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VIRTUAL ENVIRONMENTS AND INTERACTIVE TOOLS TO COMMUNICATE MEDICAL CULTURE IN SMALL MUSEUMS

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Abstract

Virtual Environment technologies are becoming increasingly important, carving out place in several sectors like training, learning, entertainment or industry, thanks to their adaptability for different contexts.
In the Cultural Heritage field, they have been mostly used to reconstruct and represent lost archaeological patrimony, or to create virtual tours of ancient cities and sites. However, these technologies have now also entered museums and cultural institutions, contributing in changing the concept itself of Museum as institution and its relation with the public, supporting an approach more centered on engagement and participatory experiences.
This is particularly true in the case of topics commonly intended as "specialistic", difficult to approach and understand for general public, such as those related to scientific, anatomical and medical collections. The use of VEs and, in general, also of simpler but carefully designed ICT tools (such as institutional websites) can become an important tool to raise awareness and knowledge about these matters.
In the present work we describe our experience, focused on a small Anatomy Museum of the University of Pisa, in which we have conducted a study on visitors, and consequently developed asset of interactive tools, aiming at increasing engagement and improving the educational experience, attempting at reducing the gap between the general public and the communication of scientific and medical topics.

Keywords

Virtual Environments, Web3D, Anatomy Museum, Medical Collections, Interaction

1. Introduction

Virtual Environments (VE) technologies, after a period in which they have been considered little more than an engaging gadget or a niche commodity, are nowadays taking a place increasingly important in a number of application sectors like training and learning, industrial design, medicine, entertainment, etc. The key factor is without doubt the possibility of simulating or re-creating believable situations comparable to the real ones at reduced costs, with an increased safety and with an almost complete control.

In the cultural sector VEs are now widespread for specific purposes, such as digital conservation and documentation, but is becoming increasingly popular also for divulgation and education; the appeal of what is still considered a cutting-edge technology, despite being

more than thirty years old, makes it particularly suitable for cultural communication; information and knowledge is transmitted by means of multisensorial feedback, hence it is easily received and assimilated regardless of the confidence with the technical means.
For this reasons museums, more and more open to the use of technologies to improve the appeal and the efficacy of the communication, have recently become an ideal test-bed for digital media on different levels of complexity, from simple multimedia totems to large immersive installation. Users want experience over product and new technologies demand people to act and choose: this means a radical change in the learning process, a more natural and instinctive way of learning challenging communication and educational traditional methods.

Museums are therefore required to diversify their proposals to engage users by offering them different educational/divulgation path, based on different targets of people. If the use of technologies can still meet some resistance and mistrust in classical museums, where the sacredness of the institution and of the physical place itself may act as a brake on the use of digital interactive systems, this does not commonly happen in science museums where, because of their own nature, the concept of structure-container is more easily forsaken to become an increasingly lively reality, where playful-educational activities become a core point of the whole visit. Among these, cultural institutions dealing with peculiar scientific topics, such as medicine or anatomy, traditionally reserved toscience are expected receive a strong benefit from the use of new media to present their objects, exploiting these appealing means to enlarge the base visitors and engaging them by playing on the edge between sensation and instruction.
This may represent a challenge in the field of art and science communication, and it is very interesting to investigate such implications, aiming to improve the pleasantness of fruition and the efficacy of presentation of specific objects which may impact on visitors sensitivity.

2. Related work

Research efforts dealing with anatomical collections, medical museums and the use of new technologies have been carried on from different perspectives in the latest years. The increasing importance of engaging the public, stimulating its participation and interaction,

have certainly been changing the concept itself of Museum as institution and its relation with the public. This is even truer for institutions hosting medical and anatomical collections, for which multimedia resources represent a strong aid to open a dialogue and become more accessible places.

The Scottish anatomist Frederick Knox reportedly said that 'He who attempts to teach anatomy without a museum strictly deserves the name of impostor', with museums being stimulated in becoming dynamic and vibrant entities that grow and adapt to shifting circumstances, generating and facilitating a range of activities pertaining to engagement, education and research functions, and therefore remaining relevant and at the same time innovative (Alberti, 2011)

As a matter of fact, medical exhibitions should keep up the pace with contemporary new medical diagnostics based on images that make the body "transparent"; the way science centers display the human body needs to involve computers, 3D animation, digital technologies, hands-on models of large size human parts to explain and illustrate not only medicine history but the human being as a biological creature (Canadelli, 2011).

