Available and Implementable Technologies for Virtual Tourism: A Prototypal Station Project

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Abstract. Authors report here their experience and knowledge on the state-of-the-art in relation to a prototypal station for virtual tourism, able to relate geomatics references to cultural content and to offer a whole experience, involving users also from the sensory point of view. That's nowadays a specific purpose of new technologies applied to cultural heritage.

Keywords: Museography, Virtual tourism, Geomatics and shared databases, Human computer interaction, Social inclusion.

1 ICT between Real and Virtual World

The most recent technological revolution, concerning the web and so called ICT, has had an impressive growth, that's not only changed individual and collective behaviors, but has also allowed experiences no possible before: a real time communication, regardless of the distances; an extended access to disjointed data and sources; the shift in different realities – missing or entirely imaginary.

This is not the place to explore the number of solutions and inventions in this field, and even to summarize systematically the implications or give a systematic critique.

There's no doubt that the traditional dialectic between reality and fantasy has been replaced by a coexistence of several "hybrid": even the term "experience" is no longer univocal.

Therefore if we can define "reality" what we perceive, even by the filters of our interests and our background, nowadays new technologies have expanded this concept: physical reality, virtual reality and augmented reality have long been able to offer different "experiences", in mutually reinforcing.

2 Virtual Museum, Virtual Tourism

Among the fields that have mostly boosted by the existence of different realities, there are certainly the games production and the dissemination and communication of cultural heritage.

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Moreover, according to *edutainment* concept for a long time acquired (according many sources, this neologism was coined by National Geographic Society's documentary film producer Bob Heyman in 1970s: it refers to an educational activity which uses techniques and methods of entertainment:), for about 30 years we are witnessing a true gamification in the communication of cultural content.

The concept of virtual museum is by now established, multi-faceted and so widespread that it is now inflated: this term is often used inappropriately, and it indicates the possibility of access to the historical, artistic and cultural heritage through the network, sometimes replacing sometimes integrating the real experience of visit.

Then we have "virtual museums" that simply are "catalogs" on line, but we have also cases in which, with more or less interaction, we can perform via video true visits (selecting paths, objects, information). The static nature of these experiences is often the weakest point, despite considerable progress [7] [28][29][35].

Aforesaid solutions, in fact, interpret "virtual" as "simulation" (on the screen) of a real experience.

This "replacement" (which anyway provides immediate availability and accessibility everywhere - sometimes more than in the real situation) nevertheless pays a price: not only the loss of certain sensory components (at the moment only the sight and hearing can be surrogated) but also and above all the barrier effect of the screen and disorientation.

The loss of the viewer's corporeality creates alienation and separation (and avatars - not just those already available in many applications, but the real "*alter ego*" of the famous film by James Cameron - are precisely the attempt to fill this last, heavy gap).

But if we attribute to the term "virtual" its scientific meaning, i.e. simulation of reality (and consequently simulation of experience), new scenarios open [39].

Therefore the virtual museum is not the computer version of a real place, but a place that does not exist - or that has a collection that does not exist, or no longer exists (virtual collection features are really interesting in certain cases, such as in the archaeological field: virtual reality thus becomes a tool to support the imagination.

Other experiments have enhanced museums by "virtual guides", i.e. synthetic characters that can interact in a more or less advanced way with visitors [28]. In other cases, they have attempted to give back a "physical", bodily dimension to the virtual tour: in Italy one of the pilot cases goes back to 1994, and it concerned the virtual reconstruction of the Nefertari tomb [35]. You could visit the interior, no longer accessible, thanks to a joystick and stereoscopic glasses[1].

But in this field there have been many experiments[2], more or less immersive, someone scientifically rigorous, someone similar to videogame *tout court*, very poor from the cultural point of view [28] [29]. As already mentioned, the gamification is an educational strategy that not necessarily means "low cultural level". They're studying solutions - using geo-caching, geolocation in the interior (still a bit problematic) – that

[1] "Nefertari: Luce d'Egitto", temporary exhibition in Rome, Palazzo Rispoli, 1994.

