

Universidad Carlos III de Madrid  


Institutional Repository

This document is published in:

*Computers in Human Behavior* 27 (2011) 4-July, pp. 1408–1415

DOI: 10.1016/j.chb.2010.07.044

© 2010. Elsevier

# Design for All in multimedia guides for museums

Belén Ruiz \*, José Luis Pajares, Francisco Utray, Lourdes Moreno

*Universidad Carlos III de Madrid, Spanish Centre of Captioning and Audio Description (CESyA), Avda. Universidad 30, 28911 Leganés, Madrid, Spain*

**Abstract:** The Design for All principles define the characteristics which a device should possess in order for it be utilised by every type of user, independent of his or her sensory disabilities or technological competency. These principles are realised in the current work as an integrative tool with which to facilitate universal access to museums via multimedia and portable guides, making access available to all. Based on these principles, this article describes the main findings of the design and use of the MGA (Multimedia Guides for All) approach proposed in this paper. This approach involves a series of recommendations for the selection, application, preparation of content, and maintenance of this type of computerized device, in order to achieve these principles. Firstly, a comparative analysis of the principal types of electronic guides available in museums which incorporate accessibility criteria is provided. Subsequently, a real case study case is presented which conforms to the MGA approach. The MGA approach can be applied to other domains, which should be explored in further research. The conclusions in this article have been drawn from two R&D projects financed by the Spanish Ministry of Industry, Science and Technology supported by the EC FEDER R&D Program.

*Keywords:* Mobile media, Design for All, Museums, Cultural heritage, Interactive guides.

## 1. Introduction

Different electronic guides with sign language videos and audio descriptions are beginning to be introduced in museums (Santoro, Paternò, Ricci, & Leporini, 2007; Tellis, 2004), with the aim of allowing disabled visitors to explore them in a more independent and adaptable way, encouraging the inclusion of citizenship in the information society (Kaitavuori, 2008; Lytras, Damiani, & Ordóñez de Pablos, 2008; Lytras & Garcia, 2008; Lytras & Ordóñez de Pablos, 2007, 2009; Ordóñez de Pablos, 2002; Rodríguez Pérez & Ordóñez de Pablos, 2003).

Furthermore, many museums have set up initiatives to create portable devices which make museum visits accessible to visitors with distinct types of needs. These devices are of a diverse nature and they enrich the visitor's experience, some of which will be mentioned in the current work.

The MGA (Multimedia Guides for All) approach is designed to provide universal access to mobile contents by including sufficient configuration and adaptation features, enabling people with or without disabilities to make equal use of them. As a result of the development of these features, the applications in museums have the potential of becoming an essential tool in museographics.

Section 2 discusses museographics in relation to the use of mul-timedia guides. The approach, MGA is demonstrated in Section 3

\* Corresponding author.

*E-mail addresses:* bruiz@inf.uc3m.es (B. Ruiz), jpajares@cesya.es (J.L. Pajares), futray@hum.uc3m.es (F. Utray), lmoreno@inf.uc3m.es (L. Moreno).

and compared with similar devices. Section 4 describes the case study, GVAM (Spanish acronym of Accessible Virtual Accessibility Museum Guides). Finally, some conclusions and areas for future research are outlined in Sections 5 and 6.

## 2. Museographics and virtual guides

Museography is the science that studies the construction of museums, as the exhibition holds very special importance as a system for presenting pieces, as well as the arrangement of the pieces for presentation to the public (Salas, 1980). This science involves the application of the museological requirements of the project, taking into account the architecture, the collection, the financial and human resources, and other factors limiting "how" the museum is presented to its visitors. In this context, traditional human guides are a resource in short supply. They are employees who are experts in the content and narration of the pieces on display, their social or human historical context. They give life and vigour to the museum and even entertain visitors, making their visits stimulating rather than boring, and of course, educational, given that they are capable of responding to any situation, question, type of audience, emergency, among other elements.

This requirement for training in content, social skills, language, and other aspects and the growing number of ever-increasingly demanding visitors implies that museums must develop educational resources to complement the services of this traditional guide.

Additionally, visitors' behaviour has changed and they now avoid forced human contact and predefined routes. Faced with the linear nature imposed on the experiences and social interactions taking place in museums and in other cultural exchange areas, many visitors prefer to be free to explore the depths of the museum on their own, and place great value on the ability to participate in the experience of scientific discovery, whether it is archaeological, biological, technological, or any other type of scientific exploration.

On the other hand, museums have been changing their approach to visitors and their social function of teaching and preserving knowledge and heritage, however, this transformation has not been rapid enough to keep up with the changes demanded by the external environment.

A museum is most likely one of the clearest examples of an environment which requires a universal design approach. As previously mentioned, visitors like to walk and learn at their own pace, ask rather than listen and identify themselves with the contents. In other words, they fulfil their social need to participate rather than observe from the outside. Museography techniques attempt to solve this major problem without losing other traditional virtues such as preservation or objectivity.

