

www.lea.net.ar: “An Accesible Web Site for Visually Impaired and Blind People”

Prof. Javier Díaz

Universidad Nacional de La Plata, Fac.de Informática, LINTI
La Plata, ARGENTINA, 1900
jdiaz@info.unlp.edu.ar

Mr. Jose Ferreyra

Universidad Nacional de La Plata, Laboratorio de Investigación de Nuevas Tecnologías Informáticas
La Plata, ARGENTINA, 1900
jferreyra@info.unlp.edu.ar

and

Lic. Ivana Harari

Universidad Nacional de La Plata, Laboratorio de Investigación de Nuevas Tecnologías Informáticas
La Plata, ARGENTINA, 1900
iharari@info.unlp.edu.ar

Abstract

This paper seeks to establish which are the difficulties faced by Latin American and Spanish visually impaired people when interacting with the Internet. One of the biggest problems a handicapped person encounters is that the design and the architecture of pages is not normalised according to different standardisation and accessibility patterns. However, the barriers do not only have to do with the medium itself, but they can also be found in the adaptive tools visually impaired people use in order to access Internet content. These systems, which are provided by several multinational companies, are not in general oriented towards Spanish speakers, who have to cope with both linguistic and socio-cultural barriers.

It is taking these needs as a starting point that we constructed an accessibility portal designed to satisfy the needs of Spanish-speaking visually impaired people, which integrates different adaptation features in a natural and efficient way, preventing the user from having to use many different programs in order to do a certain task. Such tool also automatically translates the content of a given page, taking as a basis the different accessibility norms published by different organisations and consortiums.

Keywords: Web design, Accessibility norms, Information adaptations.

1 Introduction

Technology is a consequence of human evolution through which it is possible to interpret, manipulate and transform our environment in order to satisfy our needs. This discipline does not only include instruments, but also the necessary knowledge in order to utilise any available piece of machinery. However, the advances made through this science do not necessarily mean an improvement in the quality of life of society as a whole. Many of its advances alienate some groups of society even more, be it due to socio-economic reasons, disabilities or other limitations of human beings.

If people with some kind of impediment have difficulty in accessing resources which satisfy their basic needs, with the advent and expansion of technology, the gap between them and the surrounding world becomes even greater. Information Sciences are a consequence of technological advancements and cannot be said to lie beyond the scope of such criticism. [1] The Internet as a medium has reached all socio-economic stands and allowed people to be close to each other. Nevertheless, such achievements also have a dark side to them, and this is that they have created a new barrier for the disabled, particularly for visually impaired people, who are not able to take advantage of this new concept in communication, facing web pages and sites which do not have a universal design, most of which do not respect accessibility norms [2].

Additionally, many of the products and tools which have been developed [3] in order to assist the disabled present many problems of integration among them, either because they have been developed by different companies or because the different versions of the same product are incompatible. Some of them are extremely difficult to use, while others lack versions for speakers of different languages.

An accessibility portal has been designed and implemented for visually impaired and blind people in order to provide a solution to these problems. The aim of this portal is to transform and adapt a given web site, on the basis of a number of norms published by expert organisations and consortiums. This provides an integrative solution of different adaptations oriented to the disabled, allowing an integral answer to the accessibility problem.

In this article, we seek to establish, as a starting point, which are the difficulties faced by a disabled person who wants to interact with an information medium such as the Internet. In order to do this, a survey will be carried out on the different adaptation tools on the market, classifying them according to their nature and analysing their costs, and the problems they show.

Finally, we will present the “www.lea.net.ar” (“lea” meaning “read”) portal, whose motivation is to provide a solution for the scarcity of web page normalisation, as well as to eliminate the complexity which arises whenever someone needs to adapt a computer with existing tools.

This site sees the resolution of these problems from the point of view of a visually impaired user belonging to a Spanish-speaking community, within a Hispanic cultural environment.

2 The Problems Posed by the Internet

In this information society in which we live, every person should have the possibility of accessing the resources offered by the Internet, without disabled users being at a disadvantage. For them, this medium is very interesting, as it allows them to access different resources such as databases and catalogues, from their own homes or from libraries and documentation centres [4]. This global network of information, which has no borders, will be the most important medium of communication of the XXIst century, revolutionising communications and allowing different cultures and races to be closer than ever before.

