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A WEARABLE AND INTERACTIVE MULTIMEDIA DEVICE REVEALS THE MEMORIES OF THE CITY AT "LA CERTOSA DI SAN MARTINO" IN NAPOLI.

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Abstract

This paper discusses the experimental set up of MUSE, an interactive and mobile fruition system, at a primary italian museum, La Certosa e Museo di San Martino located inside a large and marvellous XIV century charterhouse on the Vomero Hill in Napoli. System integration, as well as content design and fruition goals are addressed. The system is going to be demonstrated in a museum section called Immagini e Memorie della Città ("Images and Memory of the Town"). This section was chosen because, with its links to the city and its history, and with its views over the real modern city, it offers a good oppotunity to verify MUSE educational and entertainment potential. The paper shows with examples how MUSE mobile device (called Whyre®) transfers knowledge, relating the artistic abstraction with the reality, and providing the visitor with a dual perception level of the city, one on its past history and one on its present life.

Keywords: Historical museum, charterhouse, multimedia, context-aware fruition, cultural tourism

Introduction

A cultural asset ("bene culturale" in italian) is a materialized testimonial of civilization. Understanding the value of a cultural asset may require knowledge, experience and education. Its emotional and educational potential often is not obvious. It's meaning ant its context are similar to jewels in a safe: they can not be accessed without a key. The case of this paper is that a promising key is multimedia with words and images calibrated to help a museum exhibit or an archaeological remain to disclose themselves to the visitor. More specifically, while multimedia is mostly used to surrogate and deplace in space and time virtual replacements of cultural assets, the purpose of this paper is to show how multimedia can be used not to replace, but to promote and disclose the essential knowledge embedded in materialized objects. Information Technology provides the mean to enjoy multimedia on-site and in presence of the visit targets, so that the proposed philosophy of on-site fruition is currently investigated by many institutions: in Archaeology the most outstanding project is Archeoguide (Gleue & Daehne, 2002) while in museums outstanding examples are the San Francisco MOMA (Samis, 2001), the Tate

Gallery (Proctor, 2003), as well as the work carried out in small establishmens by Woodruff (2001) and Zancanaro (2003). This paper reports on the experience just started at the Museo e Certosa di San Martino in Napoli within the MUSE project.

MUSE, developed by Ducati Sistemi within the framework of the Italian National Research Program on Cultural Heritage, was first presented in (Malavasi, 2000; Salmon Cinotti, 2001), while its multichannel nature and its application design framework were presented at Museums and the Web 2003 (Garzotto, 2003). The system is based on a dedicated device called Whyre designed to act as an interactive, context-aware personal guide (fig. 1).

Fig.1: WHYRE®, the interactive and context-aware personal guide

Whyre offers its educational services at several levels of depth, and it provides contents at several levels of abstraction and coverage. Moreover, it does not forget about the value of multimedia in transferring knowledge on unavailable assets: if an exhibit is temporarily unavailable, it may provide a virtual replacement on-site; and it enables the visitor to create in front of the exhibits a personalized multimedia memory that can be taken home to "multimedially" extend in time the one-day visit experience. Whyre is currently being tested in three italian sites, all of them with specific individual requirements: Il Museo di Storia della Scienza in Florence, La domus del Centenario in Pompei and La Certosa e Museo di San Martino in Napoli. Here the Napoli application is discussed.

La Certosa e Museo di San Martino

La Certosa e Museo di San Martino belongs to the Soprintendenza Speciale per il Polo Museale di Napoli - the main governamental authority for the napolitan museums - together with il Museo di Capodimonte, il museo Duca di Martina in the Floridiana Villa,

il museo Diego Aragona Pignatelli Cortes, the monumental area of Castel Sant'Elmo and la Certosa di San Giacomo in Capri.

Fig. 2: Il Chiostro Grande with the monks cemetery

La Certosa di San Martino, built by the Angevins in the XIVth century, is a large and marvellous charterhouse, located on top of the Vomero hill in Napoli. Its formerly austere gothic structure was deeply modified by the most famous architects of those times, starting from the end of the XVIth century and going on during the XVIIth and XVIIIth centuries.

