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Some Issues on Artistic and Cultural Heritage Applications

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Abstract

Information and Communication Technologies (ICTs) are undergoing rapid progress, which is having an increasing impact also on the management, preservation and promotion of arts and cultural heritage. Besides providing solutions for existing problems, new media technologies open up entirely new application scenarios.

Based on these technologies, numerous arts and cultural heritage projects have recently been implemented and some relevant technological roadmaps have been identified.

In this paper we analyse and discuss some issues related with technological support for artistic and cultural heritage applications and discuss aspects of a technological framework for future applications development that is based on an analysis of existing Information Technology (IT)-based applications and experience acquired recently from projects in the field.

Index Terms — Information and Communication Technologies, Digital Arts, Artistic and Cultural Heritage Applications.

I. Introduction

In the last few years Information and Communication Technologies (ICTs) have been undergoing rapid progress, which is having an increasing impact on the management, preservation and promotion of arts and cultural heritage, as new media technologies open up entirely new application scenarios.

Artistic applications aim at the generation of new content by materialising concepts and re-using existing material, artistic or not. Artistic creation begins with a concept or an abstract idea, which is gradually transformed into a form of intangible, digital content that can be both the means and the end product.

Like earlier technological revolutions, we are again experiencing a similar phenomenon, as communications technology and distribution innovations merge together and use global communication networks and tools, including the Internet and other emerging technologies.

Creative people use these new technological tools to both transcend and connect communities, disciplines, worlds and experiences and these "new media" artists use advanced technologies as the main tools for their artistic practices.

In this paper we analyse and discuss some of the technological issues related with artistic and cultural heritage applications.

The paper first presents some initial pre-definitions related with art. Section III considers the design space in digital art and cultural heritage applications. Next come some issues related to a technological framework for artistic and cultural heritage applications are and finally come some technological recommendations and the conclusions.

II. PRE-DEFINITONS OF ART

Art may be defined as "the conscious use of skill and creative imagination especially in the production of aesthetic objects" [1]. A broader range of terms, however, permits a better understanding of the meaning associated with art, which can be seen as incorporating "skill, cunning, artifice, craft meaning the facility to execute well what one has devised." Here s*kill* stresses technical knowledge and proficiency; c*unning* suggests ingenuity and subtlety in devising, inventing and/or executing; a*rtifice* suggests mechanical skill especially in imitating things in nature; and *craft* may imply expertness in workmanship.

At one time arts were sub-divided simply into literature and poetry, scenic arts and music, and the visual arts but more recently UNESCO has recognised digital arts through its DigiArts initiative [2], which incorporates both visual and new technology arts that can be dynamically defined as:

> "*the conscious use of skill and creative imagination to produce artistic artefacts and cultural contents using new technologies*."

III. THE DESIGN SPACE

The design space describes the abstract components for the transition from a conceptual level to a final "product." It also defines its own workflow for this transition and helps to identify the key procedures that are and must be performed to reach the desired outcome.

The starting point for artistic applications is the content. Content and data from digital repositories can be used as raw resources to implement hybrid artistic applications that are

