M E R C A T O R M U S E U M S N E T W O R K

DECLARATION OF INTENT

The members and associates of the Mercator Museums Network (MMN), brought together under the direction of the Archaeology Museum of Alicante (Spain), declare that this field of work, the objective of this protocol, comes under the **MERCATOR, Merchant Routes and Towns,** project. This project has been selected to be co-financed by the European Commission (ERDF fund), within the framework of the INTERREG III-B Western Mediterranean Community Initiative Programme (CIP), approved by the MEDOCC Managing Authority (INTERREG Division).

The group firmly declares that the principal objectives of the Mercator Project are the identification and promotion of the historical traits, sites and objects dispersed throughout the Mediterranean region, which demonstrate the interrelation between the Mediterranean cultures now and in the past. One of the most important factors which has contributed to this process is trade, and for this reason the project has been named MERCATOR. The aim is to involve different countries in the Mediterranean region in a number of common projects to promote, disseminate and develop the tangible, intangible, material and natural heritage which is associated with Mediterranean trade throughout Antiquity, the Middle Ages and the Modern period. This will cover a number of themes, from archaeological sites

associated with the production, distribution and trade of goods, to the development of multimedia products which will facilitate their understanding and dissemination on the Internet.

In fact it is precisely this area; the use of new information and communication technologies and the dissemination of our heritage, which is behind the setting up of this working group. Everyone involved are professionals of different European museums and institutions, who are committed to the use of new technologies, and who have proposed that this group will debate on **the use of new technologies in museums** as a general point of discussion.

We firmly believe that the European museum panorama finds itself in a clear phase of expansion. The services offered by museums and exhibitions are growing in quality and quantity in response to public interest. Today, museums are required to fulfil a number of different roles, nearly all of which are very challenging. In the past, museums had a more clearly defined role of safeguarding heritage and disseminating knowledge, however, today, museums are also required to transform their collections into memorable experiences for all their visitors.

Museums, of course, without forgetting their role of maintaining professional standards in care and research of their collections, must entertain, educate and, if possible, surprise and captivate their visitors. Museums are now not just centres

of science, history or archaeology. At the same time that the role of museums has become more complex, the processes involved in creating new museums, redevelop existing museums or in mounting temporary exhibitions are also becoming more complicated.

With the arrival of the 21st century, a new era museology has emerged, characterised by a higher level of professionalism and by the coordinated participation of multi-disciplinary teams in all its aspects. Today, studying the collections has to go hand in hand with the spatial design. This is a new approach to understanding museums, one where new communication mediums play an important role; from the simplest video projections, to interactive platforms, the Internet, and all the new technologies that are constantly being developed.

The growth in the development of these new technologies and the uncertainty involved in predicting their trends - due to their innovative and revolutionary nature - means that they can only be used as a reference point when including them in museographic projects.

For these reasons, this working group has dedicated this protocol to examining the impact that new technologies are having on European museums today and the influence which they could have on museology in the near future.

The MMN also declares that the conclusions from this protocol will constitute a first attempt to shine a light on the debate on the use of New Technologies in Museums. The group does not intend to produce a user manual, nor a White Paper on New Technologies in Museums, but would like to bring together the different views of professionals working in this field, in different parts of Europe. The conclusions of the debate and the experiences of these professionals in this impassioned and complex field of New Technologies in Museums can be consolidated, with the hope that the contributions made will serve in the future to widen the debate and dialogue as the principle way of making progress.

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THE IMPACT OF NEW TECHNOLOGIES ON EUROPEAN MUSEUMS

THE CURRENT SITUATION

For more than ten years specialists from the cultural sector (cultural managers, museum professionals, artists, IT specialists, academics) have been debating on how to make the best use of technology in order to resolve some of the principal problems that are found in their professional areas. These range from cataloguing to communicating or disseminating their work. In 1991, the biannual ICHIM (International Cultural Heritage Information Meeting) conference began, which became the meeting point to exchange ideas and experiences for professionals in the heritage sector. In 1997, an annual conference began to be organised in the USA on the use of the Internet in memory institutions, **Archives & Museums** (http://www.archimuse.com).

Advances in technology have led to the creation of virtual environments to contextualise collections, enabled visitors' remote and first-hand interaction and provided access to all collections through on line databases, etc... In the last few years, this type of applied research has produced a number of important results, which have led to the creation of a new space for Cultural Heritage, very different to that which we are accustomed to.