Fig. 3: Facade of the church inside the Certosa di San Martino (Dosio, XVIIth century)

According with the architectural model of the "Grande Chartreuse", founded near Grenoble by San Bruno from Cologne, la Certosa di San Martino includes sumptuos halls, cloisters (fig. 2), gardens, and also a church (fig.3) with major frescoes, sculptures, stuccos, and paintings as well as unique inlayings and precious marble decorations (fig.4).

Fig.4: Interior of the church inside the Certosa di San Martino

La Certosa used to host kings and court dignitaries, poets and artists, gentlemen and foreign travellers - particularly in the Grand Tour age - captured by the emotion of discovering ancient and quiet places, and attracted by the warm hospitality of the monks and by the slow timing of their every day life; the nearly endless list of guests includes Mabillon and the Marquis De Sade, Goethe and Taine, Picasso and Margherite Yourcenar.

After the final abolition of the religious orders established by the government of the Italian Kingdom, in 1866, la Certosa became "the Museum of the City of Naples". Under this name the Museum was joined to the Museo Nazionale Archeologico di Napoli, and it was opened to the public in 1867 by its first director, Giuseppe Fiorelli, formerly "Superintendent General to the Excavations of Antiquities".

In its new set up opened to the public in the year 2000, a significant museum section is entitled to "the Images and Memories of the City". This section includes a sequence of images of the city laying in the Vesuvio shadow: paintings, engraved maps and figurative testimonials recall with their unresolvable interlacement, the civilization of the arts and

the history of Naples, from the XVth to the XIXth century, from the Aragona monarchy to the Spanish viceroyalty, the Borboni Kingdom, and the Kingdom of Italy.

All exhibits are ordered in the area originally hosting the monks, i. e. the ancient monk cells - all of them with their personal "loggia" facing Naples, its castles, its churches, its harbour, its gulf, the isles, and the Volcano - according to a visual and emotional link to the territory, stretched out at the bottom of the hill, just like a map at the Certosa foot (fig.5).

Fig.5: panorama from the loggia of one of the monk cells (currently a museum hall)

 Such a museum ordering, made possible by the recent recovery and restoration work carried out by architect Adele Pezzullo (Spinosa, 2000), significantly enriches and improves the experience of the visit along the complex chartusian monumental structure, offering a reading key, that is unitary even if based on few specific fragments selected within large and differentiated artistic collections.

La Certosa is committed to meet the needs of modern cultural tourists. Today, museum visitors do not only look for entertainment and emotions but also for comfortable learning; they expect to find within the museum places where to stop and meditate, as well as shopping areas offering books and merchandising products. Multimedia installations and multilingual hall panels are also required. Within the Certosa, subsidiary service spaces were derived, during the recent restoration work, from the area of the ancient stables. Moreover, a unified solution to meet all dynamic, logistic and cultural information needs is currently being demonstrated, and its impact on the museum is discussed in this paper. Whyre®, the interactive mobile device developed within the Muse project intends to offer a novel multimedia "promenade" that should further bind the

museum life to our ancient history, and to its links to the - who knows whether more or less happy - present times.

Harmonizing Technology within the Charterhouse

In these first years of the third millennium, more and more exciting mobile and pervasive computing devices step into our life, as anticipated over 10 years ago by Mark Weiser (1991). Along this line, the advantages of mobile computing in cultural sites are currently being explored within the MUSE project, in cooperation with the management of la Certosa di San Martino.

When the introduction of new services in a museum is considered, many concerns are expressed by the museum authority. The environmental compatibility of the infrastructure required by the new services is their major concern: if the site and the equipment can not be redesigned together, in order to be properly harmonized, then the new equipment is expected to fit into the exsisting sites with a minimum impact on the environmental balance. Additional concerns in the specific domain of fruition services are the scientific validation of the contents and the friendliness of their interface: technology, if present, should be hidden to the visitor perception. All of these issues were taken care of at la Certosa di San Martino, and the Museum authorities took part to the project with well focused conceptual and operational contributions on system installation, on contents design and on the additional services provided by Whyre®.