[2] In particular, see V-MusT.net NoE experiments during 2012-2013 period (www.v-must.net)

offer real educative "games" in which the entire web community is involved: in this regard it should be noted that the Web 2.0 advent has given further impetus to the virtual experiences, enriching the cultural experiences with socialization and sharing[3] [26].

Last, but not least, the new concept of museum [38], much more inclusive than the "objects container", enclosed by walls, with a clear division between "inside" and "outside". Now the museum could involve entire countries, entire ecosystems, entire regions. We can speak of "museum outside of the museum" [37], that defines the extension of the museum "storytelling" on a regional scale, beyond the walls of the traditional museum. On a regional scale experiments entirely convincing have not yet been carried out, but from this point of view the cultural lands can be visited as great open air museums, with transversal or theme paths, to find objects, artworks or signs: the whole land is a "collection" to be preserved, to be presented and to be interpreted. Thus the visit allows to elicit outstanding objects, to read into landscapes with different filters. Both the physical and virtual visit seem to be a "tour".

In fact, the new concept of "virtual tourism" is very similar to "virtual museum", but it's more inclusive [18] [21] [22] [24] [28] [29] [32] [43] [44].

Its own meaning is still not universally shared, anyway it originates from the advent of new technologies in the tourism industry: not only regarding new channels of information and purchase, but also the "virtual tours", that explore synthetic worlds (sometimes encroaching on videogame) or the real world. Nowadays the attention is focusing on the second one. Often the "virtual tourism" is defined as "stationary tourism", but they're trying to overcome this feature.

Actually, we could define "virtual tourism" two different cases: a virtual trip in a virtual site (that's a model, mirroring the real world or not) and a real trip (that's powered by another reality – the augmented one). Of course, there is a lot of intermediate options, and we have to take account of specific purposes and different goals (commercial, cultural, entertaining…). But we would like to focus on solutions that don't resort to models and virtual worlds, but instead aim to face to real environment.

3 Virtual Tourism in Real Sites? Technologies to Recover Lost Dimensions

Focusing on tourism in real sites, they're attempting to expand the perception and knowledge modes, also thank to open databases more and more extensive.

We can acquire information in increasingly articulated ways, in order to rejoin virtual world and real experience.

For a long time the Authors are interested in this field [6][10][28][37]. They believe that communication of cultural heritage has yet to fully benefit from the new

[3] See Tate Gallery case (`www.tate.org.uk/britain/exhibitions/howweare/`) or Brooklyn Museum of NY (*Click! A crowed-curated exhibition*: `www.brooklynmuseum.org/exhibitions/click/`)

technologies chances, not only in Italy (where the matter is particularly urgent and strategic, although their country isn't an emerging model about ICT exploitation for Cultural Heritage). In addition, they trust in a cultural and social mission of virtual tourism: it shouldn't not only enhance already known and possible functions (increasing the commerce and information occasions), but it should also broaden avails to situations and categories of people who have so far been excluded, in different ways.

They are convinced that the time savings should not sacrifice the awareness of real parameters (distances, differences) and that the so-called edutainment shouldn't be a simple compromise between different needs, but rather a richer opportunity. Thus their interest is addressed to technologies able to tie virtual visit and *real site*. Furthermore, they want to pay more attention to "visitor's body", i.e. his physical involvement, in virtual experiences.

Many projects facing this issue are already been carried out: from simple "virtual books or tables" to particular experiments as *PointAt*[4], *Museum Wearable*[5], *Cave*[6], haptic interfaces, holograms and so on. In these cases, anyway, virtual reality integrates real environment – through 3D models and simulations.

The Authors have just developed a project, which is currently under evaluation by the Ministry of Education, University and Research, aiming to explore the opposite situation, integrating the virtual environment by *real elements*.