These achievements of the Internet, which seem to make the world a smaller place, a place with more opportunities, have nevertheless originated a new barrier for disabled people, particularly for the visually impaired. This is mainly due to the multimedia and visual nature of information, with pages which include animation, video, sound, control elements, frameworks, tables, moving text, background images and other components, which make the site less accessible [2].

It is this and other reasons which have led professionals and experts from all over the world to create international organisations, most of them in the USA and Canada, which seek to set and publish accessibility norms [5]. The most important one is W3C (World Wide Web Consortium) in which the WAI (Web Accessibility Initiative) is based. This is an international organisation which structures the global development of the WWW, especially as regards technological development. The WAI has produced the *Guide for the Accessibility and Authorship of Pages*, which contains recommendations and guidelines for the creation of pages. As well as these ones, there are other organisations working in the field: EASI (Equal Access to Software and Information), WeABLE, DOIT, NCAM(National Center for Accessible Media), ATRC (Adaptive Technology Resource Centre of Toronto University), Include (in Finland, belonging to the European Union), Microsoft Enable, Starling Access Services (Canada), among others.

These organs, with the WAI Consortium leading the initiative, advice web page creators concerning the use of design tools and site validation, also providing them with guidelines and promoting the use of standard elements.

However, the existence of such norms does not constitute a guarantee that hardware and software manufacturers will respect them. Awareness raising and training for all designers of sites and pages all over the world is impossible. It is because of this that we need to find a solution for the mismatch between accessibility and designer practices. We have utilised these norms as one of the pillars in the construction of our accessibility portal: “www.lea.net.ar“, with the aim of solving the scarcity of web site normalisation. The other pillar on which the tool is based is the unification and integration of the different concepts into which adaptation information systems are divided.

3 Adaptative Tools for the Visually Impaired

The first adaptative tools designed for blind and visually impaired people, which were in fact very rudimentary and presented a high percentage of failures, appeared in the USA in the early eighties. However, it was only in 1995 that a widely known adaptation of major importance came into being, with Windows 95.

Information solutions for the visually impaired community are many but are basically made up of two categories: adaptations themselves which we will term “**Low-level adaptations**” and the support applications for them, which we will call, “**High-level adaptations**”[6].

“**Low-level adaptations**” are access systems to digital information, designed for blind or visually impaired people. These adaptations in most cases do not accomplish any function if there is not a control program above them. Such systems are structured in three subcategories:

1. **Amplification of visualised texts and images:** these are adapters for those who at least have some visual capacity, since what they do is make characters, images and other contents on the screen bigger. The first amplification equipment which appeared, such as Vista, by the American company Telesensory Systems, was made up of an interface card to be inserted in the computer. This card was in turn internally connected to the video card and externally connected to the monitor, behaving as a magnifying lens bridge between the two of them.
2. **Voice synthesis.** This can be very useful to blind people as well as to the visually impaired, for its aim is simply to send information from the computer to the user through spoken messages. These messages can be transmitted with totally or partially synthetic voices, although natural recorded voices can sometimes be used. The transmission of partially synthetic voice is based on authentic human voices, with the combination of recorded phonemes forming letters, syllables and finally words. It allows the output to be much more pleasant to the ear, but it is nevertheless synthetic, since it lacks the nuances of real human voice. Examples of this type of adaptation are Ciber232P, designed by CiberveuSA, the Appollo2, with multiple linguistic varieties, which was produced by Dolphin Computer Access, among others.
3. **Braille alphabet output.** Very useful to the deaf blind. It consists of devices which send the information in the screen to the user, by using Braille characters in a line of 20 to 80 occurrences according to the model. The most usually used ones come from Germany, by the company called Papenmeier.

Under the name “**High-level adaptations**” we term those applications, hardware as well as software, whose results are obtained through one or more low-level adaptations and which, therefore, require one of these to accomplish their aims. According to the quality of information they process we can group them into Screen Reviewers, which obtain data in an indirect way, Document Reviewers, which obtain information directly, and Note-taking devices, which do not need input as they already count with all the information they need.

1. **Screen Reviewers:** they are seen as the most important existing group of high-level adaptations, besides being the forerunners and, therefore, the most developed ones. They are made up of those programs and controllers which extract information from the computer video card or which intercept the order sequences run by it. In doing so, after an analysis, artificial supposition and deciphering process, they transmit the information to the user. The work carried out by the screen reviewers is not easy at all, since they need to understand the content of the screen which the seeing person sees at one single glance and transmit it to the user who lacks the sense of sight in a form that is comprehensible to them.