It is also fundamental to consider new habits in cultural consumption, where people are reticent to any information that is not relevant to their immediate mood, planning time, spatial position or social recognition needs. New technology has accustomed citizens to a personalized protection membrane where interactivity provided at a rapid pace is expected. Museums must adapt their interfaces to comply with this reality.

### *2.1. New technologies as tools at the service of the visitor*

It is evident that the use of new reference and exhibition media based on information technology has been very helpful to museums when it comes to attracting and satisfying large numbers of visitors. However, it is less certain that they have become part of the actual educational process resulting from the contact and the participation in the cultural item in its original state (the piece on display), and which should be initiated by this type of system.

The traditional purpose of museums has been to acquire, preserve, communicate and exhibit the pieces and contents of their collections or the field of knowledge in which they specialise. Although the focus is on people and their interests and preferences, obvious solutions always need to be avoided in favour of an approach supported by the orderly, balanced development of these aspects (Chinchilla, 2002).

Therefore, these new technologies must be applied from the perspective of the value they contribute to these traditional functions and with the objective of developing new ones, taking into account the three basic characteristics of new museums, as stated by Santacana and Serrat (2005, p. 640): "The inexistence of any earlier requisites for understanding any type of exhibition, the educational factor applied to all types of audiences and the preference for open visits as opposed to closed circuits. Only then will real innovations be possible that do not pervert the essence of the museological project itself".

According to Rico (1994), there are four forms of exhibiting museum content with respect to the museum building. These classifications will be outlined below, including the factors which must be considered with respect to influential elements, such as the type of public, the resources available, and most essential, the use of new technological media.

#### *2.1.1. Traditional arrangement*

This type of methodology involves the arrangement of the pieces according to aesthetic and didactic criteria, without taking any account of adaptation to the environment or the visitors. These

types of exhibitions represent an extremely conservative approach to museum exhibitions, however unfortunately they are still evident in many of the world's most prestigious museums. The use of new media is nonexistent, and any proposals for their incorporation are viewed with suspicion. Rather than threatening the quality of the pieces on display, the aim of such proposals is to preserve the pieces' originality, the technology being available to the visitor at any required moment without overshadowing the significance of the piece itself. The use of virtual guide systems is recommended for these types of museum exhibitions.

#### *2.1.2. Harmonization*

This strategy refers to the integration of the piece displayed with the architecture of the building. The objective of such a methodology is that the arrangement forms a superimposed architecture, whose aim is to function as a connection between the interior space and the pieces displayed, in such a way that any visual inconsistencies are eliminated. A typical example of such a strategy is that of the Orsay Museum in Paris. In these types of designs, the devices for providing information function as query points representing the characteristics of the pieces, even though the general application is much more focused on shapes and objects, therefore the central focus is not on such types of devices. The result is that the visitor views the layout in a passive fashion while visually absorbing the architecture and exhibition. If new technologies are well applied and used they could easily be integrated into these types of displays, acting as a superimposed part of the structure which enables the explanation and relation of the piece based on the architecture of the space. Multimedia guides have a secondary and limited presence and should not interrupt the contact of the visitor with the museum environment as a result of connection with these devices.

#### *2.1.3. Asepsis*

Museums which adopt such a strategy are frequently new buildings which display modern works of art, for example, the Pompidou Centre of Modern Art in Paris, the Guggenheim museum in Bilbao and the Costume Museum (Museo de Traje) in Madrid. The works are not adapted or conceived for any specific space. The fundamental aim is aesthetic freedom with a minimum number of elements. The computational and audiovisual systems should be museum pieces in themselves, that is, the justification for their presence stems from the essence of the piece, in such a way that if the piece is not used, then its presence is not visually obstructive. Guide systems are justified in such scenarios in situations where the visitor requires immediate and personalized explanation of the piece when he or she encounters it.

#### *2.1.4. Independence*

The methodology employed in these types of museum projects is that which is most receptive to future technologies. The exhibition halls are structured in such a way that separate spaces are taken into account for each piece, eliminating conflicting relationships or leaving the pieces open to any area of the museum according to the visitors' viewing. This type of structure may be seen in the Hans Hollein Mönchengladach Museum. Thus, virtual guide systems would fit in such a scenario in a similar way to that described above, but extending their possibilities in the museum layout, as they can be integrated from the beginning. Thus they create new experiences which transform the museography itself.

### *2.2. Virtual and personal guides*

There have always been human guides in museums. Guides are the people who act as a bridge between the visitor and the knowledge hidden in the pieces, impenetrable for many without the help of the friendly, personalized explanations of these employees.

