

Cognitive accessibility of mobile ICT

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Challenges for accessible computing for persons with functional diversity

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1. Introduction

1.1 Definition of Cognitive Disability

For the organization WebAIM (non-profit organization working on web Accessibility), there is no specific definition of cognitive disability. A general idea of what cognitive disability is a person who has greater difficulties with one or more types of mental tasks than another average person [1].

Some of the difficulties that these people have to face are, for example, difficulty memorizing, difficulty in solving problems, difficulty concentrating on a single task, or the difficulty in verbal and written comprehension among many others.

1.2 Cognitive Accessibility and the ICT.

There is not a single level of cognitive impairment as the difficulties faced by people who suffer this impairment are very diverse and numerous. There are people with profound cognitive disabilities, who need help in most activities of their daily lives and that is why, as much as the developers strive to make accessible content, it will be very difficult that this content will be accessible for them [1].

Even so, the ICT are adapting and making content increasingly accessible for people with cognitive disabilities and, in this way, trying to ensure that they have the same opportunities in fundamental aspects of life such as education or employment. Information technologies are becoming more integrated in these fields.

In the case of education, it is said that ICT can be a critical tool in learning, especially for children with cognitive disabilities since they can help improve their performance and motivation [2]. In the case of employability, ICTs have a fundamental role. Nowadays, even for less complex job offers, it is necessary to be able to handle information technologies with ease. Accessible technology can increase the employability and income of people with cognitive disabilities, as well as improve their job satisfaction and quality of life [2].

The objective of this project is to carry out a review of the studies of the main needs that people with cognitive disabilities have when using ICT, in addition to reviewing publications on the necessary guidelines to develop content accessible to them and, finally, a discussion and personal vision about the current state of this topic.

2. State of the art

For a bibliographic review, it was decided to consult the publications of the main organizations, both European and international, of standardization. In the searches that have been carried out in this work, only publications from 2016 to 2018 have been taken into account.

At the international level, the following standardization organizations have been searched:

- Organization ISO (International Organization for Standardization)

For the search of standards about cognitive accessibility, a first search has been made on the official page of this organization with the string of characters "*cognitive accessibility mobile ICT*" in which two results have been obtained and none of interest for the work. After this first search, a second search was made through the chain "*cognitive accessibility*" and discarding the standards that have already been withdrawn. For this search ten results had been obtained of which only two are of interest for the present assignment.

The first result is a standard: ISO / DIS 21801 [3] which deals with general guidelines on cognitive accessibility. This standard is still in the development phase of its first edition. The second result is the ISO 21802 standard [4] regarding support products and their guidelines on cognitive accessibility. This proposal is also in the development phase of its first edition, but its proposed for publication in January 2019.

After this second search, we proceeded to make a third with the string of characters "*accessibility mobile ICT*", in which seven results were obtained, but none of them related to cognitive accessibility.

- Organization ITU (International Union of Telecommunications)

On the official website of this organization, a search was carried out with the string "*cognitive accessibility mobile ICT*" specifying that they were only publications, since this page also offers documents about meetings or related web content. In this search, fourteen results were obtained. Of these fourteen results, some of them are about accessibility in mobile ICT, but it is focused in general on people with special needs, so no result of interest for the work has been found.

- Organization IEC (International Electrotechnical Commission)

On the official website of this organization, a search was carried out with the string "*cognitive accessibility mobile ICT*". For this search only one result was obtained and it was not of interest since it was about future advances in technology in 2018. For the search "*cognitive accessibility*" there are some standards, but these do not deal with mobile ICT and it is also focused for all kinds of people with special needs, where it includes all people with cognitive disabilities.

At European level, the following organizations have been consulted:

- Organization CEN (European Committee for Standardization) y Organization CENELEC (European Committee for Electrotechnical Standardization)

For these two organizations, after searches with the same strings as it has been used in the other cases, in their respective official pages, no references have been found that are of interest for this assignment, since some of the results are only about lines of development in mobile ICT and others only of cognitive accessibility, but always as one of the many disabilities trying to cover the standard.

- Organización ETSI (European Telecommunication Standards Institute)

On the official website of this organization, a search was carried out with the string "*cognitive accessibility mobile ICT*". From this search, 8834 results were obtained, of which the first two were directly related to the topic.