This digital revolution has brought with it many wide reaching possibilities for memory institutions, such as archives, museums and libraries. These are not now limited by the type of object present in their collections or by the space that is available, as the digitalisation of their collections has enabled them to reach new audiences and provide alternative services for the community. Digitalisation has also removed the boundaries that existed between these three types of institutions – archives, museums and libraries - as the digitalised form of records, books or objects is identical. It is, therefore, not surprising that the generic acronym ALM (Archives, Libraries, Museums) is used to indicate the destination of the majority of cultural heritage projects using new technologies.

In Europe, just like in the majority of Western countries, the use of Information and Communication Technology (ICT) in the heritage sector has been primarily championed because Europe contains large numbers of architectural and

cultural treasures, which are important potential generators of income and employment. The European Commission itself has financed various research projects, such as DIGICULT, to evaluate the potential of new technologies in the cultural sector. The findings of these first projects can be consulted in the Salzburg research group report, *Technological landscapes for tomorrow's cultural economy. Unlocking the value of cultural heritage (2002).*

One of this report's findings was that the technological world is creating new hybrid professions, that combine specialist knowledge and practices that before were separate disciplines. Therefore, all professionals in the heritage sector need to have more knowledge of information technology, as well as some understanding of pedagogical concepts (Delacôte, 1998), as cultural institutions are becoming more and more responsible for informal learning and for heritage interpretation. Similarly, a wider understanding of the communication languages that are used by the different medias and an economic overview of the new possibilities (products, infrastructure, production rights) is essential. All of this needs to be understood within the context where culture is seen as a product of tourism, which has seen the greatest comparative growth in the last few years.

In the face of the new technological challenges that are having an impact on the heritage sector, Spain has now begun to realise its potential. Until now, the initiative has come from the Universities and other cultural institutions that have experimented with information technology for their internal management systems, cataloguing, providing public access and for didactic communication. Unfortunately, until now, the government has not provided all the resources necessary for the development of this technology, nor has it been a high priority, and therefore the initiatives have been limited and rather isolated in nature. However, it does seem that in the future more determined moves will be made to resolve this situation with official announcements specifically aimed towards the promotion of the digitalisation of heritage.

The situation of museums in Spain, which could be said to reflect the international panorama, is going through a clear phase of expansion. The services offered by museums and exhibitions are growing in quality and quantity in response to public interest.

Today, museums are required to fulfil a number of different roles, nearly all of which are very challenging. In the past, museums had a more clearly defined role of safeguarding heritage and disseminating knowledge, however, today, museums are also required to transform their collections into memorable experiences for all their visitors.

Museums, of course, without forgetting their role of maintaining rigorous and high scientific standards, must now entertain, educate and, if possible, surprise and captivate their visitors. Museums are now not just centres of science, history or archaeology. At the same time that the role of museums has become more

complex, the processes involved in creating new museums, redevelop existing museums or in mounting temporary exhibitions are also becoming more complicated.

With the arrival of the 21st century, a new era of museology has emerged, characterised by a higher level of professionalism and by the coordinated participation of multi-disciplinary teams in all its aspects. Today, studying the collections has to go hand in hand with the spatial design.

This is a new approach to understanding museums, one where new communication mediums play an important role; from the simplest video projections, to interactive platforms, the Internet, and all the new technologies that are constantly being developed.

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The International Council of Museums (ICOM), through its position as the body granted with the responsibility of overseeing museums in the world, has become concerned with providing a definition of a museum which is in accordance with modern society in which it has been developing. ICOM defines a museum as "a "non-profit making, permanent institution in the service of society and of its development, and open to the public, which acquires, conserves, researches, communicates and exhibits, for purposes of study, education and enjoyment, material evidence of people and their environment. (...)"

Museum professionals are conscious that important changes in the museum sector are occurring, even putting into doubt their status as non profit making organisations. Many also fear that the quantity of information available on the Internet and in virtual museums could have a serious negative impact on visitor numbers to museums.

Information and communication technologies are developing fast in the field of personal interactivity, i.e. mobile phones, PDAs and laptops. This will enable interactive global communication to become possible from anywhere in the world. This personal interactivity is very important and it is being gradually adapted to the market. We are already aware of the role of market forces in these situations, where by leading companies compete with each other to promote and establish on us, in whichever way they can, their specific format to monopolise the technology sector they specialise in. Therefore, developments in the sector will have to be carefully watched and hasty decisions should not be made with regard to implementing new technology.