The first subgroup of programs integrating the Screen reviewers are the ones called “**Image Amplifiers**” or “**Screen Magnifiers**” [10], devised to magnify the size of images visualised on the screen. The appearance of the first applications to meet this objective, such as the still market leader Zoom Text, belonging to the Ai Squared American company, constituted a true revolution and solved the problems of many people with some visual capacity. The most modern image amplifiers include additional capacities for document reading and some also include controllers which make it function with the three low-level adaptations, such as Supernova by Dolphin Computer Access [11].

The second subgroup of programs are those called “**Screen Readers**”. These programs provide an interface between the video card, the voice synthesis systems and/or the Braille reading terminals, and the computer user. The user thus expects to obtain from them the reading or interpretation of the maximum possible number of elements which

make up the screen of each work environment. With the advent of Windows [13] the work of readers has considerably multiplied.

Now, as well as interacting with the voice synthesisers (of the hardware type), they must also do so with the Braille terminals. This is the case since it is not that it only has to send to these peripherals what appears on the screen in a way that is comprehensible to them, but it must identify each interaction component such as windows, menus, buttons, dialog boxes and the like. This becomes even more complicated when it is meant for users who are completely blind, who have never been able to see a medium of graphic display such as Windows. The most popular screen readers at present are Supernova, by Dolphin, and JAWS, currently by the Freedom Scientific group. Additionally, there is, by the Microsoft company, a small screen reader called Narrator, which was provided together with Windows 2000, but which will only become widely known with its inclusion in the recently launched Windows XP [13].

2. **Document Reviewers.** They make up the second group of high-level adaptations. They are those applications that search information, from a computer or peripheral, and which will transmit information to the user via low-level adaptations. Its development is only beginning, as they are more recent than screen reviewers are, but it is believed that in the near future they will replace them [14].

The first subgroup into which we can divide document reviewers is the one called "**Document Readers**". These are very well known and most people have some time or other used them. They are made up of the so-called Text-to-Speech programs, such as TextAssist or Monologue by First Byte [12], which have as their aim the transmission of text files through voice. Other tools such as word spelling programs usually accompany them. These programs are also used to help improve the pronunciation of letters or words by dyslexic people or people with other speech problems, such as textHELP by the Irish company with the same name. These programs can of course be very useful to people with only some or no sight, too.

At present, there are also products which, apart from having the already mentioned characteristics, allow the user to save the obtained results in sound files, such as TextAloud by the American NextUp Technologies company [14]. The DocReader subprogram, integrated with recent versions of the image amplifier ZoomText, allows the user to easily access documents and even to treat the screen of the graphic desktop as such, making reading very easy, through voice or amplified image.

"**Character Identifiers**", the second subgroup into which we can divide document reviewers, deal with the capacity of scanners to digitalise text pages in the computer. This functionality, called OCR (Optical Character Recognition), is the one that is used to enable blind people to access information written on paper through the computer. The programs used to achieve this tend to be identical to the ones used by the rest of users, be it OmniPage by Caere, TextBridge by Xerox, etc. One of the most widely sold programs is the support program Open Book by the American Arkenstone company. This program was created in order to be used by completely blind people with almost no IT knowledge. This company has also launched WYNN, more powerful than the former, but created for users with some visual capacity who possess wider IT knowledge [9].

There is no denying that the field of character recognition is the one in which there is still more research to be done. This is the case since, even by using the best ones on the market, such as the recently popularised Fine Reader by the Russian Abbyy company, there is not much material which can be satisfactorily read.

The third subgroup is made up of the "**Internet Navigators**". Specialised Internet navigators, which usually combine voice and image amplification, make it easier to read texts correctly and to rapidly search links and other components of a page. These navigators, such as the already withdrawn from the market pwWebSpeak, by the American Corporation The Productivity Works, work in the same way as any other, except that they tend to assign much more importance to keyboard rather than mouse use [6].

The problem posed by some navigators which are exclusively designed for blind people is that they are already obsolete, the world of web pages being in constant evolution. Many designers of products of this kind have tried to update them, but, due to the constant implementation of scripts or due to the writing code on the pages, they have had to give in and distribute them for more concrete uses or simply stop providing them.

The IBM Company, with its Home Page Reader, seems to have found the solution to this problem, as they use the Internet Explorer navigator by Microsoft as a basis for navigation and page reading. This program takes the information it needs, in order to later transmit it to the user in a form that makes it comprehensible to them in spite of their visual impairment.

