

MUSEUMS AND VIRTUAL MUSEUMS IN EUROPE: REACHING EXPECTATIONS

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Abstract

The paper presents an overview of the domain known as “Virtual Museums”, as it appears after the four year project V-MUST.NET. It aims at describing the shift we are assisting in the museum perception and management, including how virtual museums are and can be integrated in exhibits, highlighting positive and negative elements. Visitors and curators expectations and possible answers are described, also referred to the “Keys To Rome” international exhibit example. It finally proposes new possible researches directions.

Keywords

Virtual Museum, Communication, Interaction, Museum, Narratives

1. Museums in Europe

Museums are changing. Their importance have been recognised as going much beyond the simple display of objects or artworks, their conservation and study. The definition of museum presented by ICOM goes in fact in this direction (ICOM, 2007).

How many museums do we have in Europe? EGMUS has tried to answer to this question, by collecting and publishing comparable statistical data, taking information from national museum statistics and surveys. Data are updated and stored in the Abridged List of Key Museum Indicators – ALOKMI - table (EGMUS, 2012) Although not completely reliable due to inconsistencies in data provided by the different countries, we can count around 20,000 museums in Europe, among medium and big museums.

How many types of museums are there? In (EGMUS Definition & Explanation) there is a description of the different types of museums, referred also to ICOMOS, that can be summarised here in three main categories: Art, archaeology and history museums; Science & technology museums; and Other museums.

The scenario of these European museums is changing rapidly. Their sustainability is becoming an urgent issue, being moved from European level

(available funds directly from EC) to national level.

How those museums are changing?

We are assisting to a shift in the perception of the museum, both for curators/museologists and for the visitors, in two main directions.

On one side the general crisis is not preventing people to visit museums. On the contrary we are assisting to an increase of the number of visitors, especially in the first category of museums. A reason might be that the perceived instability, together with the awareness of the rapidity the world around us is changing (i.e. technological developments, environmental changes, the type of communication itself that requires to be speed and short), pushes us to find reference points that are stable. We search for stability and reflections on our past. We don't know where the world is going, nevertheless we need to understand who we are and who we were, our story. We have created a culture of communication that makes hard to find space and time to reflect quietly with no distraction (Turkle, 2011). So the first direction refers to *stability*, especially of content and of communicated messages.

On the other side, there is a push that goes on the other directions, towards *flexibility*. Sherry Turkle (2011) perfectly observes the modern trend of communicating faster than “real-time”.



Fig. 1: Keys To Rome exhibition at the Museum of Fori Imperiali (Rome)

We need complex information divided into small parts or synthesised. We can not loose time in standing in front of an object, for example, for a long period, either we got immediately an answer to our questions or we got captured by some other information and we proceed.

museums need to communicate and to attract more visitors. The idea of a museum, whose goal is just the preservation or study of its collection, is no longer feasible. Therefore twenty first century museums needs to focus more on communication and attraction, enriching the visitor experience, enabling to better understand and experience European heritage, enjoying the visit and being social and cultural attractors for tourists and also for citizens. This is true not only for big museums (that make up a very small percentage of the European cultural heritage institution profile) but particularly for the thousands of medium and small museums. Citizens, moreover, represent the demographic visitors likely to repeatedly visit museums (ticket income), while tourists might be considered as an income stream bying into the value added services provided - bookshops and other museum services.

Visiting a museum, and, critically, re-visiting a museum, requires the museum to offer constantly **new, attractive** but **serious** exhibits, that might provide a combination of “stable”, fast and flexible contents.

What does it mean being attractive? Studies within V-MUST have connected “attractiveness” with a narrative approach to such exhibits, and one that might be successfully offered through ICT technologies by virtual museums. Furthermore being attractive has also a connection with museum social dimension. The social component has been also extensively recognised during the annual conferences of Museum & The Web (museumsandtheweb.com) and Museum Next (museumnext.com).

A preliminary poll V-MUST.NET project has conducted in 2014 in the Museum of Fori Imperiali (Rome), confirmed that museums are places of social aggregation and of informal learning and that visitors want a museum that could tell them stories.

1.1 Curators/Museologists and experts expectations

Curators have specific duties in museums daily life, including the *conservation* of the collections, their *display and communication*, the *acquisition* of new objects, etc. (Desvallées, Mairesse 2010).

In the digital era they need more and more to take care of: the *scientific quality and accuracy of digital contents*; the *concepts clarity* as respect to their communication to specific users (i.e. students); *exhibition attractiveness* (to attract

more visitors); the *communication channels or media used*; their *integration* within their museums and within the daily life management. Although traditional communication is still the main channel, new technological applications are emerging.