Even serious games, 3D technologies (Ma et al. 2012) and mobile technologies as iPad (Mayfield et al. 2012) are very important in learning and practice as they offer new opportunities for students to approach impacting medical aspects. Another goal for museums could be to personalize visitors experience, as it has been studied in the MNEMOSYNE project, whose intent is to customize the presentation at interactive tabletop surfaces placed in the museum environment, through a combination of passive, wall-mounted cameras and sensors carried by guests (Bagdanov et al., 2012).

Not only technologies inside the museum are important instruments, but also attractive, useful, simple and complete websites are important keys for engagement and communication purposes. Almost every anatomy museum presents on the web part of its collections and activities, or attempts to do it. In the following we present a brief overview on some of the most relevant examples in Italy and abroad.

- University Anatomical Museum of Torino

It is a simple, clear and pleasant website where different colors are intended to help the navigation. Contents are briefly presented, contact information is provided and no level of interactivity is foreseen.

- University Anatomical Museum of Modena

The graphical aspect of this website is not particularly attractive and up-to-date. It shows dated information and the presented content tends to be lengthy when explaining educational and playful activities for kids. No interaction is provided.

- University Anatomical Museum of Bologna

Clear information about opening hours and directions, but only a few photos of the collections are presented. Navigation through the site pages is not particularly intuitive and graphic elements are not rich, with no elements of interaction offered.

- University Anatomical Museum of Florence

This website consists of a long page were images and very short descriptions are showed; contents and content information are limited and no interaction is available.

- University Anatomical Museum of Cagliari

This website is simple and clear, appealing, and provides useful information, including links to other anatomical institutions. An interesting section of the site provides interactive anatomical paintings, where short information is given at mouse over.

- Anatomical Museum of Rome

This Anatomical Museum has a webpage inside the hospital website; it is purely descriptive and has no contact information. A photo gallery – showing ancients hospital rooms - is available at the bottom of the page.

- University Anatomical Museum of Basel

This website is quite simple and clear, with evident information about contacts, events and collections in the homepage; it hosts also a virtual tour allowing users to move inside the Museum rooms.

- The Old Operating Theatre – Museum & Her Garret, London

This website is engaging, intuitive and shows the museum as a fascinating mysterious place, allowing visitors to make a virtual tour of the place, offering also several links to historical contents and to many other medical museums and institutions.

- The Royal College of Surgeons of Edinburgh – Surgeons' Hall Museums

This is an example of a complete, clear, updated webpage; the navigation through contents is easy and intuitive; many sections illustrate Museum activities and with latest news, events, projects, past and upcoming exhibitions. PDFs download is available for many of the offered contents.

- Heidelberg Pharmacy Museum

Information is presented in a simple, clear way; contents are just located near some images and basic graphic elements define the contents and sidebar menu. No interaction is foreseen.

These examples give an idea of how medical institutions and museums (usually small-sized), present themselves on the web paying, especially in Italy, little attention to the opportunities of these media often intended more as an optional gadget respect to the institution itself, than as a proper instrument to engage, inform, involve and interest people. This commonly results in a limited experience, showing up as a bad imitation of a satisfactory visit that is only possible in real presence.

Bigger and famous science museums, like the Wellcome Trust, the London Science Museum, the San Francisco Exploratorium, the Cité des Scientes, and in Italy Museo della Scienza and Città della Scienza, are – on the contrary - giving more and more importance to their website, rich of information, activities, funny to navigate and explore, making an extensive use of social media and based on the principle of a participative interaction involving people and inviting them to pay a visit. These virtual spaces are often connected to school activities, family needs and appear living places where to go for exploring, enjoying, learning and discovering.

It appears evident that scientific institutions that *also* own medical collections more easily offer several visiting patterns, edutainment resources and engaging activities to the public. On the other hand, medical museums move generally their first steps on this direction.

3. Our Experience

The ACE group at PERCRO laboratory of Scuola Superiore Sant'Anna has a solid background in designing new media formats and investigating novel forms of engagement

using multimedia technologies for art museums. A thorough survey of such installations, together with an analysis of strengths and weaknesses of these solutions is presented in (Carrozzino, 2010). At the same time, the growing availability of high computing power and of broadband network connections has allowed us to realize complex and highly interactive presentations on the web of the museum collections (Carrozzino, 2005; Bergamasco, 2007). Museums dealing with very specific topics, such as Medicine or Anatomy Museums, might be very renowned in medical circles but almost ignored by the general public, both for the competition with art museums, presenting a more classical and conventional cultural offer, and for a certain lack in communication. The cooperation with the University Anatomy Museum of Pisa arises from the need of improving the accessibility of its collection through the introduction of new concepts and paradigms of fruition involving new technologies and multimedia applications. We decided to build on our previous experiences in order to study and design possible multimedia enhancements in order to collect preliminary data, aiming to better identify the institution needs and to drive a more comprehensive plan of renewal of the museum offer, including a set of complementary multimedia resources.