The first interesting result is the ETSI standard EG 203 350 V1.1.1 [5] which deals with guidelines for the design of mobile ICT devices and their related applications for people with cognitive disabilities and the second result of interest is the standard ETSI TR 103 349 V1.1.1 [6] which deals with the functional needs of people with cognitive disabilities by using mobile ICT devices for a better user experience in mobile ICT devices.

ETSI TR 103 349

This standard addresses the functional needs of people with cognitive disabilities when using mobile devices to improve the user experience.

The document is divided into two main sections. The first section identifies the main cognitive deficiencies. Each of these cognitive deficiencies are described, showing also the main symptoms, number of people affected and any need for specific use and the benefits that these users can have through them.

In the second section, a classification of these specific needs described in the first section is made through the identification of the most conflictive functionalities in cognitive disability. In this list, each functionality was identified through a very brief description. For each functionality, it explains what it consists of, establishes the relation it has with other functionalities different from those already identified, identifies the main problems that users have when using mobile technologies and adds concrete proposals for use needs.

For instance, for care-related functionality, it identifies activities related to care such as maintaining attention to a task or maintaining attention for a specific period of time. For this case of use, it identifies three fundamental problems that are the ability to filter non-relevant stimuli, the ability to maintain concentration in a single task even without external stimuli and problems to change from one activity to another [6].

It should be noted that the W3C organization has also carried out research for users with cognitive disabilities, which we will discuss next [7].

W3C: Cognitive Accessibility User Research

The W3C organization also carried out research on the types of users suffering from cognitive disability. Like the ETSI standard TR 103 349 [6], it also identifies the different types of user groups through the main specific cognitive deficiencies. The study of the W3C organization also identifies the main functionalities that people with cognitive disabilities have problems with. This classification is much simpler and less profound than the one carried out in the ETSI TR 103 349 [6].

ETSI EG 203 350

This document provides guidelines for the design of mobile devices for people with cognitive disabilities. These guidelines reflect the requirements of these users and are based on existing accessibility guidelines for general user groups, in addition to those studied in the ETSI TR 103 349 standard.

This standard only focuses on devices such as mobile phones, smartphones, tablets, smart watches and services accessed through these devices [5].

The design of software for these devices trying to also involve users with cognitive disabilities is a challenge. These devices suffer many updates in small time periods. These updates, in some cases, make the interfaces suffer a considerable change, sometimes making users feel confused. If, in addition, users are people with cognitive problems, this fact becomes a more serious problem.

In addition, most of the interfaces of these devices are designed to satisfy the user experience of young people without any type of diversity, so older people also have greater difficulties accessing these devices [5]. Something as simple as turning on a mobile phone and unlocking it by entering the start pin for some groups of users in a complex activity.

The guidelines described in this document help, if applied in their development, to improve the accessibility and user experience of mobile devices.

The document points out that, in addition to the specific criteria for this group of users, it is also necessary to apply general usability and accessibility techniques, such as those described in the ETSI EN 301 549 standard [8] since some of the points of this standard have taken into account the needs of this group of users.

Some of the accessibility techniques described in the document are, for instance, the application of methods that do not require the memorization of numbers or letters, since it seems that users need to read, write or memorize for a very long period of time. The device has to be able to give an alternative to memorization.

Another technique is the approach of a sentence when we try to simplify the use of language. Each sentence presented by the device should have only one idea per sentence, thus making the sentence simpler, reducing complexity, and thus making reading and comprehension easier.

In the document reference a document developed by a working group of the W3C organization, related to accessibility for learning and cognitive disabilities in content and mobile web applications [9].

W3C: Mobile Accessibility Task Force (Mobile A11y TF)

This document provides accessibility guidance on mobile devices. Although cognitive difficulties may be taken into account in some of its guidelines, it cannot be said to expressly address this issue since it deals with accessibility from a more general point of view.

That is why the guidelines and guidelines specified in this standard are poorer than those specified in ETSI EG 203 350 [5].