According to Tellis (2004) about 35 million audio guides are distributed daily in several cultural centres. Interactive guide devices are no substitute for these specialists; however, they do complement their activities by:

- Serving a large number of visitors at a reasonable, affordable price.
- Giving explanations in several languages.
- Adapting to the needs of single individuals rather than group.
- Encouraging and facilitating exploration of the museum by personalising the explanations, depending on the facilities, according to needs for accessibility, time available, itineraries based on specific pieces of interest, themed itineraries, preferences, etc.
- To facilitate, depending on its configuration, the work to modify its contents and therefore the explanations given by the institution.
- To enable the visitors to contribute in situ to the museum contents.
- To have greater control over and precise statistics about the use visitors make of the museum.

### 3. MGA (Multimedia Guides for All)

The current approach was developed in the context of an R&D project entitled GVAM (Spanish acronym of Accessible Virtual Guides for Museums) detailed in Section 4. The approach was constructed as a result of detailed research, as well as conclusion and evaluation subsequent to real life practice use of the application in experiments. The objective of this project is to provide design guidelines for any mobile or portable device showing multimedia and audiovisual contents, so they can be accessed by people with sensory and cognitive disabilities.

The application of MGA in tour guides defines a portable, interactive device that helps and guides visitors through a place of cultural interest such as a museum, transmitting information through different media (which could be text, images, video, audio, etc.) their use being adaptable to the visitors' different sensory and cognitive conditions.

After reviewing issues concerning museography that affect direct user interaction in a museum, and seeing how these can be transferred to a virtual interaction within the field of multimedia guides, the current paper presents a series of basic recommendations with the aim that such guides will offer a universal and accessible design.

For the time being there is not a multimedia guide for museums designed for all, and therefore are not documented experiences with users in academia or business. Owing to this fact, we opted to design and validate the MGA approach through these two different methods.

Firstly, we studied the current international standards designed to make digital content more accessible in the areas of Internet and television. Mainly ISO regulations and guidelines of the W3C detailed later, among other standards and relevant studies that have helped to shape the landscape on the specific area of museums. Some of the recommendations and settings in these norms are directly applicable to the MGA approach, although it needed adjustments to this particular medium, as we shall see later.

Thereupon, interviews were conducted to ascertain the main problems of people with sensory disabilities in museums. In order to maximize the collection of data, the CESyA (Spanish Centre for Subtitling and Audio description), together with the Carlos III University of Madrid and the CERMI (Spanish Committee of Representatives of Persons with Disabilities), they promote and drive the Seminar ACAM07<sup>1</sup> (Accessibility to Multimedia Contents in Museums) in Madrid. ACAM07 served as a forum for the main national

associations affected, FCNSE (Spanish Foundation of the National Confederation of Deaf), FONCE (Spanish Foundation of the National Organization of the Blind) and FIAPAS (Spanish Confederation of Families of Deaf People). Its representatives presented their demands, hopes and problems experienced in museums openly. Different museum curators were also sharing their problems and their efforts to integrate people with sensory disabilities in their exhibitions.

As a third step in our methodology, as soon as our MGA approach was reflected in the GVAM prototype detailed in Section 4, unstructured interviews were conducted at the headquarters of the FCNSE and the FONCE, in two sessions in each one, in which blind and deaf users could test the prototype. Direct observation of their reactions to the prototype and the collected data of their views through free conversations, supported the continuous validations of our approach.

#### 3.1. Accessibility mechanism

Any MGA device should be based on a usable, accessible design, which defines all its characteristics from the beginning, leading to the availability of the advantages described in Section 2.2. In order to realise the incorporation of these features, it must include menus or assistants that enable multi-language configuration and audiovisual accessibility resources adapted to times and interests, as well as the possibility of freely obtaining more information about each element, among other elements.

The current approach constitutes a proposal for accessibility requirements to consider in the design of a multimedia guide based on standards, regulations and established studies (Moreno, Gálvez, Ruiz, & Martínez, 2008). On the one hand, guaranteeing the accessibility and usability requires the extrapolation of concepts included in legislation, standards and other recommendations regarding the standardization of requirements, adapting them to the context and specific domain of museums. Regarding international regulations, the design takes into account the "ISO TS 16071-2003 for Software Accessibility" and the technical standards in Spain regarding requirements for software and hardware accessibility and the application of alternative contents for predicting accessibility such as subtitling, audio descriptions and sign language (AENOR, 2006). Usability criteria and principles of universal design were considered. For standardization documents, the W3C as Web Content Accessibility Guidelines (WCAG 1.0 and 2.0) from WAI, and MWBP flip cards of best practices for mobile Webs were used. Relevant documents from the NCAM (National Centre for Accessible Media) were also reviewed in the context of their relation with multimedia accessibility in multimedia and self-navigation menus, among other works.

In order to undertake such a diverse type of study always keeping accessibility in mind, an approach was adopted to prepare the mechanisms for accessibility.

