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Innovating Cultural Heritage promotion through virtual and interactive technologies

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***Abstract* – The Italian cultural heritage is well known due to its extraordinary richness, but its potential attractiveness is still not exploited. The cultural institutions today are facing several challenges to attract visitors, but it is not enough; it is necessary to find an innovative way to communicate culture, in order to bring it closer to the need for cultural knowledge and experience of citizens and tourists.**
This paper aims at introducing an innovative technological framework, which will enable the sharing of a digitalized cultural heritage experience. Furthermore, the potential benefits and implication related to the framework development will be described.
The framework founds on a basis of cultural heritage contents research and systematization, subsequently, on the virtual reconstruction and digitalization of historical elements and finally the creation of an interactive experience for the user.

I. INTRODUCTION

The Italian Cultural Heritage is well known thanks to his extraordinary abundance (4.976 museums, archaeological areas and monuments, 1 per 12.000 inhabitants) but it has a not yet enhanced potential. Trends, as regard profit and entry tickets, are positive, but no museums appear among the 10 most visited museums in the world, one out of three receives less than 1000 guests a year and the 70% of Italian people do not visit any museum [1]. A sample analysis, led by the *Osservatorio Innovazione Digitale nei Beni e Attività Culturali* [2] in 2016, shows that 52% of museums possess at least an account on common social networks. Nevertheless, digital services related to the enjoyment of museum collections, both online (e.g. online catalogues and virtual visiting) and onsite (as QR-code and proximity systems, mobile apps) are poor. Currently, therefore, cultural institutions have to face the challenge of sharing their own artistic and cultural heritage in a new way, closer to citizens and tourists demand for knowledge.

Enhancement of cultural assets field and tourism can be a strategical aspect in order to improve national systems competitiveness. In Italy, the rich cultural heritage is not managed effectively and efficiently, although it is of extraordinary importance with regard to local economic growth.

In Salento, a geographic region in the South of Italy rich of old artistic and cultural treasures, demand for tourism seems to be still referred only to sea places and to the capital city of Lecce. Although its growth from the nineties, tourism is limited to summer months. This aspect means a bad exploitation of the artistic, architectural, landscape, cultural, archaeological and historical heritage, which has to be overcome through innovative business models, made possible thanks to the implementation of new engagement technologies. Therefore, investments in the innovation, communication and organization fields are needed.

Nowadays, connections and integration among sites of archaeological interest serve as a showcase and they are often upgraded with unacceptable delays, re to the market timing, and the communication is really bad.

Development and spread of new ICT technologies (sensors, virtual reality, wearable device, cloud technologies) applied to cultural heritage promotion increase the earning opportunities for these business operators, since some of the opportunities efficiently match with culture diffusion requirements. These ones become opportunities for the development of first-person experience technologies, which could guarantee a strong user engagement, beyond opening up new paths in museum didactics. This field, in avant-garde countries (as regards ICT technologies), is characterized by an escalation of projects and initiatives, such as the "Approachable" Statens Museum for Kunst in Denmark [3], the digitalization program at the Smithsonian in Washington [4], the digital reconstruction program applied to cultural heritage led by the Harvard University Semitic Museum [5], and so many others.

Another clear sign of a need for innovation consists of the drop in visitors occurred in museums, mostly amongst persons born after 1980, which means a progressive disaffection for culture among young people. This information is even more surprising, if compared to data related to different communication forms centered on

user's involvement. For example, videogames as Assassin's Creed, with over 70 million copies sold in 6 years, became the first knowledge vector to get in touch people with historical locations, characters and facts actually happened in the past. It seems clear that putting users in a highly emotional and interactive context makes processes like learning and involvement easier; this remarks the necessity of a renewal, oriented towards new generations, concerning communication of the cultural heritage of a territory.

Gamification has been implemented in information campaigns, becoming a real marketing strategy, useful in communicating a positive image and in increasing the visibility of contents, thanks to the viral diffusion of the game and the related desire for sharing satisfied by social media.

Then, the right solution can be to define a model of territory enjoyment, based on highly relevant contents, innovative technologies and gamification logics. Generational change in sharing the cultural heritage passes therefore by the new "media", since they use a language oriented towards empathising comprehension perceptive aspects. Contents digitalisation is the backbone of this new scenario. In detail, three-dimensionality and virtual reality are the key features of this new trend.