This document has some considerations that should be highlighted as those related to perception. Some of the guidelines that are given are related to the sizes of the screens, the zoom application, the contrast in the interface or the designs of non-linear screens. Unlike [5], the document does give some tips to improve accessibility. For example, in the case of screen sizes, it points out that in most cases, these devices have a screen of small dimensions, so the amount of information that appears in it must be limited so that users can perceive it in an effective way. One of the tips that exposes is to adapt the length of the text of the link to the width of the graphic window.

Another one of the considerations that this document has, is the relative one to the compression of the users. Some of the guidelines that are discussed are the change of orientation of the screen, the grouping of elements on the screen that perform the same operation or providing clarity on which elements of the interface are operable. On this last guideline, for example, the standard specifies that both actionable and non-actionable elements must be easily identifiable as such in the interface and that for this they must follow known visual characteristics that make an element more easily differentiated. Some of these characteristics are the form, colour, style, positioning, text label for an action and conventional iconography. One of the tips that exposes is, in the case of having an actionable element such as a link, apply to that link a conventional style: underlined text and different colour.

Finally, it is worth noting that it relates these guidelines to the existing criteria of WCAG 2.0 [10] that are relevant to achieve the desired accessibility.

W3C: “Making Content Usable for People with Cognitive and Learning Disabilities”

This document gives to de developers some guidelines of how to develop web content that is accessible for persons with cognitive disabilities [11]. It analyses, briefly, some of the user needs (lower deepness than in the standard related to this topic).

The main goal of this document is to provide ways of how to do usability testing: the main differences from usability testing between general population and cognitive accessibility testing.

3. Discussion

As noted throughout this document, not many standardization organizations are actively working on this issue

Of the documents collected, only the W3C, ISO and ETSI organizations are actively working in this field of accessibility. The previous studies carried out to know the needs of the users are fine, but they are not as deep as other studies on the needs of other users with disabilities, such as people with visual or motor disabilities, and that is why there is still A lot of work to do to reach similar levels.

The standards proposed by the W3C and ETSI organizations, from my personal point of view, are worked on and I believe that they adequately cover the needs on which these standards are based. Even so, it is the developers and the companies that have to work with these documents and I believe that trying to develop accessible software for this group of society is very difficult due to the diversity of cognitive disorders that exist and the complexity of understanding and knowing everyone.

Cognitive disorders are not the disorders that are given more visibility in society, and that is why, reading the guidelines of the standards, it becomes much more complicated to understand them compared to other guidelines of other standards of accessibility different.

This, in addition to the fact that only one of the organizations gives guidelines on how to implement specific software for these needs complicates the development process.

The current approach to accessibility is mainly aimed at physical disabilities since they are the most recognized disabilities in society.

Cognitive disabilities should be one of the topics in the research focus. According to WHO, the number of people suffering from disorders such as hyperactivity or autism, which are disorders directly related to cognitive abilities, has been increasing significantly since recent years [12] [13]. In addition, not only there are disorders that accompany people throughout their lives as seen above, but there are also some diseases that can worsen our cognitive abilities over time such as diseases such as Alzheimer or dementia.

Mobile devices are almost an essential in fundamental aspects of our life such as education, work or even social relations. That is why we must work so that no part of our society is excluded and may have the same privileges and benefits as other people.

4. References

- [1] <https://webaim.org/articles/cognitive/>
- [2] Federal Communications Commission (2016). Individuals with Cognitive Disabilities: Barriers to and Solutions for Accessible Information and Communication Technologies.
- [3] ETSI: “ISO/DIS 21801” (Standard)
- [4] ISO: “ISO 21802” (Standard)
- [5] ETSI: “ETSI EG 203 350 V1.1.1” (Standard)
- [6] ETSI TR 103 349 V1.1.1 (Standard)
- [7] W3C: “Investigación de usuarios de accesibilidad cognitiva W3C”
- [8] ETSI: “ETSI EN 301 549” (Standard)
- [9] W3C: "Mobile Accessibility Task Force (Mobile A11y TF) of the UAWG and WCAG WG"
- [10] W3C: “WCAG 2.0”
- [11] W3C: “Making Content Usable for People with Cognitive and Learning Disabilities”
- [12] <https://www.who.int/es/news-room/fact-sheets/detail/autism-spectrum-disorders>
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