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Monograph: Information Technologies for Visually Impaired People (published jointly with Novática*)

Guest Editors: *Josep Lladós-Canet, Jaime López-Krahe, and Dominique Archambault*

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Helping Authors to Generate Accessible Content: two European Experiences

Carlos Rebate-Sánchez and Alicia Fernández del Viso-Torre

*This article aims to describe the experience obtained and the lessons learned in two European projects: VISUAL (*Voice for Information Society Universal Access and Learning*) and ENABLED (*Enhanced Network Accessibility for the Blind and Visually Impaired*). The two projects share a number of common features: their target public (the visually impaired), their goals (to help authors generate accessible Web content that is compatible with the most common technical aids) and their funding (both projects were funded by the European Commission within the 5th and 6th Framework Programmes).*

Keywords: Accessibility, Accessible Software, Authoring Tools, ENABLED, Human-computer Interaction, VISUAL, Visual Impairment.

1 Introduction

In this article we present our experience in the development of tools to help authors generate accessible content. This experience is the result of our participation in two European research projects: VISUAL [*Voice for Information Society Universal Access and Learning* (IST-2001-32495)] and ENABLED [*Enhanced Network Accessibility for the Blind and Visually Impaired* (FP6-2003-IST-2-004778)].

Before looking at each project individually perhaps we should explain why we decided to describe the two experiences and the lessons learned from them in the same article. It is a proven fact that developing tools to meet user expectations is a complicated task. Users are often fickle characters who try the patience of developers and never seem to be happy with the outcome. Unfortunately, it is impossible to build good software without listening to the users. It is vitally important to know the needs of users and involve them in the development of the product, since the ultimate success of any development will depend directly on the degree of commitment that developers and users jointly put into the software creation process. All the above is doubly important in the development of authoring tools for generating accessible content where we have two groups of users: the users of the authoring tools themselves, and the users of the content generated by those tools.

Another point that we need to make is that it is possible to find authoring tools that, in spite of meeting W3C accessibility guidelines for authoring tools [1] are not properly accessible to the author, and Web pages which meet content accessibility guidelines [2] but are not properly accessible to the end user. Compliance with guidelines is no guarantee that the end product will be accessible.

If we cannot rely exclusively on existing guidelines - de facto standards - for the creation of authoring tools and accessible content this makes it all the more necessary to involve our end users to check whether the software we are producing is truly accessible and can be used in a real environment. This is a major problem since we do not only depend on users for producing and testing a product's functional specifications but we also rely on them to know whether the software is really accessible from a purely technical point of view.

Authors

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In order to address this situation, people with visual impairment and with sufficient technical knowledge were involved in both projects in order to provide guidance during their development, with the aim of ensuring that the end product was accessible from a formal point of view (compliance with the relevant W3C accessibility guidelines) and from a functional point of view (that users were able to interact with the software in an effective manner).

Lesson 1: *If you want to be successful, always involve your end user in the design of your product.*

2 Two European Experiences

2.1 VISUAL

The VISUAL project is an international project coordinated by SOLUZIONA and funded by the European Commission IST (*Information Society Technologies*) programme under the 5th Framework Programme. Its aim was to develop technology based on voice interaction [3] [4] to improve access to the Information Society for the visually impaired.

VISUAL began in October 2001 and ended in September 2004. It enjoyed the participation of two universities (*City University* and *Katholieke Universiteit Leuven R&D*), national blind organizations from four European countries – United Kingdom (*Royal National Institute of the Blind*), France (*Fédération des Aveugles et Handicapés Visuels de France*), Italy (*Unione Italiana Ciechi*) and Germany (*Deutscher Blinden- und Sehbehindertenverband e.V.*) – and the European Blind Union.

The basic goal of the VISUAL project was to **allow visually impaired people to create their own Web content** with aid of an authoring tool which, in turn, would encourage and teach users to **create accessible Web content** in a user-friendly and intuitive manner. Target users need to be familiar with the use of technical aids and have a basic grasp of HTML.

The authoring tool had to be conceived with **accessibility in mind** from the outset and not, as is the case of most tools that claim to be "accessible", designed first and then fiddled with to meet the appropriate guidelines and recommendations. We had a great opportunity in front of us.