Likely, the closest case to Authors' project, and already made, is the virtual "Trans Siberian Railway": thanks to a simple video camera system, it offers the real sights from the train window along the 9000 km travel. The website also features images of small cities crossed, as well as tourist information, related to Google Maps[7]. However, they miss an element that Authors consider crucial: the real interaction with the physical movement of the user. Although friendly and shared, the map system is an abstraction and cuts immersive effect. All information access should be strictly related with a real sight, and originated from it: interaction interface is crucial.

Thus, as the objective is to merge physical and virtual reality, involving the body motion, the challenge is interesting because they want to present the real views, without 3D models. Another issue becomes crucial: the increase of data sharing, e.g. data related to systems as primarily Google Earth, Google Maps and Street View - now in common use. They already can provide, completely free, real images of the sites on global scale. Their content are by now integrated tools, namely repository of territorial data that we can integrate and share.

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[4] These solutions are interactive installations, the first one to consult documents, while *PointAt* allows to learn more about a digital version of an artwork, just pointing the finger on details - that's a very instinctive gesture (Museo del Palazzo Medici Riccardi, Firenze, 2003).

[5] This small, lightweight computer, in a carrying backpack, was connected to a body motion sensor and to augmented reality glasses and headphones, in order to support and enhance the museum visit (temporary exhibition "Robots and Beyond", MIT Museum, Boston 2000).

[6] An enterely virtual, immersive environment you can visit thank stereoscopic glasses and special "mouses" (e.g. Kivotos system, Foundation of Hellenic World, Athens 1999).

[7] `http://www.google.ru/intl/ru/landing/transsib/en.html`
The project was originated from a collaboration between Google Maps and Russian Railways.

Recently, another opportunity has been jointed: the integration of local and remote databases of images, and implementation in GIS systems [1].

Virtual Earth and Google Earth use a cartographic representation system not yet implemented – in Italy – in other applications[8]. Particularly interesting for our purpose are the geo-referenced images of Google Street View, implemented within Google Maps and Google Earth that provides panoramic views of 360° horizontally and 290° vertically along the streets (at a minimum distance of 10-20 meters apart). It was introduced in May 2007, and it runs in Italy since October 2008: Street View allows users to view portions of cities around the world at ground level, by placing on the map a little orange man.

Google Street View uses special cameras (the Dodeca 2360, with 11 goals and produced by the Canadian company Immersive Media) located on the roof of cars or equipped bikes. The service is now extended to main roads and urban streets of large and small centers, across all Italian regions[9].

The images quality is satisfying, although they may perceive the "junctions" among consecutive shots.

Furthermore, there are other databases of images that can integrate "real" views (i.e. at eye level), to offer to users a complete description of sites. First, the digital orthoimages (high definition) and angle shots (able to acquire buildings facades). The industrial solutions (*Pictometry* ®, *Midas* ® of *Track'air*, *iOne* ® *Visual lntelligence*,...) use systems of cameras, connected to each other and assembled on a single support[10].

In fact, in order to know and document the buildings appearance without performing measurements, less expensive systems are available: e.g. drones (UAV, Unmanned Aerial Vehicle) with photographic equipment. The APR (Aircraft Pilot in Remote) will be able to perform low altitude shots everywhere.

Finally, is now possible to create *3D City Models*, namely consultation environments where the buildings are geometrically modeled and then "dressed" with their facades. 3D City Models are one of geomatic products available for a long time, but only the recent improvements in the autocorrelation techniques may allow automatic generation processes, therefore openings to more generalized use.

All of these activities are nowadays made possible by the generalized availability of digital terrain models (DTM). They're got thank to photogrammetric autocorrelation techniques, cartographic data and - as it often happens by now - specific LiDAR shootings [2][34].

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[8] That's the system 3785 - Web Mercator WGS84, encoded in EPSG Geodetic Parameter Dataset.

[9] The updated coverage is available online at
`http://www.google.com/help/maps/streetview/learn/where-is-street-view.html`

[10] Pictometry and Midas systems have 5 cameras: 4 are installed with an inclination of 40-45 ° from the vertical and according to the four directions of view perpendicular to each other (forward, backward, left and right); the fifth camera takes from the zenith. Thus different frames share the same take instant.