The network

The MUSE system consists of a set of cooperating stationary and mobile devices linked by wire or by air (Malavasi, 2000). The stationary devices include the accounting stations located at the customer reception points, the CD mastering stations where the visitors can collect their personalized memory of the visit, and the control center consisting of a few servers: a data base server, an application server and a multimedia server. The mobile devices are the Whyres, i.e. the interactive devices delivering to the visitors context-

dependent multimedia contents received by air. The link among all devices is provided by an autonomous, self-contained LAN, consisting of a fiber- optic backbone and a multicell WLAN enabling nearly invisible wireless connectivity across the cloisters as well as throughghout large indoor sections of the Charterhouse. While the fiber-optic backbone operates at 100 Mbps, all wireless connections relies on Direct Sequence, Spread Spectrum IEEE 802.11b communication devices, with a nominal bandwith of 11Mbps. Fig. 6 shows a map of La Certosa with a path entirely covered by the wireless lan. Both, design and installation of the fiber-optic backbone and of the WLAN required careful planning: the wlan Access Points (Aps) had to be located in the halls as well as in certain specific outdoors areas, with the following requirements in mind: providing wireless access along the visit path, supporting radio based coarse localization and minimizing the APs impact on the environment. For the same environmental compatibility reasons, the optical fibers had to be placed in already existing pipes (mostly underground), while the switches and the power injectors that feed the wlan APs were located in a service area under the Charterhouse roof.

Installing the network became therefore a matter of cooperation between many actors which had to operate concurrently: the MUSE people, a service company (Olimpo) responsible for the installation of all the connections between the under-roof switches and the APs located in the museum halls, and a network research group, led by Prof. Mario Mango Furnari from the Cybernetic Istitute of the Italian Research Council, that laid down the fiber-optics backbone within the framework of REMUNA (Rete Museale Napoletana) a project currently linking over 18 museums in the Napoli metropolitan area.

Fig. 6: map of the Certosa ground level with a path from the reception to the section
"Immagini e memorie" and back

The mobile device and its interface

Whyre®, the interactive multimedia terminal designed by Ducati Sistemi with a significant contribution of Intel Labs, is a dedicated mobile device, based on a 500 MHz ultra low voltage Pentium III CPU, and controlled by XPE®, the popular Microsoft® embedded operating system. Fig. 7 shows its application specific graphic interface on its high brightness, 6.4 inches, TFT display.

Fig.7: Whyre® graphic interface

At La Certosa two main interaction modes are demonstrated: web mode and context-aware mode. In web mode, the information base is accessed as any standard web site, and the conventional link-based navigation paradigm is used. In this mode the visitor can navigate through the museum virtually. In context-aware mode, instead, Whyre® detects the visitor approximate field-of-view, and dynamically customizes its interface in order to present the multimedia content and the interaction options most appropriate to the current user physical position.

Fig.8: The museum presentation screen

In both modes, access to contents is hierarchical, according to the actual museum structure; the graphic interface is basically the same but the interaction modes differ: in web mode selection is based on scrolling menus, while in context-aware mode, selection is mostly implied by the user position; only in specific circumstances a menu is required to complete a selection. Figs. 8 to 10 show some of the Whyre® interface screens. Fig 8 shows the top level page in web mode, with the museum presentation and the links to the museum sections. When a museum section is selected (in web mode), or entered (in context-aware mode), Whyre® presents the selected section; furthermore the interface goes one level down and, if in web mode, it lists all of the halls of the selected section (fig. 9).

Fig. 9: Whyre® in web mode lists all of the halls of the Immagini e Memorie section

Fig. 10 shows the screen introducing the visitor to the painting La Tavola Strozzi and to the related contents: the left side buttons control its primary presentation, while with the right side buttons the related textual or multimedia deepenings may be scrolled and selected.