Creating a tool in the knowledge that most of the Web authors that were going to use it would be blind was an enormous challenge. The first step was to carry out an exhaustive study of commercial and free tools (Amaya, DreamWeaver, HomeSite, FrontPage, HotMetal Pro, etc.) to look for their strengths and weaknesses (which often included not being accessible at all!). Most of them had a major visual component; they were clearly based on Web authors "seeing" what they are creating (to see in order to do) – hence the success of the famous WYSIWYG (*What You See Is What You Get*) view. We had to discover our own form of WYSIWYG; a way of enabling blind people to create a mental model of the page of being built while allowing them to access, locate, place, and navigate between elements using a keyboard. The task of discovering our "user view" became the focal point of all our discussions.

The view would be the cornerstone of the tool, around which the entire Web creation process would revolve, which

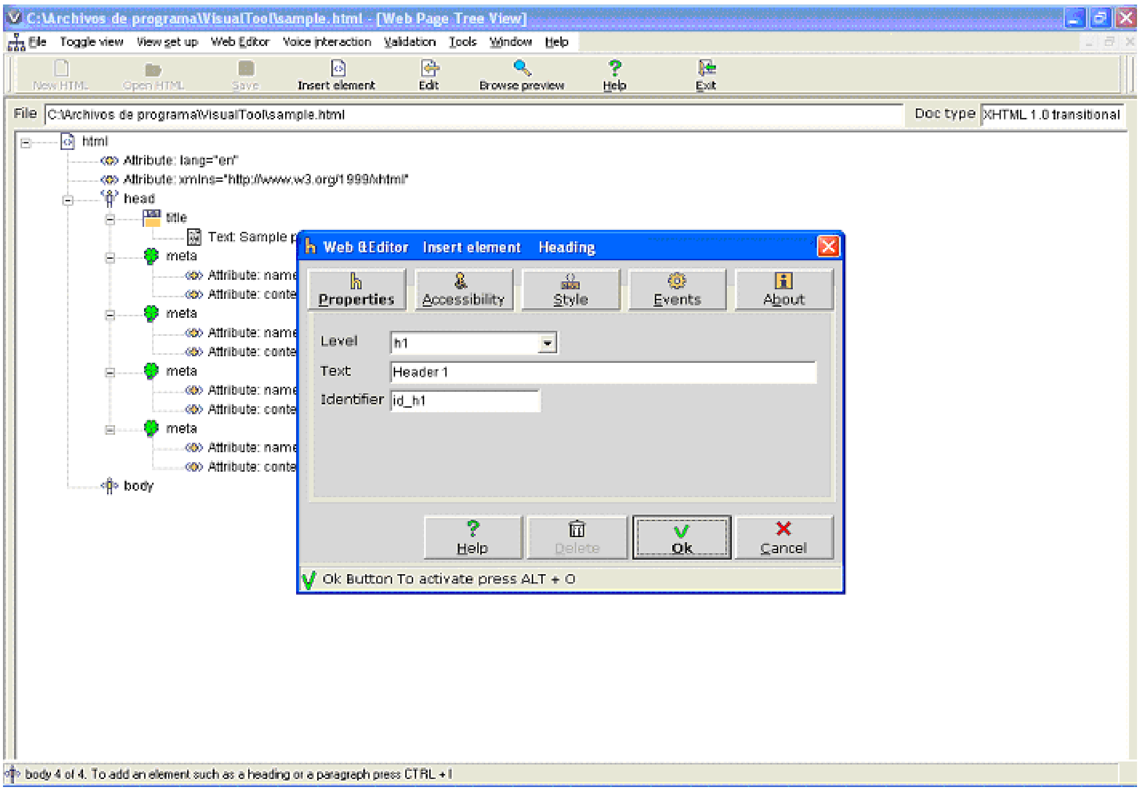

Figure 1: User Interface of the VISUAL Authoring Tool.