Digital Terrain Models (DTM) are a resource in environment and land related applications. They can be employed in several way in order to deepen the comprehension of an area investigated by extracting morphometric parameters or to perform complex analyzes on the DTM alone or by combining it with other data sources with modeling purposes [3][5][15].

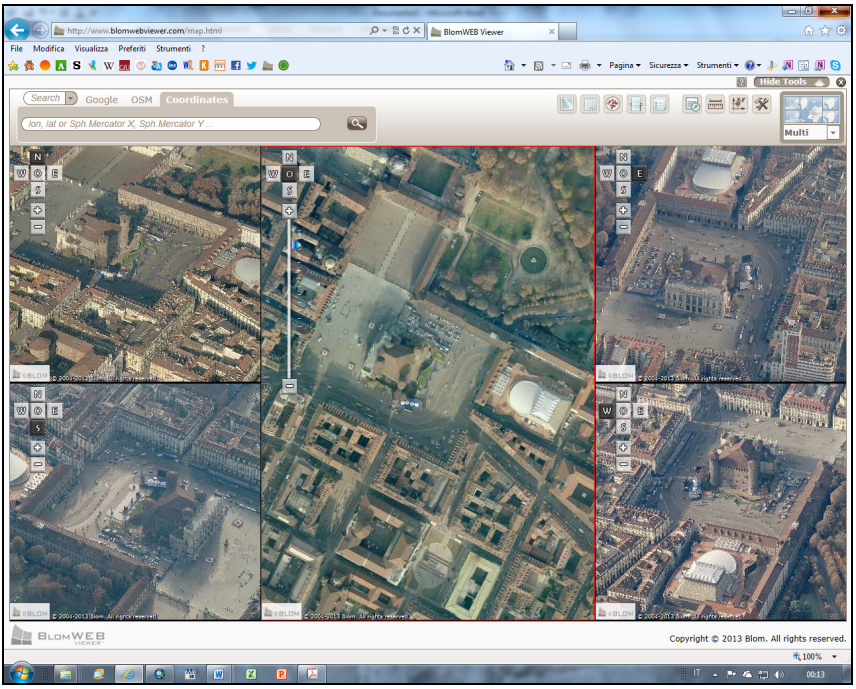

Fig. 1. Nadir sight and 4 angle shots of Turin – area of "piazza Castello"

A further contribution comes from the increasing standardization of cartographic production, advocated by the INSPIRE Directive and recently inserted in the current Italian regulations [34].

4 What Already Exists in This Field?

Other, different databases can be related: information about history, architecture, cultural heritage. The Authors will experiments integration with *MuseoTorino*.

Launched during the celebrations for the 150th Anniversary of Italian Unification, it's the new on line museum of Turin and it's an innovative, unique project created to collect, preserve and communicate the knowledge of the city. The website www.museotorino.it is conceived and structured as a museum, where you can find information on places, people, events, itineraries (thank a browsable map of the contemporary city). Each item has a brief label and a file containing notes and

information. The most interesting feature is the use of the latest platforms and technologies based on the Web 3.0 (semantic web) and Linked Open Data philosophy. The museum staff has been working on the website creation and data collection since 2009, organizing various teamworks which have produced so far more than 15.300 files on places, events, themes and characters of the history of Turin. Each file has been stored in a new generation database, a GraphDB providing excellent performances in data management.