Fig.10: Whyre® access to La Tavola Strozzi

Context-aware navigation is enabled by a multi-sensor module developed within MUSE and consisting of an accelerometer, a gyroscope, a compass and an optional GPS sensor for outdoor sites. In indoor areas, the approximate user position is provided by a positioning algorithm based on the the signals received by the WLAN access points.
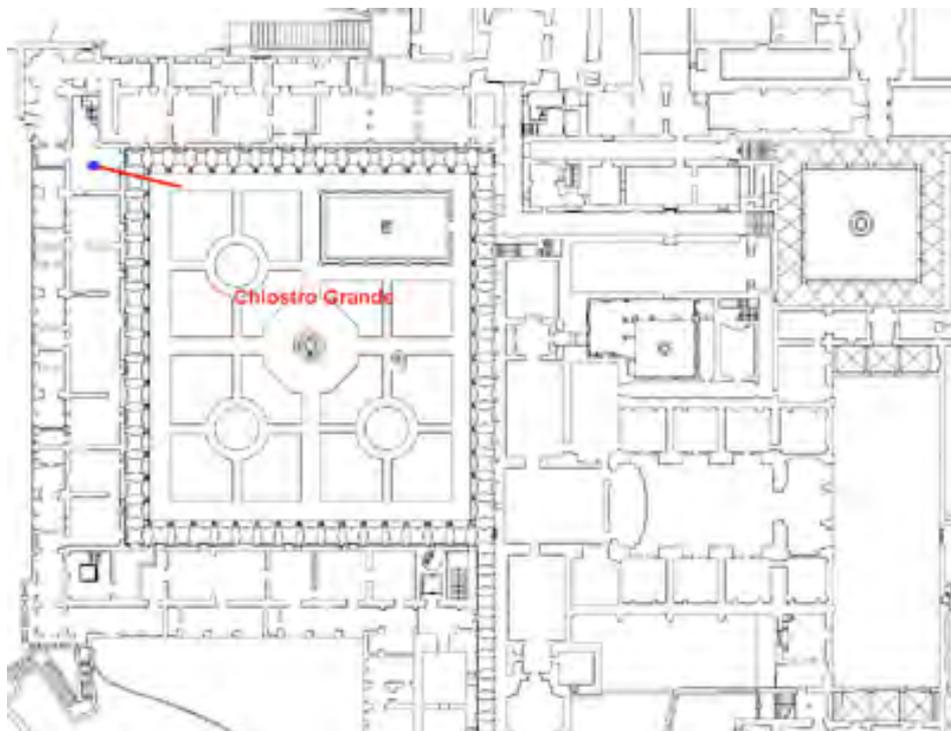

Fig.11: Whyre® tells the visitor that he is looking in the direction of Il Chiostro Grande

Whyre® multisensor outfit supports also the implementation of "thematic tours", and it enables additional "logistic" services that should provide serendipity and should help the visitor in self-orienting on the site: with the screen shown in fig. 11, for example, Whyre® tells the visitor which museum section is located in the direction he is looking at. With the screen shown in fig. 12, Whyre® provides routing information: it tells the visitor how to reach from his current location, the entrance of a selected museum section.
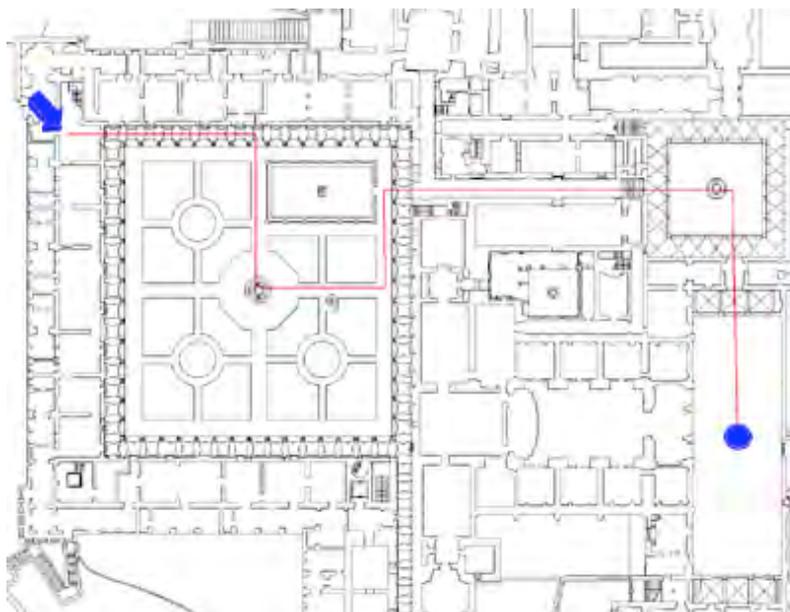