In the context of MGA, the term "accessibility mechanisms" is interpreted to indicate a tool that makes the contents available to specific users. There are several audiovisual accessibility resources according to the needs of the users that can be integrated in portable devices, and in the future these will be improved upon and will increase in number with regard to museum coverage.

Thus, it was considered that (Moreno et al., 2008) in the case of those who do not have access to the soundtrack, the resources available should be subtitling and a signing window. In the case of people who do not have access to the images, they will be provided with audio descriptions, audio navigation, magnification and a contrast modifier. It must be possible to configure these resources freely so that regardless of the person's physical and sensory condition, they can be used at any time and they are

<sup>1</sup> <http://www.cesya.es/estaticas/acam07/index.html>

considered useful tools that improve the usefulness of the device or the application itself.

Every device following the MGA approach must provide a single access point with configuration options rather than offering different access types according to the type of user. This principle is subject not only to the regulations and standards outlined, but is also supported by the international "Design for All" principles, which have an evident impact on this approach:

- The layout of the reference interface.
- The layout of the units of content – navigation.
- The layout of the physical control elements.
- The ergonomics (weight, size, transport aids, battery life, etc.).
- The solution for updating contents
- The question of accessibility.

### 3.2. Integration and compatibility of audiovisual accessibility resources in portable and mobile devices

Whenever designing the behaviour of the device, the placement of the different accessibility resources on the screen and audio must be taken into consideration, and its synchronization must be arranged in a manner that users can operate them logically according to their needs.

The areas reserved for accessibility resources must be equivalent to those occupied by first level content in the textual information, graphical or audiovisual context for people without disabilities. In order to orchestrate this, the following factors are taken into consideration:

- Regarding the placement of subtitles, it is recommended that these be placed in a box at the bottom of the screen, which will be permanent and may be hidden by the user. This box may also be hidden automatically in the event that no subtitled content is being shown.
- Due to the small size of the PDA and UMPC devices, it is reasonable that a sign language video would be provided as an element separate from the layout of the other content, appearing in a floating window which can be dragged and hidden by the user. This will prevent considerable space being wasted, which is more useful when occupied by the actual museum contents. If, on the other hand, a fixed position is chosen, if possible, this will be placed on the top right hand side of the screen so that it follows the direction of reading.

All the accessibility resources will be synchronised at all times with the corresponding audiovisual elements, in such a manner that the associated play functions for audiovisual content also affect these resources, as well as possible automatic pauses due to the user's interaction with the application, such as, for example, a menu.

### 3.3. Comparison to other approaches and devices

Institutions and organizational entities have been confronted by the challenge of integrating portable multimedia devices to museum visits. There are numerous multimedia tourist guides in existence, some of which are specifically indicated for their use in museums. However, only a scarce number take accessibility criteria into consideration, and an even smaller number take account of universal design. The inclusion of such features implies a significant additional cost, given the low percentage of information they obtain compared with the data to which the public has access to in guides for the general public. A comparison of the main existing devices with the MGA approach is detailed below:



Fig. 1. Audioguides.

#### 3.3.1. Audioguide systems

All audio guides have the potential to contain audio descriptions, as they can be programmed inside the device as an independent channel (for example, as if it were an additional language). This type of system may be considered as being the precursor of accessibility to museum contents in personalized form, however, this is insufficient for current requirements. These devices only offer the narration of museum contents, which is useful for the blind, however, devices designed according to MGA principles are developed for people with any type of sensory disability, not one specific type (Fig. 1).

#### 3.3.2. Fixed help points

The information points viewed in the diagram above may be seen in the museum's exhibition areas, and cannot accompany the visitor during the entire visit, thus they are only available in specified locations and only for a single visitor. Furthermore, they are not designed to be accessible to wheelchair-bound visitors; in fact, none of these types of information spots is currently known to take into consideration users with disabilities (Fig. 2).

#### 3.3.3. Sign language guides

This domain of museum guides refers to PDA style guides designed uniquely and exclusively for signers. Among various other guides, in this section the focus will be on the sign language guide produced by the British multinational Antenna Audio.<sup>2</sup> This corporation has been providing audio guides and other interpretation tools to exhibition locations for the past 20 years. It is a pioneering organization which made the first sign language guide available to the public in the London Tate Museum in 2003.<sup>3</sup> (Fig. 3).

According to a survey carried out by the company (Proctor, 2005), two years subsequent to the launch, 78% of visitors who used the sign guide in the same museum informed that it enriched and improved their visit, for 6% the visit did not change in quality, for 1% it worsened, and 14% did not respond to the question. The majority of the participants in the survey were either young or middle aged, representing 77% of a total of 130 people surveyed. Respondents (74–84%) claimed that they would visit the museum more frequently if they were guaranteed that the sign language guides would always be available.