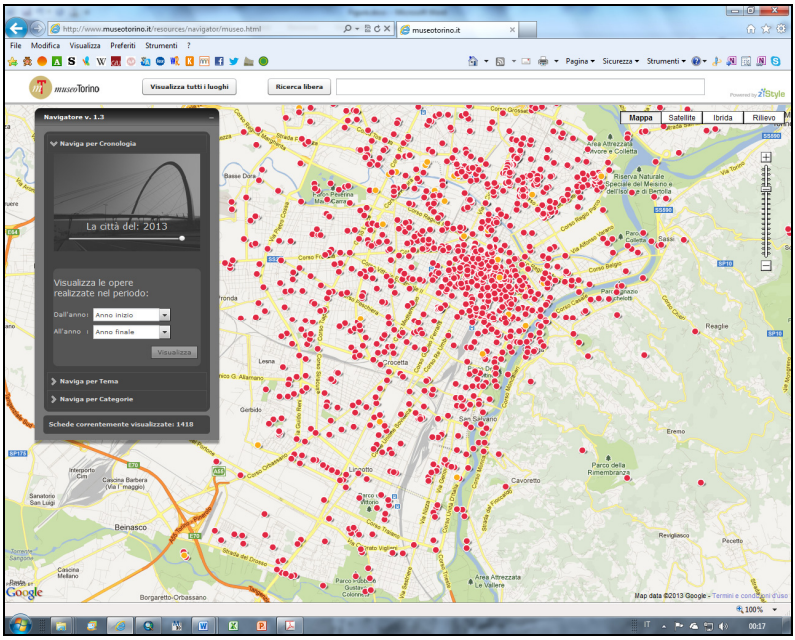

Fig. 2. *MuseoTorino*

This database is the museum catalog, which can be consulted online and which is open to free searches. In the site it is also possible to move across the contemporary city, through a Google Maps application, and to travel through time by visiting the permanent historical exhibition on the history of the city. MuseoTorino aims to involve the largest possible number of people, by sharing their knowledge and memories, suggesting ideas and projects. Icom Italia has awarded to MuseoTorino the prize Information Communication Technology (in occasion of Premio Icom Italia - Musei dell'anno 2011).

Thus, if the physical environment can be re-composed, instead of modeled, and if data and information can be collected and related, the visitor will be able to perform a "tour" without traveling. But his experience will be really "immersive" only if his motion and his perception of physical environment can be preserved.

So he will have several tools to move and to observe how and where he prefer (walking, biking, but also turning his eyes and his head), namely natural ways with which he normally explores the world.

Suitable I/O peripherals will ensure the correspondence between the physical motion of visitors and views (and a crucial requirement will be the level of immersion).

Furthermore, transposition of user' real motion along a trajectory, identified on Google Maps, will be put in relation in real-time with street view images. Several markers on these will allow to access (even through queries in natural language) not only to tourist information but also to cultural ones, detailed and specific, that will catch from different databases. Travel will be featured by shots specially made, in order to access also to particular interiors.

5 A Research Project for a Prototypal Station

Starting from aforesaid notes, the Authors consider several assumptions:

- with reference to users, the people's leisure has long been disputed between cultural activities and recreational/sports entertainment. Today we have a greater sensitivity to the quality of our leisure time, then we need to overcome this alternative;
- the journey is usually the favoured choice, able to combine both needs. It shows a more qualitative demand: however it takes for granted a time availability and other requirements that not all (and not always) can have;
- the journey virtualization is a more and more interesting alternative, but it has many weaknesses: for instance the use of synthetic worlds (although realistic) and the poor perception of distances, proportions and morphologies (i.e. of the territories as "systems"). Among the features of "real" tour, there is the free motion in places, with the support of various "guides". The new functions and services of augmented reality, in addition to unstoppable spread of smartphones (which nevertheless don't break the barrier effect of display), still require a cultural, strategic reflection.

The project therefore intends to explore a tour simulation with three basic features:

1. it offers to the "tourist" a *real* and *immersive vision* of what he would see across the places he's visiting, without turning to city models or synthetic worlds;
2. it brings together the virtual displacement on sites with a *physical motion really made* by the "tourist";
3. it uses *shared databases*.

In addition to a theoretical branch of research, the Authors aim to carry out a working prototype, replicable for different contexts (in urban environment and in extra-urban context) and different situations of use. The final prototype will allow to visit remote sites, without turning to traditional station front of a monitor, but recovering movement and free choice of timing and sequences.

