors, helping users recover from errors.

Finally, satisfaction is the aspect that identifies the level of user satisfaction when interacting with applications and accomplishing tasks, meaning that systems are supposed to be enjoyable for users to interact with.

With respect to accessibility, according to the W3C (World Wide Web Consortium) [8], it refers to the availability of tools and models that make a system accessible to every user, including people with special needs such as sensory or motor impairments, low-literate and elderly people.

W3C [8] states that creating accessible tools means to help people overcome access barriers regardless of their profile/background. It also points out that assistive tools are good not only for



Figure 1. Participants gathered around tables during the workshop: (a) Group 1; (b) Group 2; (c) Group 3.

people with permanent disabilities, but also for the public at large, such as people experiencing temporary impairment (i.e., mobility impairment requiring the use of crutches, canes or walkers).

Both usability and accessibility are essentially user-centered concerns. The former addresses the ease of use of a system while the latter how it can be accessed by several user profiles. That is to say, because a specific software is user-friendly does not necessarily mean it is suitable to people with disabilities.

As for the inclusive walk-in facility to be deployed, all interactive devices complies with usability and accessibility requirements, in order to effectively meet the needs and expectations of the target audience. Besides, the following concepts of Universal Design [9] are also guiding the design process:

- Equitable Use: design for people with diverse abilities;
- Flexibility in Use: multi-profile suitability;
- Simple and Intuitive Use: make an interaction easy to understand, regardless of the user's experience (ICTs);
- Perceptible Information: effectively communicate necessary information to users;
- Tolerance for Error: reduced error hazard during interaction;
- Low Physical Effort: design for comfortable use and minimum fatigue;
- Size and Space for Approach and Use: design for appropriate use regardless of user's body size, mobility, and so on.

3 PARTICIPATORY DESIGN

Participatory design aims at actively involving all stakeholders (i.e., developers, end users, partners, etc.) in a product's design, allowing the creation of solutions that meet all needs [10].

This practice first appeared in Scandinavia in the 70s motivated by a Marxist commitment of democratically empowering workers, generating agreements between trade unions and factories that allowed workers to deliberate about new technologies in the workplace. In the past, workers were forced to accept products disregarding their real needs, which often negatively affected their working routine [10].

In participatory design activities, all participants are required to interact with designers, researchers and developers and may be involved from the initial design stage (i.e., problem definition and exploration) to the last phases, engaging in collaborative development and validation of prototypes and solutions [10].

According to Spinuzzi [10], participatory design workshops may contribute to the improvement of people's quality of work, providing them with more autonomy to handle tools, processes, concepts, and to perform tasks more efficiently.

One of the key points of participatory design approach is the collaborative work [10], and the more heterogeneous the group of end users is the more reliable and comprehensive the results obtained tend to be (data, suggestions and feedback collected). Considering such a very broad and heterogeneous target audience (including an inclusive customer service facility tailored to the needs of wheelchair users, the visually/hearing impaired, elderly people, and non-literate/semi-literate individuals) the workshop brought together perspectives of multi-

profile end users. In the literature, authors have carried out researches embracing multiple user profiles, as Hayashi and Baranauskas [11] who worked simultaneously with deaf, non-literate, and elderly participants. Cober et al. [12] and Potter et al. [13] focused on a more specific audience: respectively, blind adults and deaf children. The case study reported next intended to reach the project's widely ranged target audience so that the principles of Universal Design [9] could be comprehensively applied along interface development stage.

4 CASE STUDY: INTERACTIVE PARTICIPATORY DESIGN WORKSHOP

The study described herein was part of a broader workshop [14] consisting of three distinct activities that took place in the same day. First, an icon intelligibility study was conducted, aiming at measuring success rate in the identification of icons from 15 typical services of an electric utility company.

Next, interaction activities involving participatory design (group) and prototype interface (individual) were conducted simultaneously.

