Accessible interfaces for educational multimedia contents

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Abstract

The use of technology is growing in every field of education, and not only in the education of disabled students but also as a learning resource for everybody. The teachers are more and more introducing these digital contents in their lessons and there are many resources related to learning on internet.. If an equal access to these resources is guaranteed, then we can avoid students feeling that their learning capacity is limited due to a possible inaccessibility to them. Inclusive methodologies have to be followed to reach these objectives applying the standards such as Web Content Accessibility Guideline (WCAG) and rules of accessibility in the design and development of web pages, technical supporting, software, author tools, etc. This papers describes a practical case with two accessible interfaces of multimedia resources implemented with Synchronized Multimedia Integration Language (SMIL.).

1. Introduction

The electronic books, educational software, audiovisual resources, web pages are now used as assistant tools, complementary resources and sometimes even as the only resource available to provide certain contents within the educational system. If an equal access to these resources is guaranteed, following the Universal Design Principles [4], then we can avoid students feeling that their learning capacity is limited due to possible accessibility barriers.

Inclusive methodologies are required following the standards and rules of accessibility in the design and development of web pages, technical support, software, author tools, etc. The need is obvious, we found ourselves with the need of these technologies in non inclusive educational systems as well as in the inclusive ones. The students have the right to be given the access to these systems independently from its form of access of use. There are alternative technologies to obtain accessible products such as multimedia contents and web pages. The author software tools do not only create accessible products but permit adapt resources giving them a better accessibility, including captions and/or audio description to an audiovisual content for students with an audio or visual disability, providing an audio description to graphs and equations for students with visual disabilities, etc.

Next section shows related work and technological aspects and standards are given in section 3. A case study is described in section 4 and finally some conclusions are given.

2. Related work

To provide access to digital resources in accessible applications and web sites there are three standards to be considered: the guidelines for developing accessible learning applications of Global Learning Consortium (IMS) [8], the World Wide Web Consortium (WC3) [17] and the Web Accessibility Initiative (WAI) [19] which play a leading role in promoting the importance of accessibility and developing guidelines which can help when developing accessible Web resources.

The WAI develops guidelines of accessibility for different components; multimedia and audiovisual contents are specially treated in WCAG. It demands alternative contents (caption, audio description, extended audio descriptions and sign language interpretation) to achieve different levels of accessibility.

To elaborate and edit accessible digital resources some normative must be followed, as the study in the educational area of Accessible Digital Media of NCAM [15], which offers a complete and valuable guide of recommendations, tools and development techniques to create all types of accessible multimedia resources.

Focusing on research in the area of education and strictly related to the accessibility, we find ourselves with the use of metadata with various uses, but the most important one is the initiative of “Access for all”, AccessForAll Meta-data [8] of IMS. Further on we

will refer to this initiative of huge interest in any e-learning platform that really does want to provide accessibility. Basically, it is an attempt to repair the imbalances between the system resources and the user needs ensuring a definite access for all the users and giving different views according to the preferences and characteristics of the users in the learning process.

3. Accessing multimedia contents in web

There are useful technlogies 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 a video).

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. This technology enables to use computers in a non-direct way, been useful, and sometimes necessary, for users with disabilities.

Nowadays, there are available a great number of tools to develop and support of multimedia on the web. In this way, authoring tools help us to create audiovisual contents integrating caption and/or audio description, and help us to edit them so that prerecorded multimedia can be included. Some examples of technologies to make accessible multimedia contents are:

- Languages and formats to synchronize multimedia, highlighting QuickTime [2], SMIL [20], Microsoft® Synchronized Accessible Media Interchange (SAMI) [10]
- Players, such as RealPlayer [16], QuickTime [2], Windows Media [11], etc. or SMIL players as Grins player, Ambulant [5]
- Caption and/or audio description editors for multimedia, such as Media Access Generator (MAGpie) [14], Hi-Caption Studio [6] or utilities as CaptionMeNow [7]
- Editors to convert multimedia presentation to an accessible format such as Flash Macromedia [1] used by many designers, SMIL editor as LimSee2 [9].
- Others, such application as SVG for images. The combination of using SVG and SMIL permits to create multimedia contents.

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 standard guides and recommendations of the W3C. For instance, the browsers and multimedia players must fulfill the User Agent Accessibility Guidelines (UAAG).

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).
	1.2.6 Extended audio descriptions of video are provided for prerecorded multimedia. (Level 3).
not mapped-	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 criteria for audiovisual multimedia contents.

Multimedia contents are specially treated in WCAG 2.0 [21]. 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 [18]. It distinguishes 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 also added, as well as complete transcription of characters, action, context etc.

It is necessary to ensure two different requirements for accessibility: the multimedia content is accessible following the WCAG and the access to the multimedia resource must be accessible. In addition, 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 in a device-independent way.

4. CASE STUDY

The resources were built for The Spanish Centre of Captioning and Audio description (CESyA) [3] devoted to promote 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 different media [12].

To achieve this, personalized educational resources could be offered to all the functional diversity in an inclusive way. The multi-modal interaction makes possible the access to students with disabilities to use multimedia educational resources, but also provides advantages independently of having or not disability in learning presenting the information in a visual way and audio-described [13].

In this line, a study case is presented. Two different accessible interfaces have been built. Both of them are able to play any multimedia content. The interface in Figure 1 allows the user to activate and/or deactivate the different audio and textual alternatives within the multimedia information.

Figure 1. Accesible Interface Prototype for Audiovisual Works Reproduction

On the other hand, the interface in Figure 2 has been built for using it at the University. This interface shows different learning resources presented in a real class. These learning resources are presented digitally, providing captioning, audiodescription and transcription. The final user is who decides what to watch in every moment, interacting with the interface controls for activate/deactivate each resource.

