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Accessibility of Multimedia Resources in Web

Lourdes Moreno, Ana Iglesias, Paloma Martínez

Universidad Carlos III de Madrid, Centro Español de Subtitulado y Audiodescripción (CESyA)
{lmoreno, aiglesia, pmf}@inf.uc3m.es

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Abstract: This paper emphasises the importance of provide accessibility of Web-based information resources for everybody, not only for people with disabilities. Due to the continuous technical and social changes of the Web, it is necessary to have in mind that new scenarios and user behaviour are appearing. Nowadays, most of Web sites use multimedia resources and it is indispensable to provide accessibility not only to the resource content, but the access to the resource in the Web site. Currently, there is enough information about accessibility standards and technologies for making multimedia resources accessible, but unfortunately only few Web sites provide universal access to the resources. This work summarises the main items to take into account in order to make accessible a multimedia resource (legislation issues, technologies, standards, etc.) and present some best practices including on-line multimedia resources in a Web site. In these practices, different design alternatives have been provided, explaining their advantages and disadvantages.

1. INTRODUCTION

As far as disabled people are concerned, the access to information technology, not only is a right, but it is an opportunity to integrate. It helps them to participate in every activity offered to us, as citizens, in the digital media. It is important to underline in this point that the universal progress in technology not only affects to a reduced number of people, but this technology must support the functional diversity found in society.

Due to this obvious increment in the use of information technology, such as Internet, it is necessary to have in mind accessibility issues when new elements are included in the Web, as audiovisual contents. Nowadays, most of Web sites

include audiovisual resources (audio, video, animations etc.). Moreover, thanks to the the convergence of Internet with television, mobile telephones, videogames, etc., which is transforming the areas of communication, we can find Web-sites collections as “Web 2.0” (O’Reilly, Tim, 2005) where the majority of the Webs are based on a shared collection of visual and audiovisual resources (p.e. Flickr (Flick, 2006), Youtube (YouTube, Inc. 2006), etc.). The presence of these new technological elements in the Web when accessibility issues are not taken into account increments the digital breach and adds access barriers not only for disabled people but for all of us. For instance, sometimes we are not able to access to a video record because we have not installed the appropriate software (recorder, connector, etc.).

This paper describes the main items to take into account in accessibility of Web information related to multimedia contents. Legislation issues and accessibility standards are summarised in section two. Technology issues in multimedia resources are reviewed in section three. Section four describes the main issues to take into account when we want to create a new accessible audiovisual content. In section five, different designs for accessible audiovisual content in Web are presented, describing their advantages and disadvantages. Finally, conclusions and further research are exposed in section six.

2. ACCESSIBILITY STANDARDS AND LEGISLATION

The lack of accessibility standards makes difficult the proliferation of products and applications that would include disabled people, causing in some cases non-desirable market segmentations. To solve such accessibility issues, various efforts are underway worldwide. The World Wide Web Consortium (W3C) (W3C, 1994) has promoted a Web Accessibility Initiative (WAI) (W3C, 2006a) to publish the Web Content Accessibility Guideline 1.0 (WCAG 1.0) (W3C, 1999a) in 1998. This guideline deal with accessibility issues to take into account when a Web site is been developed. Nowadays, they are working in the WCAG 2.0 (W3C, 2006b). This new version is supposed to be a more easily applicable standard and includes several technological profiles for Web sites and their level of accessibility. The technological profiles included in this new guideline are called baselines (W3C, 2006c).

The WAI helps to coordinate international Web accessibility efforts to bring together technical and human component considerations. WAI includes working groups to produce technical specifications that support accessibility: User Agent Accessibility Guidelines (UAAG) (W3C, 2006d), Authoring Tool Accessibility Guidelines (ATAG) (W3C, 2006e) and evaluation tools.

WCAG 1.0 is widely considered as a standard, nevertheless this guideline does not cover all situations. We can find Internet resources that fully conform the guideline but are not accessible (DDC, 2004).