At that point, participants freely produced drawings and artifacts to help designers model effective iconic representations to be used in the interface of the customer service facility's devices. Organizers invited 30 individuals as potential workshop participants, considering no-shows. A balanced proportion of invitations regarding gender and age intended to guarantee profile diversity and, additionally, individuals with different levels of literacy (and digital literacy) were carefully invited to join the group, not in the exact proportion as in the general population.

In what concerns end users with sensory impairments, five participants with visual or hearing impairments were invited and effectively attended the participatory workshop, which ultimately gathered 14 participants², whose profiles are detailed in Table 1.

Table 1. Participants' profiles.

Participant	Profile	Job
P1	Blind	Advertising person
P2	Blind	System analyst
P3	Blind	Writer
P4	Deaf	System analyst
P5	Deaf	Administrator
P6	Elderly	Cultural activist
P7	Elderly	Retired nurse
P8	Elderly	Mechanic
P9	Literate	System analyst
P10	Literate	System analyst
P11	Literate	System analyst
P12	Literate	System analyst
P13	Literate	Researcher
P14	Literate	Engineer

Two of the visually impaired participants are totally blind and the third one is almost totally blind. Deaf participants mastered sign language and were proficient lip readers, also being able to communicate in written Portuguese.

The three elder participants showed different levels of literacy and digital literacy: one of them was non-literate and inexperienced with ICTs, the second one was literate, but inexperienced with ICTs, and the last one was literate and experienced with ICTs.

Participants were arranged in three tables with preserved profile distribution, as follows:

Group 1

- Two elderly participants, one with low literacy
- One visually impaired participant
- One hearing impaired participant
- One young participant

Group 2

- One blind participant
- One elderly participant, with high level of digital literacy
- Three young participants

² All participants signed a consent form (disclaimer) detailing research procedures and guidelines on the use of

images and discussed ideas. The consent form and the procedures comply with the code of research ethics.

Group 3

- One blind participant
- One digitally literate deaf participant
- Three young participants

Support materials (pictures) representing the electric utility context (trees, lamps, electrical poles, personas, attendants, and so on) were made available to help participants engage and interact with iconic representations, as shown in Figure 2. In addition, they were offered blunt scissors, crayons, pencils and pens, glue, paper and Scotch tape. They were also asked to provide a drawing or a text with their interpretation/understanding of each concept.

Each group was asked to discuss and draw the scenarios that would best illustrate the proposed themes. Three rounds of discussion then took place involving the concepts: “start electrical service”, “restart electrical service”, and “temporary utility service”. The selection of the first two services was motivated by the feedback from the previous icon study, when some of the icons proposed by the designers proved to be difficult to grasp [14].



Figure 2. Set of pictures available..

The discussion rounds took around an hour, each session taking about twenty minutes to complete. This maximum duration was observed to avoid the workshop to become overwhelming or tedious/superficial.

5 RESULTS

The workshop started with a short presentation of the inclusive customer service facility to be proposed (contextualization of the research project) as well as with researchers introducing themselves. Participants were encouraged to engage in a warm-up activity that required a brief introduction of themselves.

The design of visual representations for the proposed themes was considered to be successful, as it can be seen in drawings of Group 1 (Figure 3(a)). It depicts an everyday life story in richness of details and colors, told by participants (anecdote) who made extensive use of available support materials.

Group 2 relied on a minimalist design to graphically represent the “start electric service” concept, as shown in Figure 3(b), as only two representations were drawn: a plus sign (+) and an image of a power meter (they were inspired by one of the pictures made available). It is worth mentioning that the group used different colors to distinguish elements.

Still regarding the “start electric service” concept, Group 3 used a similar approach as that of Group 2: they drew a lamp and a plus sign (+) to represent the icon, as shown in Figure 3(c). This choice might be related to groups containing more digitally literate young individuals.