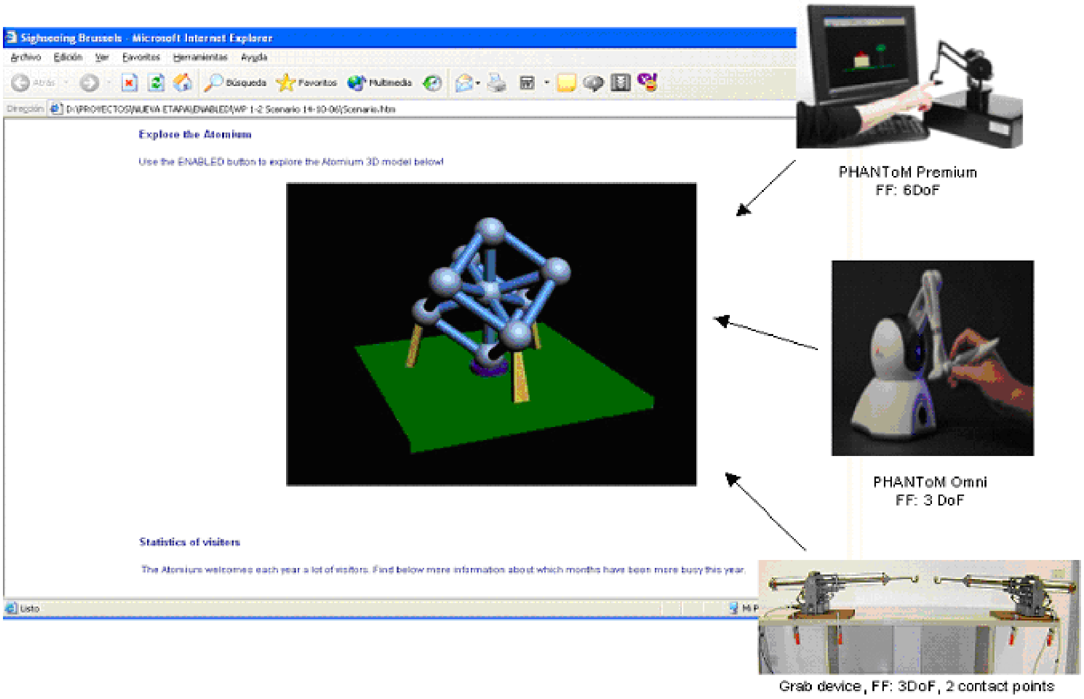

Figure 2: Insertion of an Element 3D Annotated for Haptic Exploration.

was why it was so important to find the right mechanism. After the consortium held several meetings to try and decide upon a method of interaction that would help users to navigate around the page content, we were set on the right track by a fact that had hitherto escaped us all. Discussing how users in general resist change, someone made a comment about how the arrival of Windows had been received with a certain degree of opposition by users of assistive technology accustomed to working with MS-DOS in text mode which, by using a simple screen reader, enabled them to receive the same information as a user looking at the screen output. The Windows operating system, more visual and more colourful, was a step in exactly the wrong direction for users of assistive technology. In principle, the idea of having a load of windows that opened, closed, emerged, and used icons to identify the various elements had little to recommend it to those that up until then had been used to having text as the only source of information about what was happening on the screen. Nowadays users of assistive technology have no option but to use Windows and many of them are more than happy to use Windows file explorer which shows users the content of the local and network units to which they are connected and which allows them to navigate up and down the file structure, changing its content, adding, deleting, and even renaming folders with the aid of hotkeys, all by using nothing but the keyboard.

This reflection on the usefulness of the file explorer combined with the fact an HTML Web page is ultimately a perfect hierarchical structure, provided that it is well formed (XHTML), led us to choose the file explorer model as our means of interaction for users creating a Web page with the aid of our tool. For users of VISUAL, the Web page would be represented as a tree in which each node would correspond to an HTML element or to an attribute of that element. In order to interact with the tree you only need to use the keyboard and its hotkeys in the same way as with file explorer. To interact with the XHTML tree you use the hotkeys that display the dialogue windows in which you can then input the data corresponding to each element (texts, images, links, etc.).

One of the strong points of the VISUAL tool was its user-friendliness and innovative interface (see Figure 1). However one of its weaknesses was the result of one of its objectives: **the creation of accessible content only**. For more experienced Web designers this was a drawback since Web designers are habitually less than scrupulous in their compliance with XHTML syntax rules. Having long been accustomed to using HTML elements freely without taking syntax into account, Web developers saw the tool as "not very flexible". Paradoxically this was actually one of the strengths of the tool as it meant that **it is impossible to create Web content with it that is not (formally) accessible**.