Regarding to the international accessibility legislation, different approaches protect the rights

of disabled people. For instance, in Australia and the UK, the Disability Discrimination Act 1992 (DDA) (ADA, 1990) underline the necessity of making accessible and usable services to disabled people. In DDA, the Web sites are not mentioned in an explicit way, but it promotes initiatives to follow the WCAG. Furthermore, the Disability Discrimination Commission of UK reviewed the accessibility of Web sites in 2004, concluding the necessity of extending the WCAG due to in some cases Web pages that did pass that WAI test were inaccessible. Moreover, in most of the cases, the Web pages failed usability tests.

In USA, the amendment Section 508 of the Rehabilitation Act (Department of Justice USA, 1998) arranges a set of rules for federal agencies in which the technology has to provide accessibility to disabled people. In simple terms, the legislation requires to be in accordance with the Section 508. Standards are not part of the legislation by themselves, but they are a set of technical requirements, some of which specifically connect to Web accessibility. These requirements are very similar to - but not identical to, and not as extensive as - the WCAG.

In Italy, laws introduce requirements for accessibility of computer systems, with specific provision for Web sites (Italian Parliament, 2004). The legislation, as Section 508, provides a set of technical requirements, which will serve as a standard to be adhered for Web site developers in order to ensure legal performance. Technical requirements reference the WCAG.

In Spain, Law Services of the Information Society and Electronic Commerce (LSSICE) (LSSICE, 2002), point out that administrations have to accomplish the WCAG "Double-A" level.

3. MULTIMEDIA WEB TECHNOLOGIES

When Internet is used as a mean of communication to publish multimedia and audiovisual contents, it is necessary to take into account technological resources and inclusive methodologies.

Technological resources are useful for developing and using accessible contents. For instance, user agents (as browsers) give access to the Web information; software for developing and editing accessible contents; or authoring tools for making easier the production of accessible resources or adapting non-accessible contents (for

example, adding audio description to an audiovisual material). In subsection 3.1, this paper deals with technological resources currently used for developing accessible Web contents.

Assistive technologies are also very useful for accessing web resources. When a user wants to access an Internet resource, s/he can access it using an Indirect Access via assistive technologies. This technology enables us to use computers in a non-direct way, been useful and sometimes necessary for users with disabilities. For example, assistive technologies permit the expansion of controls and texts on screen, the use of Web resources via the use of just one key, etc. instead of clicking links with the mouse.

As far as research in accessibility issues in technology is concerned, we can highlight the potential of the *eXtensible Markup Language (XML)* (W3C, 2006f) with the use of metadata. This language is able to provide adaptability of contents according to the user profile. This is a good solution and it goes beyond the Web accessibility in the multimedia contents.

On the other hand, inclusive and standard methodologies (Lawton, S., 2006). are also useful for developing accessible products. For instance, W3C provides standards for becoming the Web a universal space of information, independently from the hardware, software, language, culture, geographic localization of the users and even independently from the users. Different standards can be applied, as the markup languages: *XML*, *eXtensible Hypertext Markup Language (XHTML)* (W3C, 2006g) or *Cascading Style Sheets (CSS)* (W3C, 2006h).

Specifications about audiovisual accessibility can be applied too, as the *Synchronized Multimedia Integration Language (SMIL)* (W3C, 2006i) to synchronize audio and video (see section 3.2); *Scalable Vector Graphics (SVG)* (W3C, 2006j) to describe XML Graphics; standards for multimodal interaction activities (W3C, 2006k); or the *Web Accessibility Initiative (WAI)* (W3C, 2006a) which develops guidelines to accessibility for different components (see section 2.). Multimedia and audiovisual contents are specially treated in WCAG 2.0. It demands alternative contents (caption, audio description, extended audio descriptions and sign language interpretation) to achieve different levels of accessibility as it is indicated in Table 1. This version is more specific and measurable than the version 1.0. It distinguish between pre-recorded and live multimedia, audio description and

extended audio description, the sign language is considered as a new alternative content and the script element is added, a complete transcription of characters, action, context etc.