In this article, a new innovative framework will be investigated: the main task of the CHER (*Cultural Heritage Engineering Revolution*) framework is to revolutionize the way of sharing cultural heritages, in order to make the cultural offer match with tourists and citizens' real demand.

II. ICT AND CULTURAL HERITAGE: AN OVERVIEW

Digitally capturing cultural heritage resources have become nowadays a common practice. Information Technologies have made possible many important changes in the practices of research, narration and conservation of cultural heritage.

Rigorous scientific documentation induce to acquire and assimilate large amounts of data derived from the interaction with research objects. For this reason, complex databases are prepared to store all the metadata, relational schemas are defined to enable fast and easy communication with statistics and data analysis applications, and some more examples could be found.

Studying the Past means to tell Antiquity to scholars, scientific community and, as well, to the community of citizens; heritage professionals have to speak to a large and varied audience. Recording physical characteristics of an archaeological sites or of historic structures or, of a precious ancient book is a cornerstone of their conservation, whatever it means actively maintaining them or making a posterity record. The information produced by such activity potentially would support decision-making of property owners, site managers, public officials, and conservators around the world, as well as, to present the historic knowledge and values of these resources.

Digitisation, intended as a copy of a physical original, e.g. the scan of paper objects and documents or the digital image of a painting, is commonly used in different type of cultural institutions such as historic archives, libraries and picture gallery [6]. The digitisation of information (such as size, date, origin, title, description, context) resulting from earlier documentation or from personal knowledge generate a huge set of metadata which are useful to identify, describe, understand and value heritage material objects.

ICT techniques have a large use in museum installations and Virtual Reality (VR) techniques reveal their potential even if cultural heritage become lost or destroyed; in such direction the Iraq Virtual Museum Project [7] allows the public to enjoy the main archaeological treasures of the ancient Mesopotamia after the destruction of Bagdad Museum in 2003.

In recent years, the popularity of Mixed Reality (MR) environments has increased as they provide attractive and immersive experiences for educational, entertainment and training purposes. Software solutions allow the representation and the interpretation of reality, present and past, becoming a powerful ally of social sciences, humanities and, in particular, cultural heritage and archaeology [8]. Therefore, gamification and interaction whit customers in a virtual environment represent the new frontier of cultural communication. A significant experience has been held in the National Archaeological Museum of Naples. The video-game Father and Son (downloadable for free) gained an excellent result in audience development (more than 240,000 users from differ countries have learn about the Italian Museum [9]) and, moreover, cultural contents spread out the physical boundaries of the museum and reached a very large and expanded public, that represent a new challenge for cultural accessibility (Fig. 1)

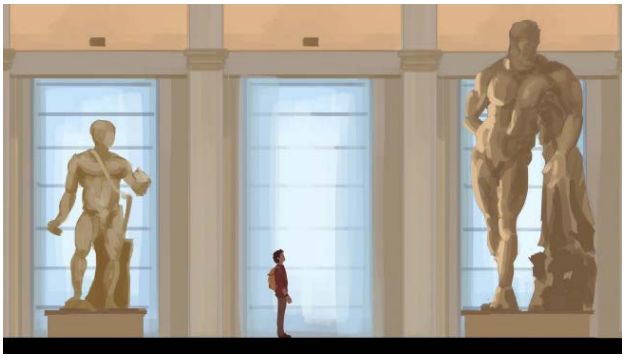

Fig. 1 Image from Father and Son – the game.

Virtual Reality and 3D modeling have been largely applied in the field of archaeology for more than three decades [10]. Much has been written on the potential of

these tools for archaeological research [11] and most of projects involving these technologies focus on the communicational aspects of 3D modeling in various media, or the technological improvements of 3D modeling tools and their use as a tool for scientific archaeological investigation [12].

The fast evolution of digital technologies and techniques of data recording have had a great impact on archaeological research. Among all available solutions, the use of 3D models is particularly relevant for the reconstruction of sites and monuments poorly preserved, often destroyed by natural causes or human action. These digital replicas are, at the same time, a virtual environment that can be used as a tool for the interpretative hypotheses of archaeologists and an effective medium for a visual description of the cultural heritage as it crosses linguistic barriers.