Likewise, the advent of the XML language (eXtensible Markup Language), as a basis code for writing web pages at a universal level, makes it possible, on the one hand, for any person to create their own language to write web pages. This may cause many accessibility problems to be added to the already existing ones. However, on the other hand, it makes it possible to separate contents and present web pages, something that has started to be done in the late HTML version (4.01), by means of the so-called "cascade-style sheets", which make it possible to configure the profile of the pages each user will receive.

3. **Note-taking devices.** These are small portable computers, designed for visually impaired people, with which it is possible to take different kinds of notes.

4 Problems of Current Information Tools

Once this survey of existing information tools for visually impaired and blind people had been carried out, we sought to critically analyse these tools [8]. This process was of the utmost usefulness in order to meet, with the information which was collected, the basic requirements for the “www.lea.net.ar” portal.

The evaluation of such tools was of a completely empirical character and was made from the standpoint of a blind or visually impaired user who does not have a command of the English language. The basic question we sought to answer was “Which difficulties can a Hispanic blind or visually impaired user encounter when trying to utilise some of the currently available information adaptations?”. Comments and suggestions regarding the information products were collected through individual and group interviews, as well as through discussion lists or FAQs.

The details of the evaluation are not within the scope of the present article. What are the conclusions which were arrived at, which are solely based on the problems detected by this specific user community when trying to interact with information adaptations constructed for them.

With the data gathered from the users themselves, directly, but also indirectly, by going into discussion lists and FAQs, the problems such users face can be summarised as follows:

Linguistic barriers: in the face of the extremely difficult situation of blindness or visual impairment, the question of language is fundamental. Many adaptations such as document readers and screen readers need adapted supports for each language, producing the inevitable lack of versions for minority languages.

Likewise, it is difficult to find training courses, manuals, technical support offered by companies, as well as product software installation, which are not exclusively in English. This hinders the correct installation and utilisation of tools.

Educational barriers: it is very infrequent to find tools which do not require, on the part of the disabled user, a high amount of IT knowledge. This makes the tool use learning process extremely difficult, as the disabled user must devote endless hours to self-training, interacting with manuals or tutorials which, as it was previously said, also mean facing the linguistic barrier.

Document readers: such as TextHelp, provide an additional educational package so that the disabled person counts with basic knowledge for its use. There are other products which demand more than seven hours of training and instruction through audiocassettes.

The requirement of having considerable IT knowledge imposed by currently used products also affects their utilisation process. There are instances in which users have given up their attempts to use them, due to the great complexity inherent in them. For example, Supernova software, which provides image amplifiers so as to increase the size of images on the screen, includes document reading, magnifying lens, window mode, automatic lens, rapid search of frequent access sections of the screen and other functionalities, displaying great complexity in the use and access to such functions.

Technical Barriers: it is not only a high requirement of IT knowledge that the visually impaired and blind user is faced, but also, in most information adaptations, to technical matters that are extremely hard to solve.

This includes compatibility, portability, configuration integration problems, which derive from the installation and use of these products. These problems greatly disturb the user, who is many times afraid of what may happen to their computer [9].

Worries over whether the operational system in question works, the demand for knowledge over configuration systems, uneasiness over whether the installed tools will become adequately integrated are very frequent. Moreover, even fear of facing problems that many times occur with the video card or some other hardware component, are the most usual unpleasant feelings that users are forced to suffer in relation to technical problems.

Most adaptations come for Windows, but there are products which present problems with some of their versions. For example, in the FAQs analysed for Dolphin, that company lists specific problems with the use of Windows 3x video controllers in software such as HAL and Supernova. Additionally, incompatibility problems may have to be solved when trying to use some of the adapters and using an IBM computer.

Products which demand WIN.INI system file editing are not an exception. Nor are those which employ certain dynamic libraries or .DLL files, which must be copied by the users themselves into specific places -otherwise it will not work, as it happens with Monologue. At worst, problems come up with already installed tools, preventing the integration of adaptation systems by different companies.

Maintenance matters are not to be neglected either. With screen readers which must identify reading, both texts and graphic aspects of the user interface, even if one wants the applications to respect existing norms in Microsoft Active Accessibility, the interaction components and the interface design vary for different Window versions.

This makes these tools extremely dependent on the kind of operative system the disabled person possesses, and they must be changed each time the user updates such environment.