WCAG 1.0	WCAG 2.0
Guideline	Guideline
1. Provide equivalent alternatives to auditory and visual content..	1.2. Provide synchronized alternatives for multimedia
Checkpoints	Success Criteria
1.3. Until user agents can automatically read aloud the text equivalent of a visual track, provide an auditory description of the important information of the visual track of a multimedia presentation. [Priority 1]	1.2.2. Audio descriptions of video, or a full multimedia text alternative including any interaction, are provided for prerecorded multimedia. (Level 1).
1.4. For any time-based multimedia presentation (e.g., a movie or animation), synchronize equivalent alternatives (e.g., captions or auditory descriptions of the visual track) with the presentation. [Priority 1]	1.2.1. Captions are provided for prerecorded multimedia. (Level 1).
	1.2.2. Audio descriptions of video, or a full multimedia text alternative including any interaction, are provided for prerecorded multimedia. (Level 1).
	1.2.3. Audio descriptions of video are provided for prerecorded multimedia. (Level 2).
	1.2.4. Captions are provided for live multimedia. (Level 2).
No aplicado	1.2.5.- Sign language interpretation is provided for multimedia. (Level-3)
	1.2.7.- For prerecorded multimedia, a full multimedia text alternative including any interaction is provided. (Level 3)

Table 1.- WCAG 1.0 y 2.0. Accessibility criterion for audiovisual multimedia contents.

3.1 Software for developing accessible multimedia contents

Nowadays there exist a great number of tools oriented to the development and support of multimedia on the web. These tools can be classified via many criterions: the platform in which they are developed, the operative system in which it works, the level of use of the tool or the level of accessibility of the final product. Many of these tools are language interfaces which allow us to modify the multimedia to make it accessible

(NCAM, 2006). In this way, authoring tools help us to create audiovisual contents integrating caption and/or audio description, or help us to edit them so that prerecorded multimedia can be included.

As mentioned before, there exists a great variety of multimedia technology that we can apply to make accessible the multimedia contents as:

- Languages and formats to synchronize multimedia, highlighting QuickTime (Apple, 2006), SMIL, Microsoft® Synchronized Accessible Media Interchange (SAMI) (Microsoft, 2003) or Timed Text (TT) (W3C, 2006l)
- Players, such as RealPlayer (Realnetworks, 2006), QuickTime (Apple, 2006), Windows Media (Microsoft, 2006), etc.
- Caption and/or audio description editors for multimedia, such as Media Access Generator (MAGpie) (NCAM, 2003), Hi-Caption Studio (Hi Software, 2006) or utilities as CaptionMeNow (IBM, 2005)
- Editors to convert multimedia presentation to an accessible format such as Flash Macromedia (Adobe, 2006), (Webaim, 2006), used by many designers
- Others, such application as SVG for images. The combination of using SVG and SMIL permits to create multimedia contents.

Due to these possibilities are not always compatible some with others, we can find different platforms, emerging technologies such as AJAX, shorthand for Asynchronous JavaScript and XML (wikipedia, 2006a), property licenses, free software, formats incompatibilities at the resource-control interaction, etc. There are so many different formats, platforms, players, languages and technologies that the task of making multimedia accessible is sometimes really difficult, but it is not impossible. It is indispensable to follow the standards guides and recommendations of the W3C. For instance, the navigators and multimedia players must fulfil the *User Agent Accessibility Guidelines* (UAAG). But before taking into account the user agent issues, it is interesting to pay attention in how to access to the Internet applications, to use scaled technologies with an easy growth on the Web, as the XML technologies. The XML is a possible option and with a promising expansion.

3.2 Synchronized Multimedia Integration Language (SMIL)

SMIL was developed by WC3. SMIL technology started off as a technology to develop the multimedia contents on the Web. It is a market language which creates multimedia presentations containing audio, video, image and/or textual elements. These elements are separately stored and synchronized reproduced. The multimedia elements in SMIL format can be provided via Internet or via a system of local archive, a unit of hard disc, CD or DVD. In the Web accessibility area, SMIL allows the creation of audiovisual contents with captioning and synchronized audio description.

Since 1998, several versions of SMIL have been developed: SMIL 1.0 (W3C, 1998) was released and its prime objective was simplicity, SMIL v2.0 (W3C, 2005a) in this version (W3C, 2005b), introducing the concept of profile and changing its structure in a modularized way. Today there exist three profiles for SMIL 2.0: *SMIL 2.0 Language Profile*, *SMIL 2.0 Basic Language Profile* and *XHTML+SMIL 2.0 Language Profile*. In December of 2005 SMIL 2.1 (W3C, 2005) was released.