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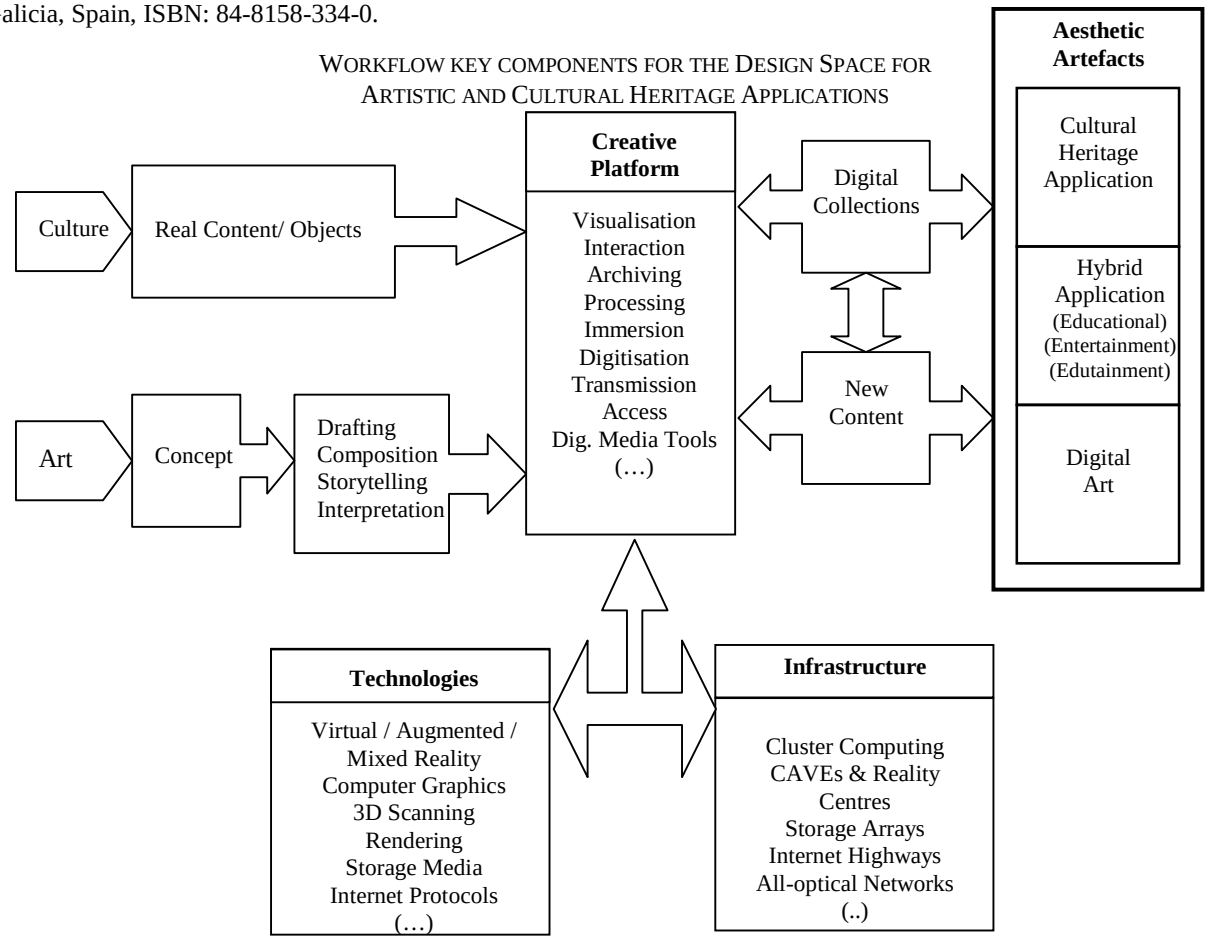

based on, related to and use historical and/or cultural content and sources.

The conception and design of artistic content is at the heart of the artistic work and while a new idea forces technology to move on this also works vice versa, so the digital media artist should be trained to have a strong appreciation and knowledge of all of the available tools. As ICTs progress, they become more specialised and certain technologies or creative procedures may be accessible to the artist only through collaboration with the IT expert. In his or her turn, the IT expert needs to be able to understand or interpret the will of the artist in order to be able to help execute the original concept.

Today, all forms of content previously strictly handcrafted by artists have a digital counterpart or at least an expression medium, from music or poetry through to painting. But apart from this, digital art has evolved independently and manifested new ways of expression, ranging from video art to image synthesis and interactive virtual reality. The key features of any type of digital art are that digital content is replicable, extensible and re-usable. Digital content may not be strongly coupled with the intended application, as it is in the case of an audio file for example, but in certain types of productions, application and content are inseparable.

Apart from format standardisation, the major issue with regard to digital content is quality. Of course, with quality comes the issue of data storage size and possible compression. Human demands are never contained and sound quality is a prominent example of this fact. Digital sound sampling and reproduction quality demands are constantly changing to capture the finest detail. Positional audio standards evolve day by day, but auditory sensors are quite simplistic when compared to other human senses, such as vision, where stimulation possibilities are very far from being explored [3][4][5].