In the current situation in which we find ourselves, where a top of the range laptop becomes redundant, in terms of spec and price, within six months, indicates that this "technological revolution" is just beginning. This reinforces the view of not acting hastily in taking decisions on acquiring technology associated with personal communication.

BACKGROUND

The origins of museums are commonly believed to go back to the collection of trophies; offerings and works of art from classical temples; relics and liturgical objects from churches and monasteries; treasures accumulated through a humanistic calling of Renascent princes or as an expression by 18th century monarchs of their absolute power. At the same time, scholars emphasised the emergence of heritage awareness as being a product of the collective and universal enjoyment that came with the beginning of the French Revolution. The emergence of the modern concept of the museum is also considered as resulting from the aftermath of this revolution. In this context, the 19th century museum should be considered as a singularly elitist institution, created by and for a cultured minority of aristocrats and bourgeoisie. The majority of 19th century European society of dedicated their free time, if this is the correct term to use for post work recuperation – to more prosaic purposes.

One of the most popular pastimes, until the emergence of cinema, were the magic lantern shows. The term magic lantern covers a wide range of optical inventions and devices that generated images by projecting slide images from a box containing a light source and a set of lenses. The first reports of these ingenious devices date back to 1659, to the Dutch astronomer Christiaan Huygens. However, some years later it was further developed by the German Jesuit Athanasius Kircher. The magic lantern projected various images, including those of a satanic, erotic, ghostly, religious, and scientific nature, which were hand painted on glass plates. In the 18th century, improvised shows were staged throughout Europe and were hugely popular. They captured the imagination of a largely illiterate public and even entered the more Enlightened salons, as a form of recreation and as a teaching instrument.

In 1789, the German, Paul Philidor invented the mobile retro-projector, which he named Phantasmagoria. This was a modified version of the magic lantern which projected images from behind a fine screen of percale, concealed by a veil, and which produced very realistic images. Although his first presentations in Berlin were not well received, when Philidor went in 1792 to revolutionary Paris, he had great success. Etienne Gaspar Robertson, a Belgian cleric, who introduced himself as an "aeronautical-physician" and a "phantasmagician" acquired the device and develop it further. Robertson introduced a number of improvements, such as a mechanism which enabled the fading of images, and the introduction of knobs, with which he could amplify or reduce the projections at will. He also experimented with projecting on smoke and projecting multiple images. His show,

which opened in 1798, took place in the abandoned Capuchin convent, which provided more of an atmosphere. During the show, celebrated figures of the revolution, such as Marat or Robespierre, universally known figures such as Virgil, as well as numerous more distasteful scenes were projected, and which had a profound impact on the audience.

Due to the enormous success of the *Phantasmagoria* shows, imitations quickly emerged and the "ghost machines" spread all over Europe. In the first decades of the 19th century these kinds of presentations became popular preludes to theatre productions. However, by repeating the same formula, the public began to lose interest in banal distasteful images, and new subjects such as narratives and landscapes were introduced. By using synchronised pairs of slides, summer scenes could be merged into snowy landscapes, or volcanoes could suddenly erupt. In 1838, the Royal Polytechnic Institution was opened in London, which was committed to the promotion of the recreational and educational uses of the invention. Under its director Henry Pepper, presentations of literary works and children's' stories of the time were projected. Pepper also developed a variation of the phantasmagoria, which consisted of making images appear on the stage, back projected from a lower level using a set of mirrors. This was known as Pepper's ghost and was very popular in Victorian theatre.

The arrival of the wet plate collodion method in 1850 breathed new life in to the magic lantern, which enjoyed a second golden period with popular presentations of landscape views and scenes inspired by realist and moralist inspiration. It was also used as an instrument of political propaganda.

In the second half of the 19th century, as a result of continual experimentation in the fields of optics, chemistry and the moving image, a number of variations of the magic lantern, phantasmagorias and other similar devices were developed. These laid the way towards the development of photography and cinematography, but at the time were themselves very fashionable and hugely popular shows as they were perceived as being at the cutting edge of technology. Some of these other pre-cinema inventions included the Zoetrope and the praxinoscope.