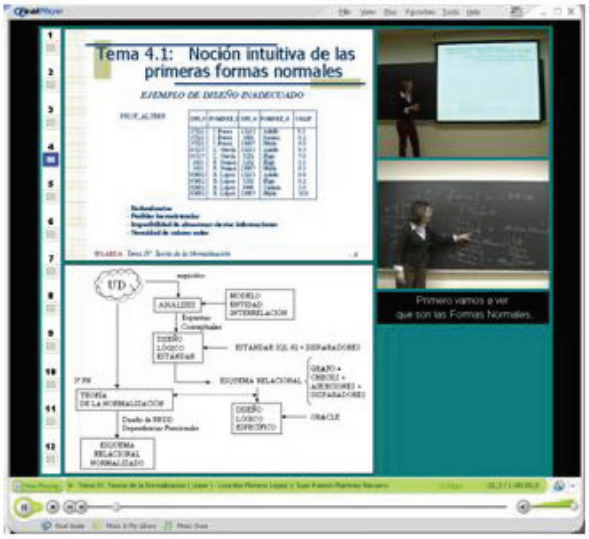

Figure 2. Accesible Interface Prototype for Learning Resources Reproduction

Both interface prototypes have been implemented using SMIL 2.0 and the reproduction of their multimedia content is associated to an external player: Real player [11]. 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 reproduced in a synchronized way. In the Web accessibility field, SMIL also allows the creation of audiovisual contents with captioning and synchronized audio description.

SMIL is compatible with the following players: QuickTime Player, RealPlayer, Grins player and Ambulant 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. Although the interfaces have been developed by SMIL, not all the players implement it in the same way, and the results are slightly different. In these cases Real Player is used as it is a player which apart from its extended use, implements a high level of SMIL which has permitted:

- To add hypermedia elements to the interface such as buttons associated to events, to provide adaptability to the interface and allowing the user to control the

different means that are presented to him (including audio description, caption, both or none).
- To follow the philosophy of SMIL, as well as synchronizing audio description and caption. This makes the multimedia content accessible. Accessibility to the interface and its use by means of different access devices such as the mouse, keyboard and now voice synthesis is being researched.

To emphasize that the characteristic of adaptability is interactive, it does not have to decide which adaptation of contents the user wants at the beginning, but has to be able to personalize its interaction whilst the reproduction is taking place.

4.1. Developing with SMIL

The coding in SMIL is based on the creation on regions in which the different multimedia contents which will contain the presentation with the tag <root-layout> and <region> are included. Different multimedia contents have been associated to each one of these regions. Moreover, some regions have been created in order to include the interface controls for activate/deactivate each accessible resource. Once the regions have been defined, the multimedia resources have been included using the <body> tag. Moreover, depending on the type of mean which we are going to make reference to, a different tag is used: <audio>, <video>, <textstream>, etc.
In the inclusion of the different elements in the code it must be stressed that that better results are given when adding the lighter elements before the bigger ones due to problems of synchronization which may emerge. This does not appear in the specification of SMIL, not even something which could be extended to every example but it is a conclusion extracted from the different trials which have been carried out. It is important to point out that the different implemented controls have been included through images.
If we make reference to how the different buttons control the different means its function should be explained according to the mean in question. In general the only way to start up the means in SMIL is by means of begin and end events through the tags <begin> and <end>and according to the element which is being dealt with, we will define its function. For example, if we are working with the audio control we can see that it is being done through the attribute <set> as it is shown in Figure 3.
We use the attribute <set> to achieve the activation and deactivation of the audio-description. With the <target element> tag we make reference to the region that contains the audio-description archive. With the <attribute name> tag we indicate that sound level is the attribute to be modified. The difficulty is found in the interactivity, and finally the activation or deactivation is simulated by the means of the <to> tag and indicating the percentage of volume that we want to be maintained. In other words, in order to inactivate a means it is necessary to set the <to> tag to "0%"; to activate it, it is necessary to set <to>=100%.

```
<!—FILE AUDIO -->
<audio
region="audio"
src="audio/audioforall.rm">
<set
targetElement="audio"
attributeName="soundLevel"
to="0%"
begin="stop_audiodes.activateEvent"
dur="0.5s"
fill="freeze"/>
<set
targetElement="audio"
attributeName="soundLevel"
to="100%"
begin="play_audiodes.activateEvent"
dur="0.5s"
fill="freeze"/>
</audio>
```

Figure 3. SMIL code of implementation

Finally notice that the event is launched using the attribute <begin> relating it to the corresponding button according to the function that it is wished to have, to activate the means it is needed to set <begin>="play_audiodes.activateEvent" and to deactivate it, it is needed to set <begin>="stop_audiodes.activateEvent". In the rest of the cases the means are activated and inactivated using begin and end events just as the ones used in the previous case but they are not included in the code using <set> but done directly in the declaration of the corresponding multimedia element. It is important to point out the way of making the means that include images disappear from the presentation (caption, transcription) is done using layers that are superimposed over the means when the user wants to inactivate it. We have created a method that allows us to apply, with the attribute <set> in conjunction with <z-index> the same effect of layers to avoid the scrolling bar being restarted when a new element is launched. Finally we also need to make reference to the inclusion of alternative descriptions for every element included in the presentation, buttons or means. This is implemented using the <alt> tag. In the label code <alt> we are allowed to add an alternative description which will later be shown by the player.

5. Conclusions

In this paper, a case study has been presented. Two accessible interface prototypes have been implemented using XML technologies as SMIL. These interfaces reproduce multimedia audiovisual works and multimedia educational contents in an accessible way. They have been developed according the Universal Design and they favours the inclusion. These prototypes offer personalization of the alternative contents such as caption, audiodescription or transcription in an interactive way.

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