This constantly changing face of evolving formats and digital content standards brings to the fore the issue of digital medium resilience. Time and again the prophetic words of technology providers have been laughed at a few years later when a new protocol and storage format replaced the current “ultimate” solution. This instability in digital media

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specifications is the cause of frustration and uncertainty about the sustainability of any digital production. This situation is only alleviated by the fact that there are always transitional periods between one technology and another, when support for both old and new specifications is necessary and indeed possible.

A. Artistic and Cultural Applications

The term new media has been used to refer to electronic media that have been in existence since the 1940s. Sixty plus years later its definition involves interactivity, the very aspect that makes it unique to the computer medium and most specifically today, interactivity on the Internet. New media have evolved from large-scale interactive installations - the "history of new media" [6][7] - that artists have created, since the invention of the computer, to very small artefacts based on palmtop computers.

The bipolar manifestation of artistic and cultural heritage applications results in a different workflow for each class of application. Cultural content in an artistic application (e.g. film) is frequently the historical background or simply the supplier of stylistic ideas to support the narrative and help it evolve in a convincing way. Building an interactive scenario on an important era, famous site or historical fact is often a good starting point for a successful application that is ideal for educating, entertaining and gaining community respect.

In these types of applications, artistic freedom can contradict the precise historical facts, which results in a severe risk of distorting or mocking them.

On the other hand, cultural heritage applications often enliven dull and meticulous historical details in order to facilitate the evolution of a scenario or to make the application more attractive. Interaction with the environment and characters through a storyline or perhaps a whole game provides the stimulus for a healthy and effective edutainment environment. Exaggerated characters and facts, mythical or heroic qualities, the introduction of new sites or persons and chronological jumps are frequently exploited in this way. Indeed, as long as entertainment or artistic licence do not overly outbalance the historical importance of given data, the transformation of the cultural heritage content into a lively contemporary creation promotes the content and adds value to the significance of the material presented [6][7].

B. The Creative Platform

The creative platform is the collection of infrastructures, tools and technologies that enables the generation of artistic and cultural heritage content, the storage, transmission and exchange of digital data and it provides the presentation space for access to information and content by both specialists and the public.

In most cases, the tools for developing artistic and cultural heritage applications or content are the same. This is mostly due to the fact that the needs for cultural heritage content and the platforms that drive the related applications are affected by and usually borrowed from artistic creativity tools and current IT trends.

Without doubt technology sets the limits and spurs the creative mind for all types of applications. Cultural heritage has a very weak impact on the advances in the related technology, because the turnover from its exploitation of new technologies is marginal. On the other hand, the needs of the artistic community have always been a challenge for IT and equipment providers, a prominent example being cinema and special effects [8][9].

IV. ISSUES FOR A TECHNOLOGICAL FRAMEWORK

A technological framework starts by classifying the existing technologies and evaluates all relevant ones with respect to their possible application areas in the field of arts and cultural heritage. The ultimate target being the creation of guidelines for identifying potential technologies from the methodological point of view of an application or possible combinations of technologies, while emphasising eventually existing constraints.

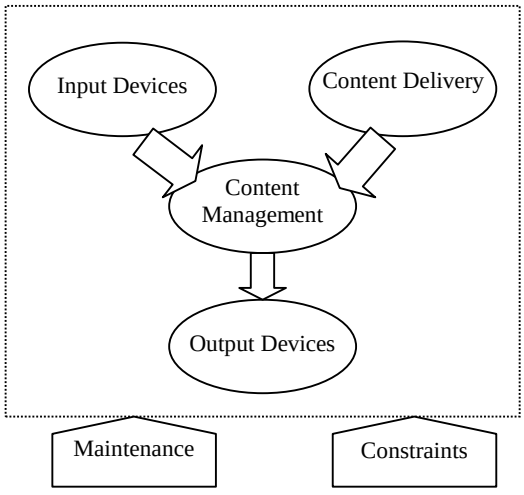

Fig.1. The generic structure of IT-based artistic applications.

Technologies used for artistic and CH applications cover the following main technological tasks (Fig. 1):

- Input devices;
- Content delivery;

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- Content management;
- Output devices;
- Maintenance; and
- Constraints.