In 2011, V-MUST.NET has carried out another survey, interviewing 50 stakeholders, among museum directors and ICT developers. What emerged was that 40% reported they would have developed or would have been interested in developing a new virtual museums, and 57% were interested in on line 3d Virtual Museums (Corsini, M., Scopigno, R., Calori, L., Graf, H. 2011).

In 2013, the Italian MIBAC made a survey on 4198 Italian museums. From this survey it came out that 88,5% of museums still where using traditional written panels, with an increasing number of multimedia interactive applications (27%), audio-guides (12%) and mobile applications (6%) (MIBAC 2013).

From this result, it is clear how curators should also take into account: *technological innovativeness* as referred to visitor attraction and understanding (interaction, visualisation, immersivity, usability), *technological integration* and *technological accessibility and usability*.

Moreover, if they want to attract new visitors or made them coming back, they have also to change the model adopted until now, often introducing new thematic exhibits and renovating their museums. In this case, their expectation is to have more *flexibility* both in the traditional display system and also in the possibility to integrate different technological applications, to complement their exhibits.

1.2 Visitors expectations

What visitors expect from a museum exhibition in the digital era? There are five basic questions they have:

1. What is that? What does it represent?
2. How would it look like?
3. Where does it come from?
4. What was it connected to?
5. How was it used?

These are the questions curators and developers should try to answer, by complementing their exhibitions with appropriate communication supports.

Are there other expectations people have, when thinking about a modern exhibition or museum? To answer to this question, V-

MUST.NET has carried out a preliminary survey at the beginning of 2014 with the visitors of the Museum of Fori Imperiali in Rome. This museum was selected because it would have been the venue of a new technological exhibition named "Keys to Rome" in September (Ray, Pescarin, Pagano, 2014: 40).

The goal was to try to understand:

1. How important is for visitors the scientific value of the applications (relevance, completeness, clarity of concepts, metadata visibility etc.);
2. How important is to have interactive applications in museums;
3. How important is to be emotionally involved;
4. How important is trasmediality (i. e. with contents re-used and communicated through different devices).

More than 100 visitors replied and the result can be summarised as follow:

- visitors of this museums state to be *familiar with technology* (96%): they use audio guides, touchscreen or touch tables (55%) and tablets or smartphones (40%) normally;
- (1) visitors think that stories and visual information are more important that get access to "*how*" those visual reconstructions have been done (i.e. through metadata);
- (2) some visitors do not think that complex *interactive system* are more important than stories and visualisations (most of these visitors don't have experience of interactive systems in museums)
- (3) the majority thinks it's fundamental that a virtual museum could:
 - *tell stories* to help them to better understand cultural information;
 - help them understanding through the *visualisation of reconstructions*, virtual representations and multimedia detailed information;
 - offer more details on objects displayed in the museum, with reference to their *context and relations*;
 - use *interaction* to let them *choosing and focusing* on a detail or on a reconstruction of the physical objects;

- offer *involving and enjoyable situations* inside museums, some of them (historical and archaeological museums) are reported to be not attractive, especially for the young generation;
- communicate with simpler *language*, closer to the one they use every day;
- are integrated into a comprehensible museum itinerary, aesthetically pleasant, but rational (the scope of the exhibition should be clear and appropriate language should be chosen, trying at the same time to reduce the number of the objects on display).



Fig. 2: - Multimedia touchtable used to get deeper information at K2R exhibition

2. Virtual Museums

Any exhibition should take therefore into account both the tension toward stability and that toward innovativeness and flexibility. Digital applications play an important role, IF they are well integrated in museum itineraries, developed following the exhibition goals. Interactive virtual museums offer a potential that need to be carefully developed, trying to answer to visitors expectations, without going too far from curators needs.

But what is a virtual museum? After three years, V-MUST.NET had reached to a wider explanation. There has been always a debate on this sector, in most of the cases because the term “virtual” is used in different ways by experts in computer science (virtual = interactive / simulation), in humanities (virtual = digital, but also being essential), and by the common people

(virtual = on line). Although along the 70s and 80s there have been several examples of ICT applications especially in archaeology, in the 90s appears for the first time the term “virtual archaeology”, before (Reilly, 1990; Forte Siliotti, 1997) and than “virtual heritage”. The first virtual museums date back to the middle of the 90s (1995-1998: i.e. Infobyte interactive exploration of Nefertari tomb, NuMe project, Delft exploration in 1660). With 2000 the concept of virtual evolves towards the concept of simulation, of interactive visualisation of the different potential realities of cultural information (Barcelo, Forte, Sanders 2000).