<sup>2</sup> <http://www.antennaaudio.com>

<sup>3</sup> The Tate Museum provides information regarding availability on its web page: <http://www.tate.org.uk/modern/Multimediatour/bslctours.htm>. It is possible to try out a reduced interactive demo: [http://www.antennaaudio.com/content/blogcategory/13/84/lang.es\\_ES/](http://www.antennaaudio.com/content/blogcategory/13/84/lang.es_ES/).



Fig. 2. Standard information points.

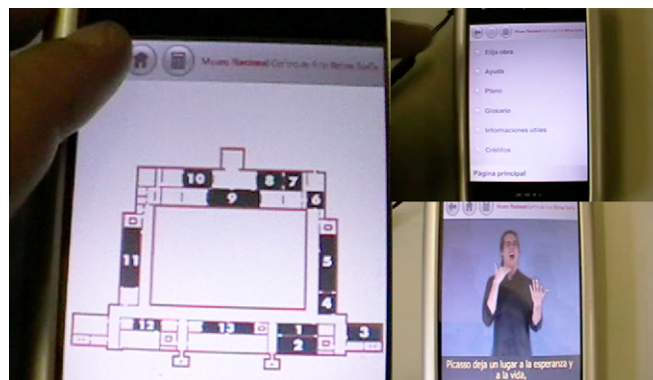


Fig. 4. Images from MNCARS' sign guide: The image in the left hand demonstrates the real size of the guide which is showing an interactive map of the museum. The image on the upper left shows the main menu of the application. The image on the lower left shows the screen playing a sign language video.

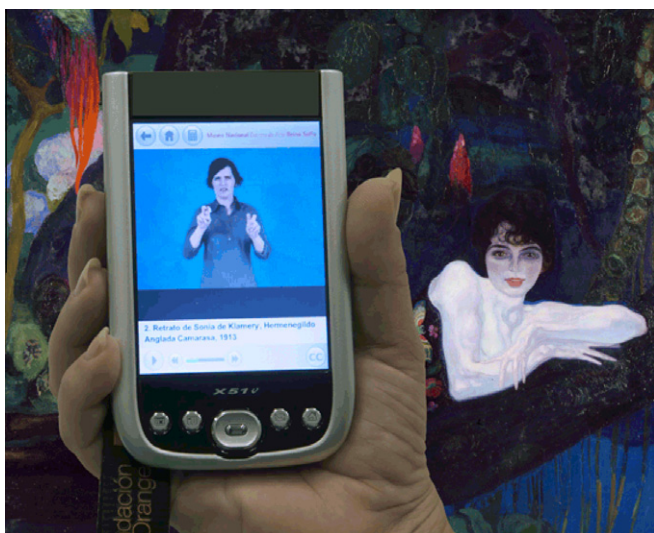


Fig. 3. Antenna Audio's sign guide (Tate Museum).



Fig. 5. A+ Multimedia Guides.

### 3.3.4. Other PDA multimedia devices

The Louvre Museum introduced its Mon Guide at the beginning of 2008, a multimedia guide based on the new XP-Vision model from Antenna Audio, a PDA with a redesigned frame and interface. However, this guide can still not be considered as incorporating the MGA approach, as it cannot be used by blind people. It does integrate sign language within the guide globally, but not as a specific device. This guide does take into consideration people with reduced mobility and includes a route for wheelchair-bound visitors (Fig. 7).

For blind people, the museum offers an independent audio guide, with audio descriptions which are associated with the museum pieces comprised of a tactile route. This tactile route provides themed exhibitions which include miniature replicas of pieces on display in various rooms in the Louvre museum, that can be physically touched by people who are blind. Meanwhile, the audio guide continues functioning. Blind people are able to visit this room independently, due to specific routes raised on the floor, and railings which lead them to the works. The works have reference numbers assigned to them in brail which are transferred to the audio guide.

MGA style devices undoubtedly offer an improved screen size, with the subsequent improvement of the legibility of contents for deaf users, which can read subtitles with ease, as well as for other users with reduced vision or other moderate visual disabilities. Major audiovisual features in order to simulate sign language

At international level, Antenna Audio has established its sign language guides in museums such as the Wax Museum in London,<sup>4</sup> the Versailles Palace<sup>5</sup> and the Reina Sofia National Centre of Art in Madrid (Figs. 3 & 4).

A+ Multimedia<sup>6</sup> is a branch of the English company Eyegaze,<sup>7</sup> an organization specialised in the production of accessible devices. Its sign language guides are employed in a number of museums, such as the Guggenheim Museum in Bilbao, as well as the British Tate Museum and the Wimbledon Lawn Tennis Museum (Fig. 5).

Node Explorer<sup>8</sup> is another type of multimedia guide produced by the British company Node, whose use is designed not only for within museums but in every type of natural and urban environment due to its geolocation capacities. The company Continuum has used these devices to create sign language guides by means of its subsidiary MultimediaTours.com (Fig. 6).