Geographical barriers: at best, the blind or visually impaired user may count with the sufficient resources in order to assemble at home a PC which meets their needs. It would be less likely for them to be lucky enough to be offered at work the computer they need, in accordance with their condition. It is even less likely that they will be able to find a cybercafe or “*Locutorio*” (locally, shops providing many telephone booths and Internet services) which will have invested in equipment of this sort. It is irrational to expect the disabled user to move around with the information adapters and other components in order to make a computer in a public place suitable to them. This makes the physical environment where these users can access the Internet absolutely limited, leaving the user confined to their own home or an institution for visually impaired or blind people.

Economic barriers: in general, the cost of assembling a computer of the kind described is extremely high. Special information adapters are very expensive, both high and low-level [9].

Given the situation in which the user wishes to have a low-level voice synthesiser, they must invest more than 300 dollars. Their being so expensive derives from the fact that they utilise material based on exclusive spare part manufacturing which are produced in small series. Obtaining devices for Braille output is extremely expensive, too, such devices sometimes reaching the price of 12,000 dollars.

The same happens with high-level adapters. If the visually impaired person wanted a screen reader such as JAWS, which includes a conversation synthesiser called Eloquence, they should invest around 800 dollars. Screen magnifiers such as Supernova are over 900 dollars. Not to think of software updates which are frequently required and cost around 200 dollars per product.

The inconveniences disabled users face when wishing to access some of the information tools designed for them are too many. They are tools with a very important functional component. However, they cannot utilise them due to cost, complexity and formation problems.

The experience obtained through the participation and feedback on the part of disabled users was extremely enlightening and enriching for us and it was one of the main motivations of creating the “www.lea.net.ar” portal.

5 The “lea.net.ar” Portal: an Integrative Solution

The explosion of specialised information systems, contrary to expectations, does not necessarily mean that the barrier between the visually disabled person and the computer is eliminated in a suitable way. What is more, most information products which are commercialised at present still supply a partial solution to the problems of such users [7].

The “www.lea.net.ar” accessibility portal was designed and constructed with the aim of facilitating access to information for visually impaired people. This is done by laying emphasis on the needs of Hispanic disabled users.

Two important elements were taken into consideration in the construction of this tool, regarding accessibility. Firstly, the need to solve the problem of web page normalisation scarcity. Secondly, to eliminate the complexity that adapting a computer with the existing tools in the market entails.

One of the main functionalities that this site offers is that it can be adapted to any kind of web page, which is translated into a page which is accessible to the disabled user, according to its complexity. It is through this transformation that it is possible to build for these users “a door into the Internet”. This adaptation mechanism, which runs from the server, involves two transformation stages:

- **The Normalisation Process:** this process consists of the conversion of the page the user wants to access into a well-designed page which is easy to use and which respects accessibility norms established by the above mentioned organisations and consortiums.
- **The Personalisation Process:** this process consists of the conversion of the already normalised page into one that is adapted to the kind of visual impairment which is detected, as well as to the hardware and software kinds the computer possesses.

In order to serve these purposes, the portal must be able to detect the visual problem the user has and solve, at that point, the adaptation scheme that is suitable for them. This will benefit and assist the reading process, navigation, Internet search and other activities. This is achieved by taking into account accessibility norms, firstly applying those rules which directly involve good performance by a visually impaired user. Emphasis has been laid on those norms whose automatic application was possible. This is why the normalisation process is based on the following rules:

1. On web design:

- Avoiding too outstanding backgrounds, as text may obscure, making it impossible to read properly. In a like manner it is necessary to avoid dark or bright backgrounds, if they are proven to be inappropriate.
- Offering a sharp contrast between text and background. Choice of colours is very important. In this way, good legibility is offered to people with limitations in the perception of colour or users with black and white

monitors. The user must choose the text colour (headings or normal text), hypertext and background colour or choose preconfigurations established by the portal which are optimal in terms of colour contrast.

- Eliminate emoticons or other drawings provided in ASCII text, since they are difficult to identify by visually impaired people. Besides, they cannot be interpreted in an appropriate way by voice synthesisers or screen readers. In the same way, it is important to avoid abbreviations and/or key words, or xx/yy/zz date formats, writing them in their extended form (29 April 2002).
- Using vertical hypertext and links lists, instead of writing them in one line.