Fig.12: Whyre® tells the user how to reach the section Immagini e Memorie from Il Cortile Monumentale

The contents

Content production is a major step in the development of a mobile cultural multimedia application with on-site nomadic access. In the case of the Muse project demonstration at La Certosa di San Martino, the mobile device (Whyre®) is expected to deliver position-dependent multimedia content concerning the charterhouse, the museum, its sections, its halls and its artworks. Emotions, feelings and knowledge need to be communicated to the visitors. Content should be intriguing and faithful, and should address, from many points of view and at several depth levels, many types of exhibits, such as paintings, historical maps, sculptures, ceramics and furniture. Consequently, content creation must rely on the cooperation among many actors, including experts in technology, communication and

humanities, and a content development and validation methodology is definitely required (Cantoni & Di Blas, 2002).

Content organization is based on the notion of "cultural object", an entity defined with the UML diagram (Booch, 1998) shown in Fig. 13. Every item known to Whyre® is a cultural object, and it can be associated to many well-organized digital representations. In this way the visitors can get specific "views" of every item, according to their wishes and attitudes.
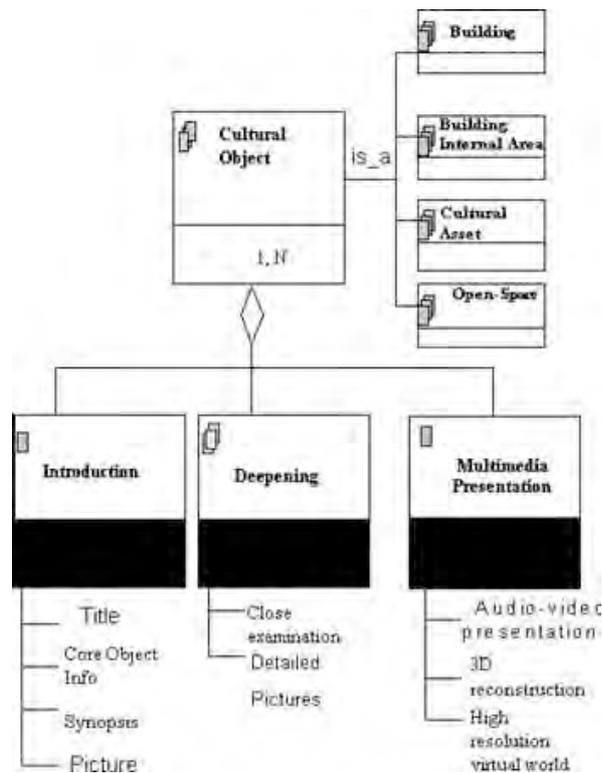

Fig.13: The content of Entity Type "Cultural Object"

Content creation starts from an extensive search for iconographic and documentary sources (Bocchi, 1999). The selected sources usually require some specific preprocessing action (Valacchi, 2001): pictures, audioclips and manuscripts need to be digitized; sources that are already in digital format, may need to be converted and/or resized. The basic rule for the content creator is that text and images need to be contextualized, since they are going to be delivered in front of the exhibits. The text is written by an expert and checked by the curator; afterwards, the digitized sources are assembled according to the text, and are edited into atomic videoclips. The text is then read by a professional speaker and eventually synchronized with the video. At this point, in order to make the clip deliverable

in specific locations on-site, a postprocessing stage is required. Post processing includes file encoding into a streaming format, file binding to its reference spatial location, and file uploading to the information base.