Assessment of each single technological component is needed to establish initial recommendations for its use, to identify usable and feasible components and to identify the required ingredients for the considered application.

A. Input Devices

The choice of suitable input devices for an application is probably the most important task during the creation process.

Such devices are often (together with the visible output devices) the only hardware the artistic or CH user may recognise. Non-technical and technically unversed users normally do not want to know how a system works, since they are mainly interested in the idea behind the application. In general, input devices are classified according to two different goals:

- Devices for user interaction; and
- Devices for the creation of digitised exhibits

Devices for user interaction should be intuitive and easy to use in order to address a wide range of human beings and even technically unversed users. As opposed to interaction, devices for the creation of digital exhibits like digitised painting or 3D sculptural models may be more difficult to use, as the task of creating digital exhibits mainly addresses expert users or users that are able to spend time on a learning phase to get familiar with a particular device.

Furthermore, input devices should be classified with respect to some constraints indicating, if the current state-of-the-art is sufficient, whether or not a device can be used for an application for arts and cultural heritage:

- Usability: this raises questions that determine if the device is mainly usable with or without training, if it can be used by a range of different users like children and adults, or if cables may reduce the freedom of interaction of the user;
- User acceptance: new technological devices that are not widely used, such as data gloves, have to be especially evaluated with respect to their acceptance by different user groups. Users should not quit their interaction due to an insufficient understanding of device behaviour;
- Further development: some innovative input devices that are still under research and only available as prototypes, like haptic devices with force feedback or gesture recognition systems, are only partially usable. Evaluation of the need for further developments to transfer these research results to commercial products is a major goal;
- Expert support: input devices do not need to be a piece of hardware like a mouse or a keyboard. Input devices can also be tracking systems or gesture recognition systems, which normally need regular maintenance by an expert.

B. Content Delivery and Management

Though content delivery and management systems are normally hidden from the user, they play an important role for IT-based applications in the field of arts and CH, so we propose to classify content delivery and management systems with into the following categories:

Content Dimension

The main task is to clarify whether 2D content like digitised paintings or 3D content such as digitised sculptures should be rendered or subjected to interaction. Overall size of the content objects has obviously a direct influence on the choice of input and output devices;

Data-types

A wide range of different data formats exists for both 2D and 3D rendering. During the creation of a new application, it is important that all involved modules (from the creation of the digitised copy to the final output rendering module) “understand” the same data formats. Import filter and conversion tools should be identified in order to translate different data types without loss of quality or application performance, if required. Exchangeability of content between similar applications has to be considered in order to ensure data usage and transfer instead of single application solutions.

Expert support

Even for content delivery and management systems, expert support plays an important role. Current databases for storing single content objects are especially difficult to handle, while easy to use and intuitive user interfaces to store and retrieve information are not commonly used.

C. Output devices

Output devices are, beside input devices, the second direct interface with the user and, therefore, an important choice for the design of an IT-based application. We propose to classify the existing output devices in the following way:

- Usability of the device: the choice of the output device depends upon several application constraints. Applications that render high detailed digitised objects

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should use large scaled screens instead of standard computer monitors; applications addressing a group of users should obviate flat screens; and applications showing 3D objects could use stereo capable output devices.

- Further development: the higher resolutions and falling prices of new output devices like Head Mounted Displays, binocular or even beamer point ups, result from fast research and development. Some devices are sufficient for proto-typical installations but will not be accepted in the current development stage for applications addressing a wide range of interested users in public places like a museum.
- Acceptance evaluation: evaluation of user acceptance is necessary for several output devices. It is known that Head Mounted Displays are not favoured by a large percentage of users, who may have to wear them for a long time.
- Expert support: output devices like stereo beamers projecting content onto a large-scale screen need the technical support by experts, as they need to be carefully calibrated.

D. Maintenance of applications

During the research and development stages of new technology (both hardware and software), maintenance often goes unattended. Nevertheless, when new IT applications come out of laboratories and into public places like museums, art galleries or cultural heritage institutions, its maintenance requirement plays an important role in its usability. From the technical point of view, applications have to be designed and implemented with respect to:

- Personnel costs of eventual expert support:
  - How many times and how often is an expert necessary to keep the application running?
  - How often must hardware or software be recalibrated or reconfigured?
- Cost of maintenance of the equipment;
- Robustness of hardware (e.g. useful life time).