Today, Virtual Museums can no longer be considered as simple digital duplicates of “real” museums, nor can they be regarded as being exclusively restricted to just online museums. During the last five years they have evolved into complex communication systems, strongly connected with narratives, interaction and immersion in 3d reconstructed scenarios (Ferdani, Pagano & Farouk, 2014).

Quoting the last discussion on this topic (Hazan, Hermon, Turra, Pedrazzi, Franchi, Wallergard, 2014):

“A virtual museum is a digital entity that draws on the characteristics of a museum, in order to complement, enhance, or augment the museum experience through personalization, interactivity, and richness of content. Virtual museums can perform as the digital footprint of a physical museum, or can act independently, while maintaining the authoritative status as bestowed by ICOM in its definition of a museum. In tandem with the ICOM mission of a physical museum, the virtual museum is also committed to public access to both the knowledge systems imbedded in the collections and the systematic, and coherent organization of their display, as well as to their long-term preservation.”

Therefore V-MUST definition (in Ferdani, Pagano & Farouk, 2014: 10) is:

“A Virtual museum is a communication product made accessible by an institution to the public that is focused on tangible or intangible heritage. It typically uses interactivity and immersion for the purpose of education, research, enjoyment, and enhancement of visitor experience. Virtual Museums are usually, but not exclusively delivered electronically when they are denoted as online museums, hypermuseum,

digital museum, cybermuseums or web museums.” [V-MUST ver 1.4]

Virtual Museums can be defined in accordance to their content (archaeology, art, etc.), type of interaction (interactive / not interactive), duration (permanent / temporary, etc.), communication style (narrative / descriptive), immersivity level (immersive / not immersive), type of distribution (on line, off line etc), scope (educational / entertainment etc.) and sustainability level (in Ferdani, Pagano & Farouk, 2014: 12).

2.1 *Keys to Rome experiment*

Over the past four years (2011-2014), V-MUST.NET has undertaken the challenge to realise and implement the potential of technologies for the virtual museum. The result has culminated in a showcase exhibition presented in four museums in Rome, Amsterdam, Sarajevo and Alexandria: “Keys to Rome”. This exhibition includes an array of different technologies: immersive movies, natural interaction systems, Virtual Reality headsets (Oculus), interactive serious games (Admotum); multimedia touch applications; Augmented Reality (AR-tifact and Revealing Flashlight); holographic display (Holobox); tangible interfaces (Virtex); interactive projections making use of specific sensors such as Leap Motion and Kinect (Revealing Flashlight, Admotum); web3d and mobile narrative applications (Matrix app).

Conceptually, Keys to Rome is based on the idea that it is possible to build thematic exhibitions from permanent collections, following a narrative approach, enhanced by the use of technological applications. The objects selected for the exhibition belong in fact to different historical periods, within the wider context of the Roman Empire: from the 2nd century BC to the late Empire. Moreover, they are a subset of four museum’s permanent collections, representing different themes and styles, from widely different contexts.

The technology and the development of different virtual museums would have helped to build an impossible exhibition, enabling different visitors in four different countries to explore those objects, separated by physical distance, to understand Roman culture, through its common and contrasting elements. Narrative approach and technological applications have been used to enhance visitor experience and knowledge. A

common story has been created as a general container, while local stories are connected to objects displayed during the exhibition. The different applications used by the exhibition, make use of a wide digital asset in a multitude of different ways, pushing the limits of the concept of transmediality.

An international team of more than 50 people coming from 10 different institutions in 9 countries have worked together to develop this asset and the applications that use it, in a unique, incredible transmedia project: Keys to Rome. Each object has been acquired from participating museums, using the most appropriate 3d acquisition technique, according to the type of object, its condition, location and available time to digitally capture it. The main 3d acquisition techniques and modelling techniques that have been used are: Image Based Modelling, laser scanning TOF (Time Of Flight), laser scanning triangulation, 3d Computer Graphics modelling from pictures.

The acquired data has been stored in the V-MUST Production Platform (<https://hpc-forge.cineca.it>) and accessed/shared through specific client software (i.e. Rapid SVN, Tortoise, CyberDuck). From this entire set of digital data, were produced different outputs for the various applications developed.