The information base is partitioned into three subsystems:

the relational database provides structured access to cultural objects, provides the references to their multimedia representations, and hosts all textual information according to the "Dublin Core" (http://www.iccu.sbn.it) metadata standard

the "Media Server" holds all of the multimedia clips deliverable on-demand to the Whyres®

the geographical information system binds to the proper site location the references to the items stored in the data base.

The content developed so far for the MUSE demonstration at La Certosa e Museo di San Martino consists of approximately 90 cultural objects and 60 multimedia animations. Macromedia Flash was mostly used for authoring while file encoding for streaming was performed with Windows Media Encoder.

The Whyre® Experience

The visit experience with Whyre® starts from the MUSE reception area, located near the Museum main entrance. Here the visitors are logged into the system and are invited to choose the services they are going to be charged for: the visit, the personalized memory, the number of personalized pictures and/or audio-clips to be collected during the visit. Other services may be devised in the future. The first action the visitor is called to, after wearing Whyre®, is to aim towards a specific wall and push a button. This action aligns the direction sensor and draws to the display the direction pointer on the room map, triggering in this way the cooperation between the visitor and Whyre. From this stage onwards, the visitors know that Whyre is actually aware of their field-of-view, and at the same time they learn that they may be called from time to time to realign the sensor system. At this time the visitors can select their visit mode: this can be a guided tour, according to specific themes offered by the curator, it may be a virtual tour, useful if the

visitor wants to sit down and have a look on what the museum offers, or it may be a free visit: the visitors are invited to visit the museum and learn about its exhibits when they pass nearby. This mode, encourages serendipity and it is herewith briefly summarized. First, both the Certosa and the Museum history are introduced, with a presentation of their most significant parts (the cloisters, the church, the court, and the museum sections). When a museum section is entered, the section is presented. Once in a section hall, the visitor is introduced to the hall itself, and afterwards to the hall exhibits, not only if they are currently present but also if they are temporarily removed. After a first short introduction, several optional deeper contents ("deepenings" in fig. 13) are offered to the visitors; deepenings can be multimedia clip, audioclips or textual presentations. One deepening is always available: this is the Dublin Core catalographic record of the item under examination (IUE). A second deepening is associated to all exhibits with a known creator: the author's biography. Other multimedia contents, covering historical, artistic or geographic aspects of the current IUE may be available. Fig. 14, for example, shows a frame taken from a deepening on La Tavola Strozzi, the main exhibit of the XVth century hall. This painting shows an extraordinary view of Napoli, virtually taken from the middle of the Gulf sometimes in the last quarter of the XVth century.

Fig. 14: A frame from a deepening on La Tavola Strozzi explains the city structure in the XIVth century

The frame shown in fig. 14 enhances three important elements of the ancient city, that are still detectable in the panorama from the Chartehouse logge: a building (Castel Nuovo), next to the see for city protection reasons, a hill (nowadays called Vomero) with the Charterhouse and Castel S.Elmo, and a district (i quartieri bassi) the ancient heart of the city, nearly a sacer isle, as suggested by so many churches still active on the territory (S. Chiara, il Duomo, San Lorenzo Maggiore and San Domenico Maggiore).