In 1894 Thomas Edison presented the kinetoscope, the first device that was capable of reproducing a moving image from photographic film. A year later, Auguste and Louis Lumière brought about the demise of the magic lantern with their brief film of workers leaving a factory. This opened up a new world of expression; the new show of the masses had just been born at the dawn of the 20th century.

In one way or another, all museums use new technologies, just as everyone does as part of daily life. For around 15 years, computers have been used to support the inventory and cataloguing of collections; automated systems (replacing humans) control museum microclimatic conditions and security systems guard

museum facilities. The introduction of new technologies in museums has been similar to that experienced in the industrial and commercial sectors. The personalised mailings that museums send to their potential visitors are computer produced. Computers manage more accurately the personal details used to compose letters and emails (and soon sms) in a formal or informal way. The Internet, has marked the line between what exists and what doesn't, and has started a never ending rush to be on-line. This urgency is as justifiable as it is rash, and often the true understanding of how to work on line is left until much later.

The use of multimedia technology in exhibitions is another important issue. Diaporamas, sound and video recordings have been used intermittently in temporary exhibitions since the 1980s, however, it wasn't until well into the 1990s that audiovisual technology, combined with light and relay resources and other special effects, tentatively opened up the way for its use in permanent exhibitions. Amongst the pioneering European installations in this field were the French *Archeosocpes* which were opened at Carnac, Vielsalm and Mont-St-Michael. These were designed by scenographer Yves Devraine, as interpretation centres, and made use of the full range of technologies available at the time as well as employing scenographic features to facilitate the interpretation of the monuments. They even went one step further, by using narratives that involved the visitor, a direction which has been closely followed since then by other heritage interpreters.

The use of these types of new technologies in the Spanish museum sector was heavily influenced by the emergence of various companies which installed the pavilions and set up the spectacular events which characterised the 1992 Expo in Seville. In the temporary setting of La Cartuja, the public was presented with such technologies as: video-walls, projected on to previously unimaginable surfaces, such as water and smoke; retractable walls and incredible lighting effects. At the time these were state of the art in the field of computer, sound and light technology. Some of these companies decided to concentrate on working in the museum sector, whilst others moved into setting up events or thematic exhibitions.

The first use of these technologies in the museum sector was tentative. One example was the multimedia installation which opened in 1993 in the Museum of Empuries. This provided visitors with a first-person experience (including the feeling of the sea breeze on the face) of Greek colonists, from the prow of a boat, arriving at Catalan lands. It was located in the entrance of the museum as an introduction to the mostly classically designed permanent exhibition. However, this type of installation quickly gained in confidence. A short time later, the installation in the old refectory of the Monastery of Santes Creus contained tables, benches and tableware, as well as large jars, sacks and barrels, which recreated the material conditions of life in the monastery. Another example was the audiovisual presentation in the archaeological ruins of the Forum in Zaragoza. Created in 1995, this was mainly developed on a purposefully built stage, but the images were also projected on the walls of a large drain and even on the white coloured face of

a statue of Augustus, which brought it to life. These early installations, and others like them, were the blueprint to follow in terms of formal planning and in their content. They were sensationalist and often stunning installations, due to the use of new technology, which went further than the normal resources used. They also associated with scripts which were based on personal narratives rather than reported style descriptions, which aimed to involve the visitor more.

THE IMPACT OF NEW TECHNOLOGIES ON EUROPEAN MUSEUMS

Technology available for museums as guardians of knowledge and as an educational resource

Museums are going through a time of change in their internal structure, traditionally based on the three core principles of: conservation – investigation – dissemination. This last point, dissemination, is beginning to enjoy the same standing as the other two. Planning strategies are being formulised in order to attract different types of museum visitor; one of which is school groups. A large number of museums and heritage sites have realised that it is necessary to understand the needs of this visitor group, so that strategies can be developed that will attract future visitors. Therefore, the educational, pedagogical and didactic services in place in a number of museums are being reviewed. The most successful of these museums, without a doubt, are those which have a clearer understanding of what is their role within formal education and which have been able to successfully apply the term didactic to their services, without using it exclusively as a marketing feature.