Now we had a philosophy to follow: a tree view (hierarchical representation of the Web page) with the use of *wizards* and dialogue windows to act as a guide in the creation of accessible Web content. All combined with an accessible user interface via a keyboard, compatible with assistive technology, in which the tool's own speech synthesis system combines with the synthesis provided by the assistive technology or can even replace it if so desired. It also includes a "code cleaner" [5] and an integrated accessibility validator to debug existing pages.

The tool was evaluated by 24 people with visual impairment (13 of them blind): 5 from the *Unione Italiana Ciechi*, 5 from the *City University*, 5 from the *Fédération des Aveugles et Handicapés Visuels* in France, 4 from the *Royal National Institute of the Blind*, and 5 from the *Deutscher Blinden- und Sehbehindertenverband e.V.* together with a number of experts in accessibility from the various organizations in the consortium.

2.2 ENABLED

ENABLED [6] [7] is a large scale European project involving 14 entities from 10 countries including major companies, universities, and research centres. Led by *Queen's University of Belfast* (United Kingdom), ENABLED enjoys the participation of SOLUZIONA and the LABEIN Foundation in Spain, the Lund University in Sweden, SCALAB in Italy, Tekever in Portugal, Siemens, OFIS and CAS in Germany, NetUnion in Switzerland, and British Telecommunications (BT) in the United Kingdom.

The goal of the ENABLED project, which began in 2004 and is scheduled to finish this year, is to improve Internet access for the visually impaired in two ways:

- By developing technologies that make it possible to create **accessible Web content**.
- By creating **tools to provide users with access to information** and available Web services through the use of **adaptive and interoperable interfaces**.

Unlike VISUAL, ENABLED limited its scope to delivering accessibility to one particular type of content, non-text content (images, graphics, maps, 3D objects, etc.). The web is full of non-text content which cannot be accessed by the blind and for which a text description is often insufficient. Unlike VISUAL, the ENABLED project is not aimed exclusively at Web authors but also addresses the problem of interaction with non-text content from a dual perspective:

1) On the one hand, the Web author, by using the right tools for annotating this content so that all the information can be conveyed to users in a non-visual manner.

2) On the other hand, the users, who can access those annotations using available tools or devices to allow them to access the information contained within the image via other alternative senses such as touch or hearing. The project goes even further and enables users to obtain information and interact with the content (depending on the device used).

If with VISUAL the greatest difficulty was finding a means of interaction that would be familiar to users and would allow them to use their "own" tools when creating Web pages, with ENABLED the difficulty resided in having users use new means of interaction which would not permit them to use "their own tools" but would instead require them to use new devices or new interfaces of which they had no prior experience.