E. Constraints

From the technological view point, the identification of application constraints is one of the most important but often undervalued issues. Inevitably, the correct choice of input and output devices depends basically on the different conditions and constraints under which the application will be used. We propose to classify applications with respect to the following constraints:

- Site usage: the choice of the input, output and computational hardware depends mainly on the prevailing environmental conditions. In mobile applications for an archaeological site (outdoor scenario), only light weight hardware such as light pocket PCs and binoculars should be used.
- Environmental conditions: new input devices like optical tracking systems demand constant light conditions, which restricts their usage to indoor scenarios with controllable lighting.
- Mobility: a major reason for the choice of hardware is its supposed mobility. Mobile applications need light weight hardware, while stationary installations often use large-scale screens for displays.
- Single/multi-user applications: clearly, the number of persons using an application at the same time leads to different possible input and output devices. Small displays with a restricted viewing angle can not be used for multi-user applications.
- User experience: the range of different persons using an application plays an important role in the choice of input and output devices, so it is important to know if the system will be used by experts or beginners and whether the application is mainly addressing children or adult users.

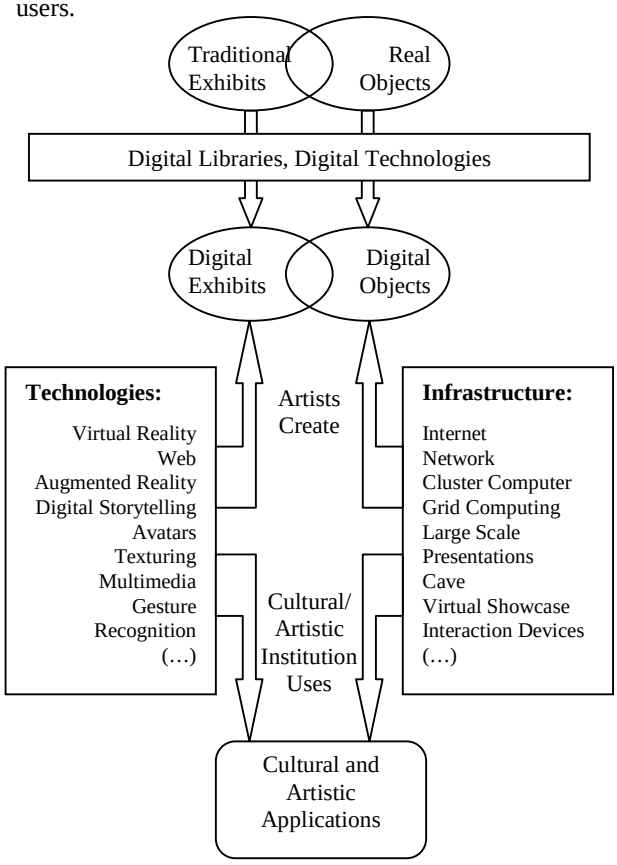

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Fig.2. TechArt: the technological framework overview.

- Addressees: A typical constraint for the design of a new application is the target group. Applications can address the field of infotainment or E-Learning. Such constraints are less technical and are not part of the technological framework.

V. RECOMMENDATIONS FOR IT-BASED ARTISTIC AND CULTURAL APPLICATIONS

A. Digitisation

As digitisation is an extremely time and cost-intensive process, artistic and cultural institutions need to have a clear understanding of why and for what purpose materials are to be digitised. Indeed, what to digitise should be part of a master plan based on a national policy that sets out clear priorities. Based on this general framework, artistic and cultural institutions should have an organisational policy to:

- Develop methodologies for selecting material for digitisation. Institutions should understand their sources, user demands and expectations;
- Define user-centred approaches to digitisation; and
- Define the quality of the final result.