SMIL is compatible with the following players: QuickTime Player, RealPlayer, Grins player (Oratrix, 2006) and Ambulant (CWI, 2006) among others. It is important to underline in this point that different players of SMIL provide different levels of implementation, that is to say, not every accessibility characteristic described by SMIL is supported by the player.:

- What modules are included in the content, it distinguishes between two kinds of means according to it's nature: continuous means as audio, video or non-continuous and discrete means as images or text.
- The spatial disposition, describing how the SMILE components are allocated in the space.
- Adaptability. According to the system characteristics and users. SMIL can play remote files in different ways. These options would be specified by the preferences of the user due to the fact that the coexistence of one or another depends on the system (Internet connection, hard disc, RAM memory, etc.).
- Interaction. SMIL allows browsing through the Web contents, providing control of the interaction to the user. It allows the users to put or take off the captions or audio

description via the interface of the player and the Web page. Each SMIL player has different characteristics and can provide menu or dialogue window options for this interaction but, to be able to achieve a greater accessibility, the designers should consider to add accessible buttons in the interface of the player which would make easier for the user the selection of a certain point in the track playing in each moment.

- Time control. It consists in synchronizing the means, planning and distributing the initial time for each means.

4. WEB ACCESS IN MULTIMEDIA

Due to not every people access to the Web in the same way, it is necessary to take into account this diversity in order to provide full accessibility to the Web contents. But the way of accessing to the Web is not the only difficulty for accessing to the Web content. Users usually have other kind of problems derived from the context of use and technological incompatibilities (software and/or hardware) of the access mechanism. We therefore have to have in mind the next access possibilities:

- Regarding to the access characteristics in the field of disability, we can find different uses of the Web depending on the type of disability (visual disabilities, hearing impairments, physical disabilities speech disabilities, cognitive and neurological disabilities, multiple disabilities, aging-related conditions, etc.). But these disabilities embrace a variety of subtypes. Moreover, these disabilities could be temporary and not exclusive, but one user could have various disabilities at the same time.
- Regarding to the type of access, one user can use a direct access, having control of all the interaction with the computer; or indirect access using assistive technologies (see section three), needing screen readers, refreshable Braille displays, speech synthesizers, magnifiers, adaptable keyboards, software for voice recognition, etc. Usually, indirect access led to access barriers if the Web designer does not take into account this kind of access.

Access barriers to Web-based multimedia resources affect not only to people with

disabilities, but to people without disabilities too. For example, one person could be interested in obtaining audio information from Web via a reader, not only because is a blind person, but because his/her eyes are occupied by other tasks. On the other hand, *usability* is intimately linked to *accessibility*. Captioning is a good usability mechanism, because it does not only benefit deaf users but also raises the efficiency of content searches.

Any multimedia product needs to be designed following a certain methodology of inclusive design which will make possible and easier the access for users with and without disabilities.

We can finish this section defining the concept of *accessibility* as the possibility of access to Web contents regardless of whether the access characteristics to the resource are, the context of use is or the technological conditions are. We can also define the concept of *adaptability* as the previous definition but including the possibility of adapting the contents depending on the profiles of the different users.

4.1 Access to multimedia Web contents

This paper has previously described the causes of access barrier to Web multimedia resources, affecting users with and without visual disabilities or/and hearing impairments. This problem can be avoided offering to the user equivalent alternatives to auditory and visual contents.

Going back to the accessibility definition exposed in this section, a multimedia content is accessible when a user can access that content, regardless whether his access characteristics and context of use are. Sometimes we can find in Websites accessible contents (offering alternatives as captions and/or audio description), but non-accessible resources because they are reproduced via a control that does not appear in every navigator. Or vice versa, sometimes it is possible to access the multimedia resource, but the resource's content is not accessible because it does not offer alternative contents. In conclusion, we need to ensure two different requirements for accessibility:

- That the multimedia content is accessible
- That the access to the multimedia resource is accessible.