Each participating institution was permitted free choice in terms of selecting the most appropriate tool for contributing to the project. This resulted in five major modelling software applications being used: Blender, 3D Studio Max, Modo, Cinema4D, Maya. Three software packages have been used just for lighting based applications: Mental Ray, Vray, Cicle. Five file formats for common exchange or models were selected: Obj, Fbx, Dae, 3ds. It was required to have just one exporting format to be used for Real Time applications, such as the game Admotum: osg (OpenSceneGraph). A specific software package has been developed by CNR ITABC to be used to control this .osg format and to enable direct further modification, like controlling the scale (Adviewer.), optimising the geometry of the models and scale them (Smoother, Adpack and Scaling). The main tool used to prepare final scenes in Admotum has been specifically developed (Painter) for scene dressing, item arrangement into a scenario, development of colliders and of pre-defined path.

The digital asset is composed by almost 15,000 textures, more than 60 unique objects. Most of these objects have been included in the 12 applications developed:

- Keys To Rome Short movie
- Matrix App
- Walking Map
- Talking Statues
- Multimedia Touchtables
- RFid
- Virtex
- Revealing Flashlight
- AR-tifact
- Admotum
- Holobox
- Keys to Rome Matrix Totem

Visitors of the Keys to Rome exhibition can therefore experience the exhibits in many different ways, for example following an itinerary that is fully narrative. Keys to Rome concept is based on a gradual cognitive itinerary through which visitors of the four different countries, can search and find Roman remains, understanding their use and also their original context. This itinerary is possible thanks to an involving experience, designed to change the traditional visit to our museums.

2.2 Reaching expectations

The applications integrated in the four museums try to reach users and curators expectations, as described in the paragraphs 1.1 and 1.2.

Flexibility



Fig. 3: The modular system of the new re-organised Allard

One of the emerging needs in the museum domain today is flexibility in the creation of exhibit. A solution has been adopted by the Allard Pierson Museum in Amsterdam, where the

display cases are based on a modular system to allow the curators to often renovate the museum, without worrying too much about moving the objects (fig. 3). This makes the museum ready to host and mix real exhibit with digital ones, easily integrating virtual museums.

Scientific accuracy and transparency

Another need of a curator is to store and communicate to experts the entire reconstruction process that has led to a specific 3d reconstruction. Interaction in this case is fundamental. Although common visitors do not need to access this level of information, a specific ICT interactive application can be developed and made available in a particular area of the museum (i.e. a scientific room or lab with touchtable, etc.), or left for on line home exploration (i.e. web3d exploration of digital datasets and their metadata, as in the case of on line Livia's Villa, recently developed (Livia web3d, 2014; Lucci Baldassari, Demetrescu, Pescarin, Eriksson & Graf 2013).

Fragments

To solve the problem of helping visitors understanding how would have look liked an object or a site, a mobile application for iPad has been developed by Fraunhofer IGD, based on Instant AR framework/ WebGL and on the paradigm of transmedia and digital contents portability: ARtifact (fig.4). The tablet in this case is used not only to provide a visual input on a possible reconstruction of the object, but also as a personal storyteller (Katifori et al 2014).



Fig. 4: By just pointing at this fragmentary object in Rome (shoulder of Mars belonging to the group of Mars and Venus)

Color

What could have been the original color of ancient architecture and artworks? This is a problem that has been treated in different ways

recently. Most important application regards the projection on an entire complex surface of a reconstruction (as in the recent exhibition “I colori dell’Ara Pacis”). With the development of sensors that now are on the market at reasonable cost, it is possible to create more personalised and “shocking” experience, letting the visitors exploring smoothly a surface, using their fingers as light torches (fig.5). It is the case of the “Revealing Flashlight” project, developed by INRIA (Ridel et al 2014)



Fig. 5: With the Revealing Flashlight visitors can smoothly and gently discover the hypothetical original color of Augustean slabs from the Temple of Mars in the Forum.

Context

As emerged also in the survey carried out and described above, one of the key problem in our museums is to let users understand the context the objects they see belong to. For this reason CNR ITABC has developed an on site virtual museum, based on natural interaction (kinect sensor), where visitors can in a game-like approach find the museum collection inside their original reconstructed environment (Admotum, fig. 6).

Virtual loans

Building a thematic exhibition often require the curator to activate a loan procedure, to integrate it with objects coming from other museums. Sometimes, unfortunately, objects can not be moved for preservation issues or are too far expensive to obtain. For this reason a possible solution would be to create a low-cost holographic display that could easily complement the exhibition (Holobox: fig. 6, on the right). Integrating the display with touchscreen of natural interaction sensors (such as LEAP

motion) can transform the simple vision into a manipulation activity and detailed exploration.