2. On HTML:

- Avoiding scintillating text or other disturbing visual effects, as they make it difficult to read the text. It is for this reason that it is also important to translate marquee-effect texts into plain texts.

3. On Advanced HTML:

- Making hypertext accessible to visually impaired people by moving with the Tab key. In the same way, spaces are allocated, separating each link
- Translate tables, whenever it is possible, by putting information into the most linear and hierarchical possible format.
- Regarding lists, the elements in them are numerically labelled to make it easier to find them. The same is the case with nested lists, being the hierarchical form (1, 1.1, 1.2, 1.2.1) the most favoured one. It is also important to include spacing between elements of a list.

Even if the application of these rules can be done through an automatic process, there is a great number of norms which cannot be immediately applied, but they must be thoroughly studied before they are. Otherwise, undesired effects may be brought about. If the original page presents deficiencies in its design stage, or in the advanced HTML codification, these defects are difficult to normalise. The norm which reads "Do not use expressions such as "Click here" or "complete version" or "enter" must be taken into account, for example. In this case, when the translation is done, the portal takes an incorrect decision. The only outcome of this is that the original document will be obscured, undoubtedly confusing the user. It is for this reason that the translation process is the most critical part of the accessibility portal and, therefore, it must be improved and analysed if the tool is to work properly all the time.

6 Adaptation Mechanisms of the Portal

The "www.lea.net.ar" site incorporates a series of special services, which are intended to assist the simplified use of the portal by visually impaired users. An automatic voice synthesiser, a screen magnifier and a keyboard and mouse controller were incorporated.

Concerning the voice synthesiser, this was used in order to speak the linear text of the page out, as well as to identify and inform the user about the different interaction and graphic components that a web page may present. In a like manner, it allows the user to go through a number of containing elements, such as tables, forms, frameworks, among others, informing the user about their contents. Additionally, the synthesiser assists the user with the portal's services, permanently informing them as regards the actions they can take in each context they encounter.

Through the screen magnifier functionality, the user can configure the web page font size, as well as the text, links colour and that of other screen elements.

A keyboard controller is also offered. This controller makes it possible to disallow certain control keys in order to prevent the disabled user from making mistakes by pressing these keys accidentally.

These functionalities work together, as, for example, whenever the user increases the text font size, the voice synthesiser informs them about the selected size. It also informs them about the chosen background colour, text colour or selected font. Additionally, the synthesiser works together with the keyboard controller. When the disabled person presses a key, it indicates which one it is and in some cases waits for confirmation before proceeding.

The above mentioned functionalities do not take expensive installation procedures. Nor do they need external support programs. Their handling is entirely based on the portal, using the keyboard as standard input. All the portal desktop, including Help, services and registering procedures use Spanish as the means of interaction with the disabled user, providing a familiar environment for those belonging to the Hispanic community. This versatility makes the portal more natural than the support devices previously mentioned in this paper.

Other services offered by the portal are the following:

- **User registration:** They can register their personal information, as well as the kind of visual impairment they suffer from. Tests are carried out as regards font size, colours and contrasts which the user can better perceive, as well as tests concerning the sound to be used, monitor type, voice synthesiser speed, etc. In a like manner, the characteristics of the equipment are requested, such as monitor type, printer and other peripherals, so as to take advantage of the resources the user possesses.

- **Navigation assistance:** Establishing Information in the Hyperlinks, informing them about the size, type of content, estimated reading time as the page in the link is accessed. Classification, rating of hyperlinks, advising the user on the degree of usefulness of the page - based on statistics, and a projection of the efficacy rate of the conversion process.
- **Address book:** called “Blue Pages”, it consists of a number of web site URLs, analysed according to the accessibility norms, and which can be transformed without much information loss. Such Internet addresses are divided into different categories according to their nature, allowing a visually disabled person to reach their content almost immediately, without this meaning too deep –and time-consuming- a search on a particular topic.

7 Conclusion

“www.lea.net.ar” is a portal created to satisfy the need to establish a different normalisation policy, based on a number of homogenised rules and norms. It has as its main objective to make already published web pages more accessible. This allows the visually impaired user to determine the shape in which they wish the requested page to be presented, according to the nature of their disability.

Its motivation is given, additionally, by the aim of simplifying the complexity displayed by the process of adapting a computer with existing tools, integrating different elements which conform information system adapters.

The architecture on which the construction of the portal was based makes it an easy intuitive framework to be utilised, orienting it towards visually disabled Hispanic users.

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