The virtual tourist would thus have the opportunity to visit any place, stopping when and how he wants.

The experience will provide most of the functions available for real tourism (e.g., relating to already existing e-commerce network, the access to commercial services, with a simple "stop" to buy online - for example - typical products). It will also provide cultural services (exploiting virtual reality and augmented reality).

Tourists can make stops, get into some interiors and benefit of observation points that are not possible in physical reality, but easily achievable in the virtual tour (elevations of points of view, spherical shooting etc..).

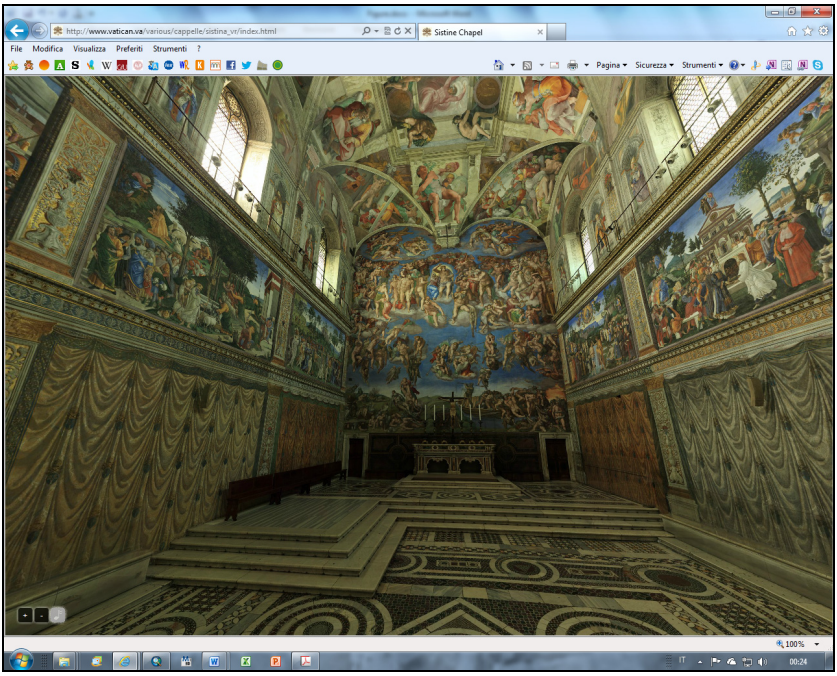

Fig. 3. spherical shot of Sistina Chapel, from http://www.vatican.va/various/cappelle/sistina_vr/index.html

The interaction should be as natural as possible, using also the natural language and virtual assistants.

For all practical purposes, the sites will be visited as a "museums outside of the museum" [37], able to integrate the benefits of both on-site tour and virtual tour.

The project encompasses several disciplinary cores: museography (that's exhibition strategy and communication of cultural heritage, complemented by historical and technical disciplines); geomatics and image processing (connection between the visitor's motion, the geo and cartographic reference and related databases); virtuality (and web 2.0.), ontologies (and web 3.0); tourism sociology and marketing (implementation of investigation/verification techniques, and their transposition to the virtual tourism).

Fig. 4. Immersive and interactive virtual reality, at LAQ (High Quality Laboratory) "Auditorium", Politecnico di Torino

6 Conclusions

The matter the Authors wish point out, in conclusion, relates to the use of technologies and databases now widely available.

In fact, in addition to the scientific and experimental contents in itself, from their use can arise important effects for people.

Indeed it concerns not only economic and commercial business (even if the creation of new jobs and new employment sectors is undoubtedly important). Let's rather consider the social importance of a tourism solution that does not exclude whole, weak segments of population, due to income, age or disability.

In addition to effects of social inclusion (which is a main goal of European Strategy for 2020) should also be underlined the opportunity for a greater access to culture, that's a primary factor of human development and progress.

Technology has always to support man, and not vice versa.

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