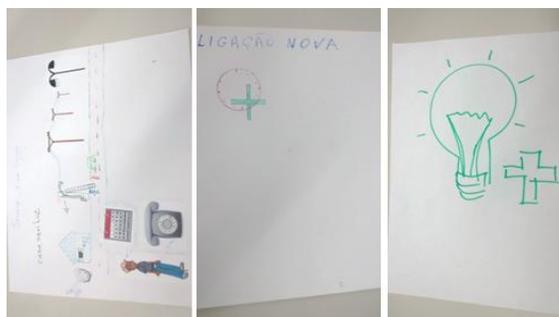


Figure 3. Icons for “starting electric service” theme/concept: (a) Group 1; (b) Group 2; (c) Group 3.

It was possible to observe an unusual pattern of icon designing. Though the groups were formed to gather different profiles, specific profiles seem to have influenced results. Group 3, for example, was formed mainly of three young digitally literate participants, and tended to draw icons by replicating those used in computer interfaces, with small dimensions and few details, and adding

elements such as the plus sign (+), arrows (→), and so on. The same pattern was observed in icons created by Group 2, in which young participants were the majority. On the other hand, participants of Group 1 relied on stories to represent the services, possibly due to their age and less familiarity with computer interfaces which explains a strong tendency to produce richly detailed, colorful icons.

This pattern was observed throughout the following activities and it is worth mentioning that regardless of the prevailing profile, all members of the three groups showed a strong commitment to the objective and continued participation in discussions, in a very collaborative way. Participants with disabilities were also able to contribute with ideas and suggestions, assisted by other members of the group. As none of the visually impaired participants was blind from birth, their previous visual experience may have influenced their contributions.

Some noteworthy facts about the workshop involving physically impaired participants were the statement made by one of the blind participants, who expressed his profound gratitude for being invited to join the workshop and for the opportunity to help people to see the world from a blind person's perspective. Another remarkable fact was that one of the deaf participants drew a picture of a mobile phone to represent the icon for "start electric service". Such misunderstanding occurred because the Brazilian Portuguese for "start (electric) service" ("ligação nova") may be interpreted as "new call" (telephone call) and lead those who are not familiar with the general context of the solution to several mistakes. The same deaf participant also mentioned spontaneously that the (electrical) service "change contact number" concept (presented in the intelligibility study) might be confusing as well. The literature recommends the use of familiar terminology in system designing [15], [16]. An alternative approach would be to rename some of the services, bringing them closer in meaning to what customers expect to find.

As mentioned, the intelligibility study preceding the participatory workshop aimed at validating some icons designed under the premise of being based on representations of the everyday

life of users. An effort was made to represent things participants were acquainted to in order to leverage icons understanding, according to the literature [15], [16] and confirmed by the results of the participatory activities, which used icons designed under this principle. Users with little experience with ICTs may rely on previously experienced situations related to the service request through a non-high-tech (traditional) customer service facility. This is especially true in the case of elderly or non-literate users, or even for people not familiar with the language or the context used by the solution.

According to Ávila and Costa [15] and Piccolo et al. [16] and results obtained from the participatory study, iconographic representations for the elderly, non-literate, and low-literate users must consider everyday situations people can relate to. Younger users with higher level of digital literacy, however, seemed to be more comfortable with minimalistic icons, as those used in ordinary computer interfaces.

6 CONCLUSIONS

Some studies involving the creation of an intelligible set of icons were described throughout this paper. The challenging inclusive walk-in customer facility proposed by Cemig aims at allowing any customer to request services with no or little help from human facilitators. As icons can be the key point behind the understanding of service names or unusual system options, participatory design activities were carried out involving the target audience of the project, in order to collect relevant feedbacks for the development of multimodal applications for devices to be used in the facility. Results confirmed the initial hypothesis that traditional icons (with little details and colors) may not be the best option to communicate a message to all users, since some user profiles may present some difficulty in understanding system terminology – especially the elderly, non-literate, and low-literate users. Due to the heterogeneous nature of the target audience, this work also contributed with the proposition of a workshop with very different user profiles gathered together, proving to be a very interesting experience since

individuals interacted in an unexpected dynamic way, in which all participants were equally committed in helping each other. Feedback from this activity will also provide designers with valuable input for development stages, allowing adjustments in the proposed set of icons and serving as a basis for the creation of icons to be designed.

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