<sup>4</sup> www.madame-tussauds.co.uk

<sup>5</sup> www.chateauversailles.fr

<sup>6</sup> www.aplusMultimedia.co.uk

<sup>7</sup> www.eyegaze.tv/cm/services/guides

<sup>8</sup> www.nodeexplore.com



Fig. 6. MultimediaTours.com Guides.

and other resources for audiovisual accessibility within the guides content avoid duplication of viewing time which occurs in PDA type devices, which provide this function separately. Unfortunately, these multimedia guides still only provide useful experiences for a handful of people, similarly to the guides previously described.

#### 4. GVAM: initial MGA prototype

The GVAM is an R&D project of the Spanish Ministry of Industry, that started in 2006, carried out by Dos de Mayo Ltd., the firm that leads the team integrated by The Spanish Centre of Captioning and Audio Description (CESyA), in collaboration with Carlos III University of Madrid, CNSE Foundation, The ONCE Foundation and the General Directorate of Museums and Cultural Heritage under the Ministry of Culture of Spain. As a specific application domain the Spanish *Museo del Traje* (The Costume Museum), was used, but the aim is to obtain solutions which are easily adaptable to different types of museums. This museum is a pioneering space

in museology approaches, both in management exhibition, and artworks presentation through the use of new technologies as an information and training resource.

#### 4.1. Hardware

The GVAM application meets at the current stage of development, with most of the design specifications defined in this document for MGA, representing the only solution to truly provide universal and adaptable museum contents at an international level.

The hardware relies on the UMPC (Ultra Mobile Personal Computer) category and is also consistent with the MGA specifications, the needs of the R&D project and with the configuration of most museums. These are, broadly real time positioning, with 1 m error and without cable installation needed, meaning no visual impact in the museum walls. The portable device weights less than 500 g, works over Windows XP and Adobe Flash, offers connectivity via WIFI and RJ45 and gets 3 h of battery operation. It has physical navigation buttons and joystick, as well as a touch screen, desirable alternative for users without visual disabilities. The screen is 7 in" widescreen and 1024 × 600 px. An optional belt at the waist, as a device stand for people in wheelchairs and those with other types of physical disabilities, is also available. The actual working prototype is planned for 2009 and has already established an action plan for promotion by the end of 2008 (Fig. 8).

#### 4.2. Structure and content

The organization and nature of the contents are very much pre-defined, however each museum has its own specific characteristics to which the content of the guides must be adapted.

Likewise, titles comprise a first level within the description of each piece, the second is the formal description and the third is the contextual information.

The content included in the GVAM is placed in these last two levels. Although the GVAM can also be used to identify the piece using photographs, the user would have to confirm this with the corresponding title, which is why the information presented on the screen must be organized in the same way as that provided in the titles and panels adjacent to the works (Fig. 9).

With regard to the drafting of the content, reference can be made here to WCAG 1.0, 2.2. "Content developers must make the content comprehensible and navigable. (...) Not all users are able to use the visual clues such as maps, navigation bars, continuous frames and graphics that guide sighted users around the desktop".



Fig. 7. From left to right, Antenna Audio's guide Mon Guide ([monguide.louvre.fr](http://monguide.louvre.fr)) used in the Louvre and the Multimedia Scalex guide ([www.scalex.info](http://www.scalex.info)).

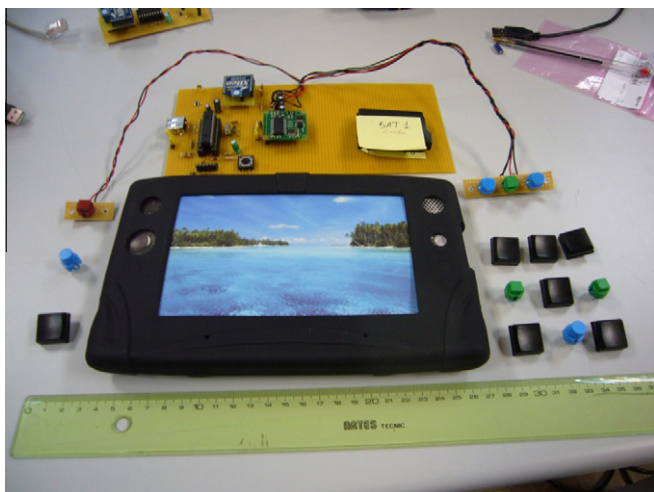


Fig. 8. Hardware components of the GVAM 1.0 prototype.

In the context of the museum, the semantic labelling of the content must also help guide the visitor, particularly when searching. Activating this function makes the interoperability of contents possible (Colazzo, Garzotto, & Paolini, 2005). Semantic labelling is also essential to give consistency to the database, beyond the taxonomies the museum may have established.