Each "digital experience" offers a new creative perspective for local cultural heritage, presenting a mature interpretation of reality and offering a 'sixth sense' for understanding remains from the past. By creating such virtual workflow of contents, the aim is also to increase the access that general public has to the cultural heritage, promoting a better sharing and communication of archaeological and historical information. The ICT techniques enable the viewer to gain a variety of historical themes and their application could be spread to different multi-layered historical contexts.

A recent experience of virtualizing local cultural heritage is offered by the DiCET Project [13]: Augmented Reality solutions make available virtual tours of the main ancient monuments of the old town of Lecce during on-site visit (Fig. 2). Similar technical solutions have been adopted in a very new project of digital storytelling that involves the roman harbour of Lecce [14] (Fig. 3).

Fig. 2 Semi AR application. The virtual reconstruction of the amphitheatre of Lecce superimposed to the real site.

III. THE CHER FRAMEWORK

The CHER (*Cultural Heritage Engineering Revolution*) framework aims to revolutionize the enjoyment and promotion of the cultural heritage, implementing in a new way, various technologies and competences in the creative and cultural industries. It proposes an innovative approach, able to engage visitors through an interactive formative path, which mixes gamification techniques, 3D virtual scenarios and various adding contents available in interactive (aka touchable) video (advertisement spot, audio recordings, images and in-depth information box).

Fig. 3 Visual synthesis of the narrative process in the digital storytelling on the maritime harbour of Lecce. The realistic model of the roman pier of St. Cataldo superimposed in its real scenario.

The CHER framework final output is the interactive narrative (in a language that combines virtual and multimedia) of a story, which rebuilds ancient worlds and elements, in an engaging and exciting way thanks to the gamification and film production.

Elements, whose CHER framework consists of, are:

- A modular model of Digital Storytelling based on gamification logics,
- A set of digitalized contents relative to the cultural heritage,
- Interactive video and Virtual Reality technologies,
- An innovative process of storytelling development,

which combines technology and cinematographic paradigms.

All the elements composing CHER are represented in Fig.4.

Central element of the CHER framework is the base of historical contents, collected through literature, archive, iconographic and field researches. These contents are systemised, digitalised and virtually rebuild. They are used, therefore, in order to build an interactive storytelling path that is embedded in a multi-scenario story.

Possible CHER framework contents are country life sets, landscapes, costumes, characters, sounds, artefacts of various kind, etc. Contents are independent and can be combined in different stories; they can even be scaled and used in different fields and environments (museums, archaeological parks, squares, etc.).

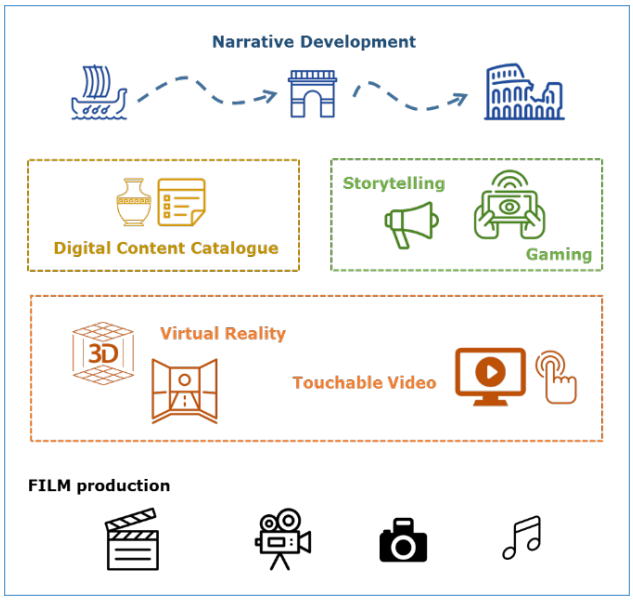

Fig. 4 CHER Framework

The framework supports the narrative creation, through a digital storytelling model application, which embeds contents and technologies for an immersive experience. The structure backbone is a gamification system, capable of enforcing user's engagement towards contents, helping also him in becoming familiar with implemented technologies and with multimedia narrative itself.

With the purpose of maximising user's involvement in the cultural heritage diffusion, the CHER framework uses two technological directories: Virtual Reality and Touchable (or interactive) video.