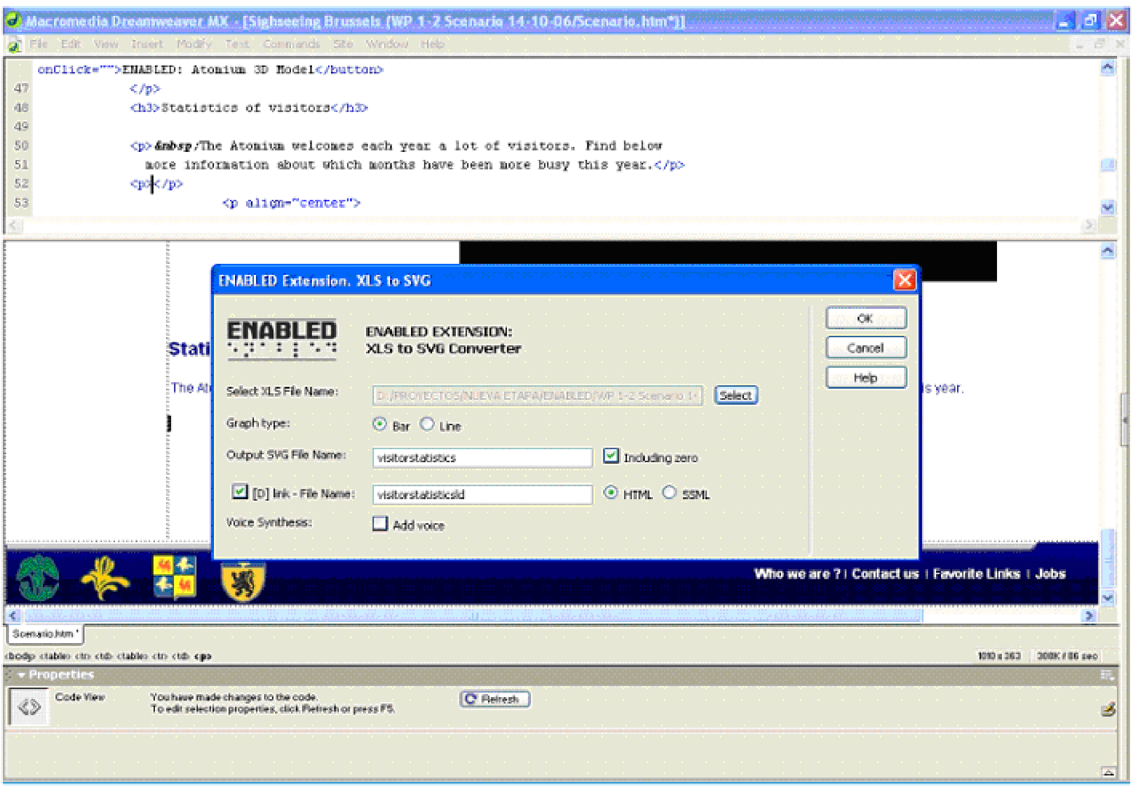

Figure 3. Extension of DreamWeaver for the Creation of a Vectorial Graphic (SVG) Annotated to an Excel Spreadsheet.

Thus the great challenge was to gather user requirements that could be used to guide the development of these tools in the knowledge that users had no idea of what those tools were going to be like. It was like "let's play at inventing" a means of interaction. In order to limit the scope of the problem, user requirements were ascertained by asking users to talk about the known reality and therefore about their present day access problems. Thus by identifying, with the aid of the users, the areas of improvement which we needed to focus on, it was the project's job to come up with innovative ideas or approaches to address these problems. Below we show two examples: Exploration of 3D figures with haptic devices[1] (see Figure 2) and the creation and insertion of vectorial graphics (SVG) annotated to Excel spreadsheets (see Figure 3).

3 Lessons Learned

As we had already anticipated, the first lesson is that users need to play a key role in the process. For this reason, in both projects we used an iterative and incremental model, alternating the release of various versions of the tools with evaluation periods.

The data gathered from each evaluation is standardized by the experts who took part in the user requirements gathering process, and are converted into recommendations for future versions of the tools. In the case of ENABLED, prototypes were also used to enable concept tests to be performed to check whether the chosen way was the right one before incorporating new features to more advanced developments.

With regard to the evaluation of prototypes, in both cases predefined scenarios were evaluated in order to be able to compare results with subsequent evaluations, and to involve the user in what was to be a day to day use of the tool.

From the evaluations performed in the two projects by users and experts we can deduce a list of desirable features that any accessible interface should have regardless of its purpose or future use:

- Visibility of system status: the system should always keep the user informed about what is going on by appropriate means (speech synthesis, text, etc.)
- Match between the system and real world: avoid using technical terms to refer to real world entities. Use concepts that are familiar to the user rather than system-oriented concepts.
- User control: the user should have control over the application at all times, and be able to undo, repeat, or return to a previous state whenever he or she so desires.
- Consistency and standards: the user should not be made to wonder whether different actions, terms, or situations mean the same. The conventions established for each platform should always be observed.
- Error prevention: the system should prevent users from making a mistake due to the incorrect use of the interface.
- Do not rely on recall: the user should not always have to be remembering what to do. The instructions for use of the system should be visible and intuitive.
- Flexibility and efficiency: the system should be tailored to the experience of the user so that more experienced users can use shortcuts to actions that they are familiar with.
- Less is more: avoid including irrelevant information in user dialogues or any extraneous information that will be rarely needed. Any unnecessary information competes with information that is really important, with the risk that the user may miss the part that is really important.
- Help recognize, detect, and solve errors: error messages should be expressed in natural language indicating what to do next to solve the problem.
- Help and documentation: necessary help and documentation should be provided so as to explain to users in natural language the steps required to carry out any particular task.

*Translation by **Steve Turpin***

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