One of the first emerged needs was to improve the accessibility to the museum by "virtually" extending its spaces, considering that it cannot be daily opened to mass audience due to structural limitations. Moreover, it was deemed important to improve the approach to visitors, by getting people involved in more engaging experiences. This is particularly important to bring people closer to medical contents, traditionally harsh, and increase the effectiveness of communication on those topics to general public, even spreading information to the remote audience through the internet.

Of course particular care must be put on the risk of a gap rising between scientific topics communication and generic public; if museums fail to set appropriate instruments and models, people could feel uncomfortable and bored by exhibitions. To attempt reducing this risk, we have conducted an analytical survey of people experiences inside the Museum, in order to focus the main aspects/problems concerning the approach to the medical and anatomical collections during the visit (Scucces, 2012)

We have acknowledged that about 90% of the interviewed people showed great interest in the possibility of enriching their museum experience by means of using dedicated multimedia instruments during their visit, and also in the opportunity of extend this experience, also in the stages of pre-visit and post-visit, with dedicated features on the institutional website.

The emerged reasons can be summarized in:

- *having more information about the collections we already visited;*
- *having deepening contents and texts about the collections;*
- *simply being more interesting;*
- *accessing the museum several times;*
- *having a better comprehension;*
- *spreading the museum culture;*
- *learning new things;*
- *benefiting from an increased visibility of the museum;*
- *having more resources to learn and to answer questions;*
- *allow remote audience to access the museum.*

Only a very few people said that t*he real visit cannot be substituted by any virtual interaction or visit.*

The most important emerging need appears to be that people mostly want a larger amount of information about the Museum collections; if this we can be trivially assumed for any exhibition or art museum, becomes even more truthful when dealing with medicine, anatomy and scientific collections, that are commonly intended as "specialist topics" difficult to approach and understand for general public. People ask for a more complete guidance not only during their visit but even when they are back home and, reflecting about their experience and learning inside the museum, they want to step back into it with new questions and stimuli to satisfy.

On the basis of these results we have developed two interactive applications, located at the Museum facilities and based on different objects and different interactive paradigms: a Multimedia Catalogue and an Information Landscape.

The Multimedia Catalogue (fig.1) shows a selection of the archeological collections hosted at the Museum, providing an alternative vision of the exhibition and at the same time the opportunity of learning additional or more detailed concepts an information. Pictures are shown as slides floating in an abstract 3D environment and can be accessed on three different

level of zoom; browsing and zooming is achieved by means either of desktop input devices, such as keyboard, mouse or joystick, or of more advanced ones, such as smartphones, motion sensor, or touch surfaces.

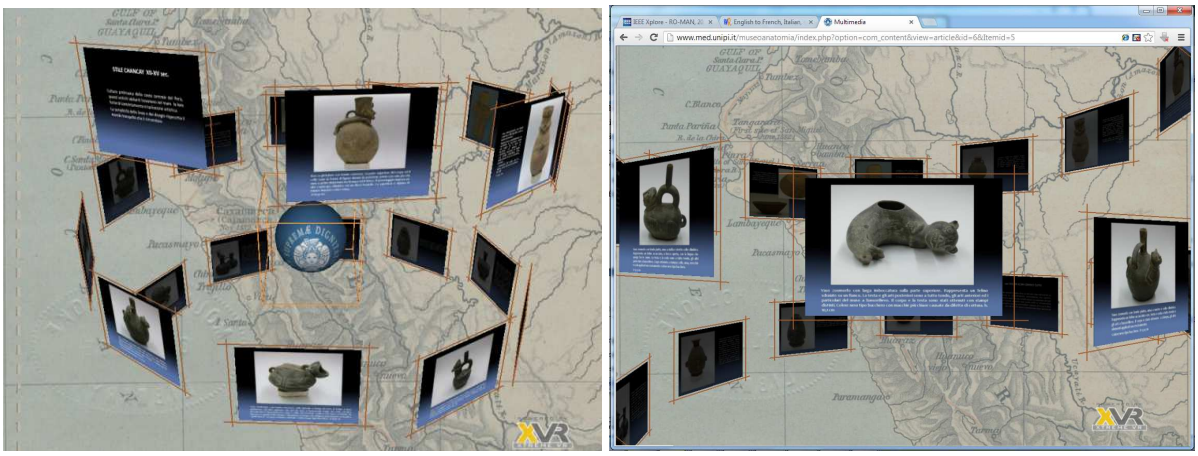

Fig. 1: The Interactive Multimedia Catalogue as a stand-alone application (left) and in a web browser (right)