Virtual Reality allows developing and realizing the scenography able to make immersive final user's experience. The CHER framework involves 3D reconstruction of virtual scenery, which replay historical details, such as building materials, tools and artefacts features, characters' costumes and landscape morphology, to create a context as realistic as possible. These scenes can be used as game or movies backgrounds.

Touchable videos are interactive videos that enable the user to interact with the video itself and to access extensive contents. In order to make easier touchable contents individuation and overcome the main weakness of existing application, techniques belonging to the field of cinema, such as slow motion, slow zoom shot, Steadicam shots can be applied.

Convergence between these technologies is supported by the gamification logics introduction, while the cinematographic techniques adoption permits to evaluate effects that these technologies cause in pre and post-production phases and in the video, audio and photography direction contents development.

Lastly, the framework enables an innovative process of creative writing and storytelling development. From the subject writing, that is a short story outlining the historical storytelling synopsis, to the storyboard and screenplay final version, interactive aspects to be developed during the realisation have to be highlighted. In this operation, the originality, that creates movement and that plays the role of charming the user, has to be pointed out, together with all required details for virtual reality implementation.

IV. EXPECTED RESULTS AND POTENTIAL BENEFITS

The international debate of last decades has promoted culture as playing a main role in economics, both local and advanced. The application of CHER framework will allow to considerably reduce distances between who produces culture and who enjoy it, facilitating a strengthening of historical processes knowledge. The modular, and so customizable, structure, which it has been designed with, locates it across more areas of application: from cultural promotion to tourism services, from fashion to local handicraft.

The first application will be the retrieval and reconstruction of an interactive narrative journey involving three main scenes: an ancient pier, a Roman farm and an old village.

It is expected, that quality growth of cultural heritage sharing processes increase the territory charm with indirect consequences in economics and occupations.

Using 3D-modeling, reconstruction and computer animation software is a proper method to enhance visitor cognitive abilities. Indeed, it is a way to efficiently create "righteous" learning processes, stimulating the necessity of subjective discovery and enabling consequently new business opportunities. Supposing, for instance, a certain digital services improvement in the Italian museums context, based on relative investigations [15], it has been evaluated that visitors could raise from 180 thousands to 2 million units. This would take, obviously, to more economic incomes, ranging between 700 thousands and beyond 7 million euros.

CHER framework requires the connection of a series of

different competences, enabling strict synergies and continuous knowledge exchanges and fastening professionalism development, as the storyteller's one, main character in communication and marketing. It should also be considered that an upgrade of cultural heritage enjoyment mode would increase territories attractiveness with indirect consequences on tourism field.

CHER Framework falls under the cultural contents digitalization, bases of new best practices for culture spread. In particular, it aims to guarantee a certain kind of sensory and immersive experience that could change the cultural diffusion, defining different scenarios as path customization (*Museum a la carte*), contents multi-level follow-up (*Matrioska Museum*) and the playful experience-based aspect (*Play Museum*) based on interactivity and multimediality.

V. CONCLUSIONS

The paper proposes an innovative framework that aim to revolutionize cultural heritage promotion combining interactive video with virtual reality, using gamification techniques to engage users and providing a film production support to digital storytelling creation.

The CHER framework is conceptual and innovates the ways of cultural heritage promotion and diffusion. It introduces a high degree of interactivity (touchable video and gaming), and adds value to many of the current systems that only involve the use of "passive" technologies (static and / or dynamic virtual models) for the sharing of historical contexts without any interaction with users.

The adoption of virtual reality applications for the historical contexts use, but in general their digitization, on the one hand, generates knowledge flows and strengthens the information potential of cultural heritage, on the other hand, risks to create a sense of satisfaction in the final use a depriving him of the stimuli to direct discovery . Another critical issue is the passivity of the vision that distinguishes some products of virtual reality. The CHER framework offsets this by offering an interactive approach involving the visitor in an interactive information path through experimentation of gamification techniques and diversified content (video clips, audio narratives, images, and depth charts) in touchable video. From the technological point of view, the problems of virtual reality relate mainly to the need to overcome some barriers to logistical use (lack of adequate hardware, lack of adequate space, user geographic distance, fruition scalability, virtual mobile scalability) and linked to human-machine interaction. With regard to Touchable videos, the critical issues are essentially related to user experience: it is not always clear what the "Touchable" elements are and what part of the scene they will be; if the video moves too fast interactivity with the user is impossible.

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