Moreover, we can not forgot the necessity of integrate the multimedia contents in an accessible

and usable user interface (Web page, player, etc.). Then, the contrast of colours, accessible buttons for control (alternative texts), etc. in the interface must be taken into account. Furthermore, the user should be allowed to interact with every hypermedia element in the interface, controlling them device-independently.

In this paper we do not want to give a guideline about *good practices*. We only want to highlight that to provide subtitles in an accessible way references to non-spoken information in the video resource. It can not be confused with the subtitles of a dubbing that translates from one language to another everything that is said by the interlocutors in the video resource. Subsequently, we can distinguish between "caption" for persons with hearing disabilities and "subtitle". Regarding to audio description, the multimedia resource must precisely script and narrate what is exactly appearing on the screen. To introduce narrations, audio effects, music, etc. in the audio description can be interesting.

5. STUDY CASE

The Spanish Centre of Captioning and Audio description (CESyA) (ref) works towards the accessibility in audiovisual media using captioning and audio description services. One of the main goals of this centre is to study how to integrate accessible multimedia resources in the media. This paper presents some experiments carried out in CESyA studying the best way to integrate a multimedia resource (a video called "Nicolás") in Internet in an accessible way.

This section describes how to make accessible the video's content and how to integrate the video in the Web interface maintaining the accessibility.

5.1 Editing the video to make it accessible

Making accessible the video's content means to follow the current Web Content Accessibility Guidelines (WCAG) and to provide synchronized alternative contents such as caption and audio description. Two different options can be implemented for making accessible the video:

1. Video with closed audio description and caption. This option permits to create accessible videos, but it has a big inconvenience: the user will have not possibility of controlling the resource reproduction, choosing if s/he prefers or not to play the video or audio means separately in each moment. For example, sometimes the user could prefer to watch the subtitles, but maybe s/he does not want to listen to the audio description at the same time. This adaptability characteristic can not be controlled by the user with this option.

2. Video with open audio description and caption, separating audio and text. There are different options to create and edit a resource in different formats (for example, with software or languages such as Quicktime, SAMI, SMIL, etc.). In this case, the system provides the control to the user, allowing to adapt the reproduction of the video according to his/her current necessities. The user can choose if s/he prefers captions, audio description, none of both of them when the video is been reproduced.

This second option is more usable, because it provides more control of the video reproduction and adapts better to the user necessities. Our studies implement this option. We have used SMIL for the implementation, following the recommendations of W3C (see Section 3).

The video edition has been performed as follows:

1. Initially we had two different versions of the same video: a non-accessible version and an accessible version, both of them with closed audio description and caption.
2. The first step of the edition was to separate the soundtrack from the video.
3. Next, we put our attention in finding a compatible format for captions. They were edited with a tool called MAGpie (NCAM, 2003). This tool permits to convert the caption format to a compatible format with the player.
4. Finally, the accessible video was created with SMIL.

5.2 Integrating the video resource in an accessible way

We have considered the following possibilities as alternatives to make easier the accessible access to the multimedia resources:

1.- Integrate a multimedia resource associating it with a player integrated by a control found on the Web page. This implementation option is independent from the resource format. The most common method to include multimedia elements on a Web page is using the element <embed> (Joe Clark, 2004), element that nearly all the known navigators support. But this element has a problem: it does not form part of the specifications of the HyperText Markup Language (HTML) (W3C, 1999) or XHTML. If <embed> is used on a Web page, the code is not accessible according to WCAG. Most of Web designers prefer to use the element <object> (W3C, 1999) instead of <embed> to add multimedia fulfilling guideline of WCAG. But this solution also has a problem: there are navigators that are not able to correctly interpret this element. Moreover, this element was initially defined as a universal element (not associated to any specific player), but many browsers have not followed the standard. Even so, to use the element <object> seems to be the most appropriate way of integrating video into the Web page. It is important not to forget that it must be used with alternative techniques that reach validity according to WCAG. There is another option to include multimedia using this design. This technique is called FlashSatay (Drew McLellan, 2002) and is frequently used by the Web designers. This technique edits the code so that the video can be reproduced as a Flash resource. The only problem is that this code is only valid using the element <object>. Other option for adding multimedia into a Web page is to define a Document Type Definition (DTD) (wikipedia, 2006) and include it in a Web page using DOCTYPE. In this implementation, the element <embed> and its parameters are specified in the DTD. Following this implementation, it is possible to fulfil the guideline of WCAG (WebDesignGroup, 2006)(YoYoDesign, 2004). Finally, the implementation option studied in our experiment used SMIL and the element <object> to include multimedia into the Web page.