"Information Landscapes" (IL), invented by Muriel Cooper - founder of the Visible Language Workshop at MIT Media Laboratory – are interactive digital 3D environments differing from conventional Virtual Environments because of their constitutive elements: whilst conventional VE elements are typically 3D models, in ILs they are commonly texts and images, usually structured as geometric shapes placed in a 3D space which allows establishing a context for the most suitable visualization metaphors.

Based on our previous experiences (Ruffaldi, 2008), for the Anatomy Museum of Pisa we have structured an IL (fig.2) whose first part is based on the metaphor of a virtual corridor, where historical information are placed and perceived from the user in a sequential way. At the end of the corridor are located three virtual "rooms" hosting specific objects from the Museum collections, allowing users to visualize and navigate through them.

Fig. 2: The Information Landscape for the Anatomy Museum of Pisa, stand-alone (up) and web-based (down)

These applications - developed making use of the XVR technology (Tecchia et al. 2011), a framework for the development of interactive virtual environments - are also available as web3D applications, exploiting XVR capabilities of acting as a browser plug-in, in the specific "Multimedia" section of the new museum website (fig.3), which has been purposely designed and structured into different sections clearly corresponding to the different typology of collections, so as to offer to the public appropriate instruments to complete and deepen their experience with the exhibited medical collections.

Fig. 3: The new website of the Anatomy Museum of Pisa

Beyond the immediate purpose of supporting the activities of this specific museum, these tools have been developed as technological instruments to sustain a more general research focusing on the design and evaluation of interactive concepts to be used as communication tools by scientific museums and, more particularly, institutions involved in the dissemination of medical culture. The final aim is fact to verify and evaluate the effectiveness of the experiences provided by multimedia resources, both in terms of learning and engagement, in order to define the most suitable concepts exploiting the increasingly important role that these tools play in the contemporary cultural communication.

4. *Directions for Future Work*

The studies already carried out together with the Human Anatomy Museum "Filippo Civinini" of Pisa, increasingly exploiting the potential of new technologies, have showed

very promising results and, aiming at providing novel communication means between museums and people, we are looking forward to more structured and challenging cultural applications. On the basis of the work hereby presented - and also considering the programmed availability of further technical supports for the Museum visitors in the next months, such as QR Code patterns which will enable a more integrated use of mobile devices – we aim to verify the level of the satisfaction, engagement and instruction aspects that could be improved in the Museum experience. For instance, a further step will be, in this direction, to study how new technologies might provide aid to support the presentation of the most "horrifying" pieces, which anyway are an important part of medical history and studies.

Our direction is to create a Digital Anatomy Gallery - collecting pieces from different medical museums - accessible both on the web and on specifically conceived multimedia installations. It would be expected to use cutting-edge visualization systems able to provide immersive representations of medical art pieces mixed with virtual content, such as 3D anatomical models. This immersive experience will be enriched by advanced interaction features – involving, for instance, gesture recognition and touch feedback - in order to provide the most seamless and natural user experience.

The integration of immersive visualization, natural interaction and multimedia content would also represent an ideal didactical and experiential tool to explore the deep relation occurring between art, medicine and science. The development and analysis of the Digital Anatomy Gallery would contribute to the research on the increasing important role of new technologies for fruition and learning purposes, enabling to set beyond-the-state-of-the-art goals especially under the methodological perspective.

Also education and dissemination purposes would be foreseen as our aim would not only be to ensure a better visibility and an innovative divulgation of the cultural and scientific aspects of museum collections, but also to realize a connection with modern learning methodologies, such as those based on virtual anatomical models.

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ONLINE SOURCES

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http://biocfarm.unibo.it/museocere/

http://www3.unifi.it/anatistol/anatomia/museo.html

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http://www.scamilloforlanini.rm.it/html/carica.php?pagina=alt&sub=mus

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http://www.thegarret.org.uk/

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