When the user starts using a GVAM, and once the language and accessibility resources have been configured, the user will be able to use it. The user is presented with the basic content that will provide the following basic information:

1. Welcome and introduction to the museum. The structure of the content in the application will be presented to the user for information purposes.
2. Information about the guide itself. Explanations of its features, as well as a list of contents and the type of contents.
3. Information about where the user is at the time of listening to the introduction and the physical layout of the building.

Among the additional tools, it is recommended that a corresponding glossary of terms in the chosen language be included, which will also affect the sign language. The sign language glossary will comprise a series of terms and their corresponding videos, in which the signer shows the sign and explains its meaning. In this respect the FCNSE (The Spanish Confederation of the Deaf), in its experience with this type of resource in the development of the

sign language guides for the Reina Sofia National Art Museum, suggests that the entire application of subtitles should show the words included in the glossary in a different word or underlined to show they are available.

## 5. Future lines

The approach was initially conceived for a GVAM like device, but it has been concluded that the recommendations will be also applicable to other mobile devices. Nevertheless, in order to test the GVAM prototype and to validate the approach in this context, more user testing and comparison analysis of the main tourist audio and multimedia guides currently available in the market and throughout several museums is still required, and will be carried out in future work.

As the researchers carrying out the current work are part of a public centre, the aim of the group is to make progress in the establishment of regulations in the European and Spanish contexts, regarding audiovisual and multimedia accessibility within mobile contexts. In particular, in the domain of access to information within physical media, such as museums, natural and historical heritage elements and even urban environments with a high density of communication media. In the subsequent stages, any kind of mobile media will be taken into consideration.

When this testing is completed, the aim is to draft an informative publication with the collaboration of the organizations representing the disabled, which will be published before the end of the year 2008 to introduce the museum educators departments and boards to this topic. Maintaining the character of similar accessibility studies (Proctor, 2005; Solano, Utray, Gálvez de la Cuesta, & Pajares, 2008), a book has been presented as a guide with recommendations and best practices for including requirements in MGA devices (Ruiz, Pajares, Moreno, Gálvez, & Solano, 2008).

## 6. Conclusions

Museums are part of the new connected knowledge society. Museum solutions must be sensitive to this situation and take advantage of new ICTs. In this evolution, one should not repeat past mistakes or avoid addressing major problems such as universal accessibility. Some of the main requirements that the MGA guidelines include have been presented in this work. While user testing is still ongoing in order to ensure its full validation, the experiments already completed and the positive feedback from users and affected collective associations motivate the continuation and development of the research. These researchers believe that the benefits affect not only disabled visitors but also the entire

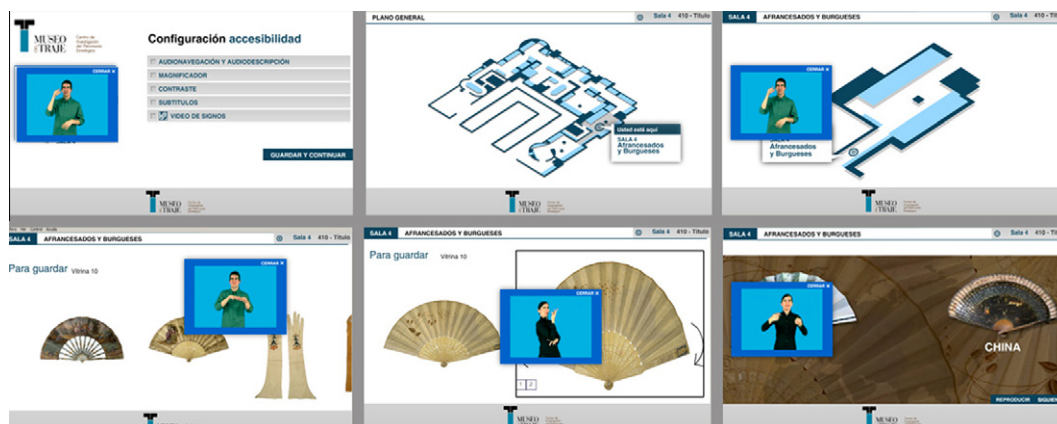


Fig. 9. Screenshots of the GVAM 1.0 prototype application.



public of a museum, which ensures the success of any exhibition, in terms of entertainment, education, knowledge transfer and overall satisfaction of the people.

In the museum setting, devices following the application of the MGA approach, such as the GVAM prototype will be revolutionary in the way they present and give access to their content to people with disabilities, as well as all other visitors. This implies that museums will be integrated into today's digital and knowledge society by providing access to all, rather than representing an area with a technological gap.