One of the most pressing issues related to digitisation is the volume of cultural material available all over the world. Automated processes and routines would be a solution for improving the performance problem with large sets of records and also problems about version management. Another requirement for managing increasingly large amounts of data is the availability of cheap mass storage, as well as access to a broadband infrastructure for transporting large amounts of data.

The acquisition conditions and the technical expertise of the users often do not match up to the requirements of existing systems, which need careful calibration every time the system is used. There is an important demand for flexibility in acquisition, so calibration procedures should not be necessary or restricted to a minimum.

Additionally, existing systems are often built around specialised hardware (laser range finders or stereo rigs) resulting in a high costs but many new applications require robust low cost acquisition systems and the recent progress in consumer digital imaging facilitates this.

B. Technological recommendations

The introduction of many new technologies is subject to public debate about their particular pros and cons. Many innovative devices are initially perceived as gadgets whose long-term uses are not clear or are considered applicable only for the amusement industries. Often the public perceives such devices as something interesting, fashionable, expensive and short lived.

In the cultural heritage sector, a multitude of new potential options offers the possibility to virtually “see” and “handle” objects not otherwise available, and to complement the comprehension of an exhibition with additional background information organised as Virtual or Augmented Reality,. Such technology could be used for research purposes and in the long-distance study of collections, which may be seen as a positive plus point.

Visual Technologies

Up-to-date research in the field of interaction devices has lead to the conclusion that the basic transformation in the IT industry over the coming decade will be closely related to the availability of cheaper display technologies.

Touch Screens

Touch screens are the simplest and most direct way of interacting with a computer. Their use is intuitive for nearly every child and adult. Regardless of the application, the essential benefits of touch screen technology remain unchanged as they:

- Enable people to use computers instantly, without any training;
- Reduce operator errors significantly, as users can select from clearly defined menus;
- Eliminate keyboards and mice, which many users find intimidating;
- Are rugged and stand up to harsh environments;
- Provide fast access to all types of digital media;
- Allow use of multiple languages in defined applications.

Head-Mounted Displays (HMDs)

HMDs are portable, wearable monitors. Stereoscopic vision is achieved via the combination of two little LCD or

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CRT monitors, one for each eye. These devices may also include a head tracker, stereo-headphones may be used to create a mood or to deliver information and they are like a set of heavy sunglasses that a computer can write over.

Current limitations, which have been recognised and should be overcome in the near future, are:

- Inadequate display update rates;
- Heaviness leading to user discomfort; and
- Inability to provide high resolution with a wide field of view.

Auditory Technologies

Auditory technologies target the second most important human sense. Their implementation is, therefore, essential for cultural and artistic applications.

Speech Input Systems

Speech input systems can be useful for people who have physical disabilities that prevent them from using a keyboard. Although speech recognition software has been in development for several decades, effective, commercially available products have only appeared in the last few years. Their main drawback for driving public access terminals is that for anything, but the smallest range of commands, voice recognition modules must be trained to recognise the particular voice of individual users.

Wearable Computers

Wearable computers pursue an interface ideal of a continuously worn, intelligent assistant that augments memory, intellect, creativity, communication, physical senses and abilities. The term "wearable" should be clearly distinguished from "portable". Its main aspect is not being easy to carry but that it offers easy communication for users.

Wearable computing is still a relatively young IT field and research has not yet matured sufficiently to fulfil the idea behind its full potential. The basic aim is to create wearable devices that need minimal interaction on the part of the user.

Wearable computers could facilitate museum visitors in their orientation and study of collections, starting with consulting a guide and ending with possibilities for immersion in an Augmented Reality environment.

VI. CONCLUSIONS

ICTs are undergoing rapid progress. The results of this development are also having an increasing impact on the management, preservation and promotion of Arts and CH. Besides providing solutions for existing problems, new technologies open up entirely new application scenarios.

In the last few years and based on these technologies, numerous arts and cultural heritage projects have already been implemented and some relevant technological roadmaps have been identified.

In this paper we have discussed the process of design and creation of artistic and cultural applications, raised technological issues and looked at a technological framework for them based on an analysis of existing IT-based artistic applications and the experience acquired during recent projects in the field, and made recommendations concerning relevant technological aspects for IT-based artistic and cultural applications.

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