These buildings are found again in the halls dedicated to the subsequent centuries, and some of them are hidden inside the panorama enjoyed from the loggia. Here the ancient city and the modern metropolis interlace in a complex web, that the multimedia contents offered by Whyre discloses and clarifies, with a significant educational and emotional value.
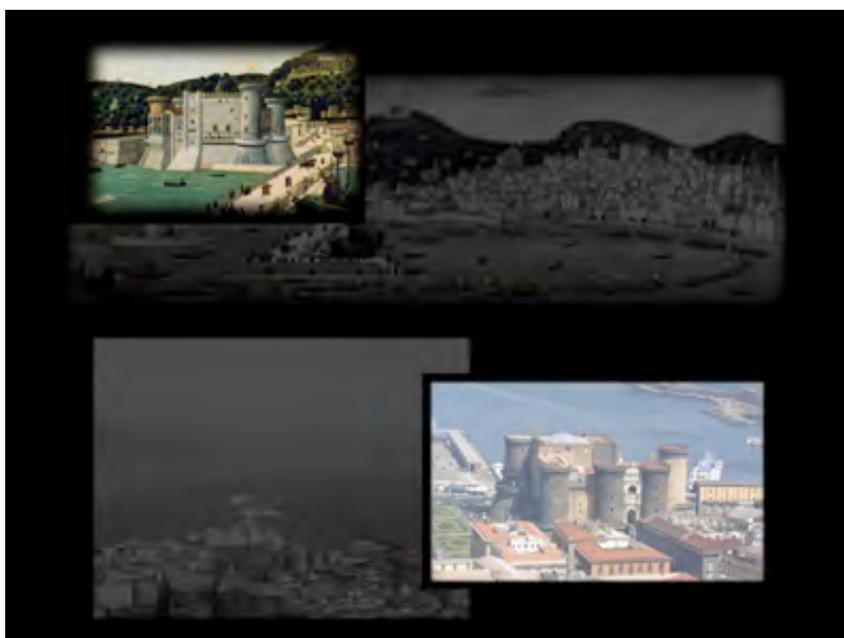

Fig. 15: a frame from the clip associated to the loggia shows Castel Nuovo in La Tavola Strozzi and Castel Nuovo as it is seen from the loggia today

Fig 15 is taken from the clip shown on the loggia: the frame compares Castel Nuovo as it was in the XVth century, with Castel Nuovo as it may be admired today from the loggia itself, and it helps the visitor in recognizing the castle within the panorama. After zooming on the castle, the clip provides multimedia information on the castle internal structure and on its current functions, relating in this way the museum with its territory. This example shows how Whyre® transfers knowledge, relating the artistic abstraction with the reality,

and providing the visitor with a dual perception level of the city, one on its past history and one on its present life.

An additional feature offered by Whyre® is its support to the fruition of totally or partially unavailable items. Fig. 16 shows, for example, a frame taken from a clip associated to a XVIIth century stipo (a piece of furniture). For protection reasons, the stipo is exhibited closed, so that its internal decoration, marvellous as well as very significant from the historical point of view, is hidden. Whyre® goes beyond this limit: the animations, in fact, show and explain all sort of details hidden inside the stipo, including maps of many cities, allegories, portraits and battle scenes.

Fig. 16: a frame from the animation showing the inside of a Stipo (1619) physically invisible to the public

In addition to the mentioned fruition support, other services are available during the visit, and they are normally one or two "clicks" away. Specifically, an orientation service shows your current position with respect to the adjacent museum locations (fig. 11), a camera service adds your own pictures to the personalized memory of the visit and an SOS service provides specific information, according to policies established by the museum authority.

At the end of the tour, the visitors are kindly requested to fill in a usability test questionnaire conceived within the framework of the MiLE method (Paolini & Di Blas, 2002) developed by the Politecnico di Milano together with the University of Lugano.

Conclusions

The first demonstration of the MUSE system in an arts and history museum, "La Certosa e Museo di San Martino" in Napoli, was presented. The application currently covers a subset of the monument, including a museum section called "Immagini e Memorie della Città" ("Images and Memory of the City"). This section was chosen because its links to the city and its history offer a good oppotunity to verify the educational and entertainment potential of the MUSE mobile fruition approach. The paper has shown how the mobile device can relate the ancient city, as represented in the exhibits, with the modern town that can be admired from the logge of the musem halls. This fruition model relies on calibrated, position dependent content, designed to help the visitor in recognizing the monuments and their historical meaning in the paintings, in the historical maps and in the panorama over the city.

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