## References

- AENOR, Spanish technical standards: Standard UNE 153010:2003: Subtitled through teletext, Standard UNE 153020:2005: Requirements for audio description and Standard UNE 139804:2007 Requirements for the use of Spanish Sign Language on computer networks. Available from <http://www.aenor.es>.
- Chinchilla, M. (2002). *El Papel De Los Museos En La Conservación Y Difusión Del Patrimonio Histórico*. Sociedad Estatal España Nuevo Milenio.
- Colazzo, S., Garzotto, F., & Paolini, P. (2005). Let's go mobile! Design issues in multichannel accessible applications for cultural heritage. In J. Trant & D. Bearman (Eds.), *Museums and the web 2005: Proceedings*. Available from <http://www.archimuse.com/mw2005/papers/colazzo/colazzo.html> [online, ref. de 26 March 2008].
- International Organization for Standardization: ISO TS 16071-2003 refer to software accessibility.
- Kaitavuori, K. (2008). From accessibility to participation. In *Conference publication of making cultural heritage truly inclusive conference*. Available from <http://www.cultureforall.info/articles> [online, ref. 24 March 2008].
- Lytras, M. D., Damiani, E., & Ordóñez de Pablos, P. (2008). *Web 2.0: The business model*. Springer.
- Lytras, M. D., & Ordóñez de Pablos, P. (2009). *Social web evolution. Integrating semantic applications and Web 2.0 technologies*. IGI-Global.
- Lytras, M. D., & García, R. (2008). Semantic Web applications: A framework for industry and business exploitation – What is needed for the adoption of the Semantic Web from the market and industry. *International Journal of Knowledge and Learning*, 4(1), 93–108.
- Lytras, M., & Ordóñez de Pablos, P. (2007). Red Gate Corner: A Web 2.0 prototype for knowledge and learning concerning China business and culture. *International Journal of Knowledge and Learning*, 3(4&5), 542–548.
- Moreno, L., Gálvez, M. C., Ruiz, B., & Martínez, P. (2008). Inclusion of accessibility requirements in the design of electronic guides for museums. *Lecture Notes in Computer Science*, 5105, 1101–1108.
- Ordóñez de Pablos, P. (2002). Knowledge management and organizational learning: Typologies of generic knowledge strategies in the Spanish manufacturing industry from 1995 to 1999. *Journal of Knowledge Management*, 6(1), 52–62.
- Proctor, N. (2005). Providing deaf and hard-of-hearing visitors with on-demand, independent access to museum information and interpretation through handheld computers. In J. Trant & D. Bearman (Eds.) *Proceedings of museums and the web 2005, Toronto: Archives & Museum Informatics*. Available from <http://www.archimuse.com/mw2005/papers/proctor/proctor.html> [online, ref. 24 March 2008].
- Rico, J. C. (1994). *Del Palacio al Museo*. Bilbao: Servicio Editorial de la Universidad del País Vasco.
- Ruiz, B., Pajares, J. L., Moreno, L., Gálvez, M. C., & Solano, J. (2008). *Guías multimedia accesibles: El Museo para Todos*. Madrid: Real Patronato sobre Discapacidad.
- Rodríguez Pérez, J. M., & Ordóñez de Pablos, P. (2003). Knowledge management and organizational competitiveness: A framework for human capital analysis. *Journal of Knowledge Management*, 7(3), 82–91.
- Salas, F. (1980). *El Museo, Cultura Para Todos*. Madrid: Ministerio de Cultura.
- Santacana, J., & Serrat, N. (2005). *Museografía Didáctica*. Barcelona: Ariel. Santoro, C., Paternò, F., Ricci, G., & Leporini, B. (2007). A multimodal mobile Museum Guide for All. In *Proceedings of mobile interaction with the real world (MIRW 2007)*. Available from [http://www.medien.ifi.lmu.de/mirw2007/papers/MGGuides2007\\_Santoro.pdf](http://www.medien.ifi.lmu.de/mirw2007/papers/MGGuides2007_Santoro.pdf) [online, ref. 24 March 2008].
- Solano, R., Utray, F., Gálvez de la Cuesta, M. C., & Pajares, J. L. (2008). Multimedia and accessible museum guides: The GVAM prototype for the dress museum of Madrid. *The International Journal of Inclusive Museum*, 1(2), 97–102.
- Tellis, C. (2004). Multimedia handhelds: One device, many audiences. In D. Bearman & J. Trant (Eds.), *Museums and the Web 2004, international conference proceedings, archives and museum informatics*. Available from <http://www.archimuse.com/mw2004/papers/tellis/tellis.html> [online, ref. 24 March 2008].
- W3C: Mobile Web Best Practices and MWBP Flip Cards (2006). Available from [www.w3.org/Mobile](http://www.w3.org/Mobile).
- W3C: Web Content Accessibility Guidelines 2.0 (WCAG 2.0) (2008). Available from: <http://www.w3.org/WAI/intro/wcag.php>.