Collective visits

The visit to a museum is in most cases a collective experience (family, friends, school). CNR ITABC has tried, since 2008, to experiment different kind of virtual museums to enable more visitors to interact with a system. The last example is the new interaction metaphor designed for Keys to Rome in collaboration with the Department of Interface and Interaction Design of Lund University. It connect Admotum and Holobox into a unique experience (Fig. 6). When a visitor finds an object in the 3d scenario, he can “send” it with a gesture into a second display (the Holobox) to let others to manipulate it.



Fig. 6: Discovering objects in their original context by using a game-like approach is the goal of Admotum (left) while

Touching heritage

One of the difference between category 1 and 2 of museums is that, in the first case, visitors can not have a direct approach with object, as touching them. The evolution and availability of low cost solutions for 3d printing, makes possible to create digital copies of objects at different scales and transforming them into interactive interfaces. It is the case of Virtex, developed by Visual Dimension (Fig. 7).



Fig. 7: Virtex uses a low-cost 3d print of an object to embed sensors. Visitors can have a direct feedback by touching the surface (Ara Pacis). (Courtesy of Visual Dimension)

Personalization

Every visitor is different. Although they report they want to understand, see visual reconstructions, hear stories, in a simple way, the level of “simplicity” differs from person to person. For this reason the personalisation of the museum experience is an emerging interesting topic. In Keys To Rome it has been developed and tested a Rfid system that enable users at the Allard Pierson Museum in Amsterdam, to choose at the beginning of the exhibition the desire perspective, among Egyptian, Roman and Lowland, and take a key-card. Each time the key card is put close to a reader, the system replies providing personalised information (Fig, 8).

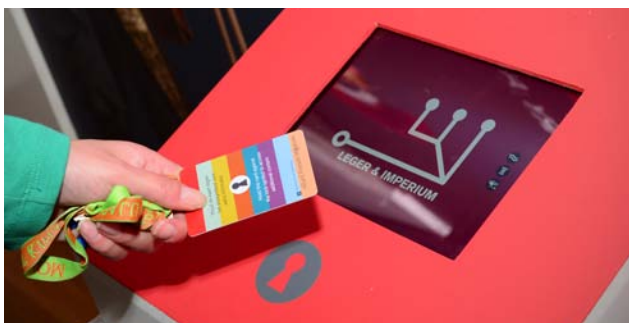


Fig. 8: A Rfid system enables in Amsterdam visitors to follow a chosen itinerary (Courtesy of APM)

Another possibility is to use mobile phones as personal devices; while pointing them at objects, visitors receive information that comes as “voices from the past”. They can also decide to follow the thematic connection of the object they see, reaching other objects displayed in other museum (Matrix App: fig. 9).

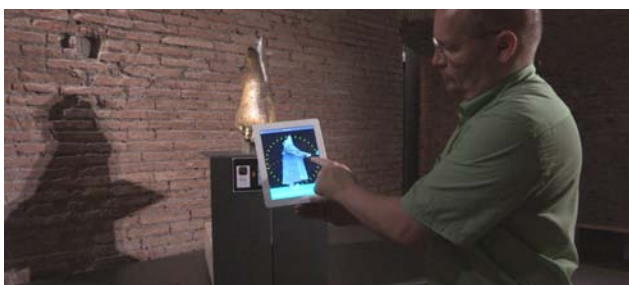


Fig. 9: Matrix App

Stability

Although it has been left as last point, the request of stable, assuring and clear information is the first priority. A linear approach is the perfect way to communicate basic information.

This is what it is usually done in exhibition, when at the very beginning a short movie introduces visitors and provides basics content. A narrative or even dramatic communication style is always preferred for not-expert visitors, because it contributes to involvement and attractiveness (Pescarin, Pagano, Wallergård, Hupperetz, Ray 2012).

3. Conclusion

In the paper I have analysed known and emerging needs and requirements of visitors and curators in this digital era. I have described technological solutions available, most of them based on stable and well known ICT, mature enough to be adopted. Nevertheless, there are interesting new directions that would need further work and researches, such as simplified web-based frameworks that could help connecting stories to digital assets; or easy to use tools that could bridge the different professionals in the museum domain; or simplified way to create 3d interactive on line virtual museums, usable by non technical persons, perhaps based on templates. Evaluation, finally, of the new museums and virtual museums is indeed a central problem and needs to be considered since the very beginning of the creation process.

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