2.- Integrate an audiovisual content using Flash in the browser without having an associated player. The implementation of this option can be done editing the video with Flash (Adobe, 2006), (Webaim, 2006) having in mind the accessibility criteria given by Adobe Macromedia Flash. Although Flash is not a public-domain software, most of users usually have installed this software in their computers, because it is compatible with most of the navigators. This option permits to use the connector integrated

without the necessity of installing a new player. Moreover, Flash allows to define captions and reproduce them. Different tools, as Hi-caption (Hi Software, 2006), permit defining compatible captions with Flash.

3.- Integrate an audiovisual content with SMIL in the code XHTML. Other implementation possibility is to use the profile SMIL+XHTML de SMIL 2.0 (W3C, 2002). This option has a problem: currently, this profile can only be reproduced using Internet Explorer (version 6.0 and higher), but it is supposed that in the future other navigators will permit it too. On the other hand, this implementation has a big advantage: it can be directly integrated in the XHTML code without any player associated via the <object> element.



Figure 1.- Interface of implementation SMIL with the user control in RealPlayer.

4. Associate the reproduction of an audiovisual content to an external player. In order to include adaptability to the user, providing him/her some control on the reproduction of the video, we can use SMIL combined with any external player compatible with this language. In our experiment, we have use RealPlayer as external player. The implemented interface shown in Figure 1 provides different alternatives for the video reproduction (including audio description, captions, both or none).

Access	Method	Advantages	Disadvantages
Player integrated into the Web page	- <object> or <embed> - <object> in Flash - <object> in XHTML - <object> in SMIL	- Compatible with any player	- No control of the reproduction - An integrated player is need - <object> or <embed> are not completely accessible
Flash + player	- <object> in XHTML	- Compatible with most of navigators - An integrated player is not needed	- Flash is not public-domain software - The adaptability and reproduction control depends on the resource design
SMIL+XHTML	SMIL+XHTML profile	- Provides adaptability by controlling the video reproduction	- Currently only Internet Explorer can reproduce it
External player	SMIL	- Provides adaptability by controlling the video reproduction	- Each player detect different characteristics of SMIL

Table2.-Advantages and Disadvantages implementing accessibility in multimedia resources

The user can choose in every moment of the interaction which media want to reproduce, adapting him/herself the interface according his/her current necessities of access. The editor LimSee2 (Limsee2, 2006) has made possible this implementation, adding accessible functional buttons to the interface for controlling the video reproduction. Nowadays, we are still working on the Web page design, improving its usability and accessibility.

As a conclusion to this section, different implementation options have been studied for integrating accessible videos into Web pages. All the implementation options provide high level of accessibility to the multimedia resources, but there exist different accessibility advantages and disadvantages when different technology is used. Table 2 summarises this information.

6. CONCLUSIONS

Currently, most of the Web sites include multimedia contents (sound, video, animation, presentations, etc.), but unfortunately most of them pay not attention to their accessibility properties. This paper presents the main items to take into account when we want to add accessible multimedia resources into a Web page. The current state of the international legislation, standards and technology related to multimedia accessibility are described.

It is indispensable to provide alternative synchronized contents (captions, audio description, etc.) in order to become the content of a multimedia resource accessible, but it is important too to provide accessible access to the resource.

Nowadays, lots of multimedia technology possibilities and market products can be used to include multimedia in Web pages. Unfortunately, there is an apparent technological incompatibility among them. That is why we highlight the necessity of technology normalization. Developers, companies, etc. should try to follow the accessibility standards in order to avoid the physical barriers accessing to Web sites.

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