Museums have always clearly understood their cultural role as depositories of knowledge, but this knowledge has frequently been directed at a more scholarly, though important, audience. However, as soon as museums commit themselves to becoming spaces of instruction, education and communication aimed at a more diverse audience (one of which is school groups), then they are obliged, not only to present heritage, but to do it in an accessible and understandable way. This involves knowing how to transmit scientific knowledge in a way which facilitates adding to the personal cultural context of the visitor, so that everyone can enjoy it.

This concern to reach a less academic audience has perhaps been most evident in science and technology museums. The supposed difficulty of understanding the field of science and technology has been the main motivation factor, from the start, behind the development of themes in displays or exhibitions to try and bring this “knowledge” into the public domain.

It would seem that it would be easier to disseminate information and knowledge of humanities based collections – geography, art, history, anthropology – however, in fact this is not the case. These subjects involve general principles that do not fit in to specific studied frameworks and are more open to being popularised rather than disseminated. It is easy to give opinions or judgements, etc… on historical or social events without referencing them, without following a specific scientific methodology or without any didactic intervention. Nobody would argue with the methods of a biologist or a chemist, however, the whole world dares

to do so with a historian, a geographer or a social analyst. Much care is required in presenting and disseminating information and knowledge of the humanities.

Due to the varied nature of museum's collections, the introduction of inter-disciplinary and multi-disciplinary practices within the different collections is required. Museums are privileged spaces to be able to examine different themes from a global perspective, which can facilitate education and learning. This way of working requires teamwork *within* and outside the museum.

The MMN proposes the following advantages in using New Technologies in museums:

~~VENTAJAS DEL USO DE LAS NT EN LOS MUSEOS~~

1. The use of New Technologies (NTs) enhances the didactic and educational character of museums

2. Interactivity increases the information available in museums and breaks with the linear development of visits to exhibitions

3. NTs provide visitors with the freedom to select for themselves the content of the interactive

4. The emergence of NTs in museums has led to the development of a new audiovisual language appropriate for these new environments

5. NTs enable the visitor to evoke, recreate and transmit feelings, which couldn't be achieved, until now, in many museums

6. Flexibility and multi-disciplinary. A multi-disciplinary team is required so that information and the means of communicating this information interact on the same level. This would bring with it new tools and visions.

7. NTs can change museums into dynamic centres culture for 21st century audiences

8. Access. NTs can place a value on heritage, for people who do not have the chance to see it.

9. NTs enable different levels of information to be communicated depending on visitor profiles.

10. NTs enable the transmission of information resulting from on-line research.

11. NTs are transforming museums into large creative spaces and centres of experimentation.

12. NTs can improve displays in museums, by enhancing poor quality objects.

13. NTs can help to improve the understanding of material, temporal and historical sequences of heritage on display.

14. They can capture non visible elements and transmit their emotional impact.

15. They can provide opportunities for dramatisation.

16. They can generate different atmospheres in museum spaces.

17. They enable several visitors at the same time to interact and carry out research.

18. They can be produced in different languages.

19. A museum visit is always subject to the limitations of *space* and *time.* A museum designer depends on the *space* available to organise the exhibition of a series of objects and to create a coherent narrative. Despite the fact that visitor profiles may vary, it is only possible to have one permanent display of objects with a unique museographical design. However, Information and Communication technologies (ICT) can provide the designer with solutions by creating completely virtual "areas", which do not occupy much space, apart from that required to house computers and Info Points. Mobile devices carried around by visitors can also aid this. Furthermore, mobile devices, computers and Info Points can enable different museum narratives to be adapted for the various visitor groups (e.g. different aged school groups, specialist groups, general visitors, local and foreign visitors).

20. In regard to *time*, museum visitor studies have shown that the attention span of the visitor is limited, before "museum fatigue" sets in. On average, a visit lasts for between 1.5 and 2 hours. A typical visitor spends time on four aspects: orientation, attention-interaction, selection and exit. The first, orientation, can vary between 5-10 minutes and consists of looking at the layout of the museum galleries and thinking about how the visit can be organised. If it is a first time visit, the visitor may calculate how much time is required to visit each exhibit or gallery. Visitors could orientate themselves before visiting the museum, by using the Internet (accessing the museum's web site with a well documented floor plan), or organising an itinerary which could be downloaded onto a mobile phone or PDA on arrival.

21. The second aspect is attention-interaction with the content of the exhibition or with the objects or exhibits. This can last between 45 minutes and 1 hour. In this second phase, the visitor is still fresh and enthusiastic, and reads all the texts and interacts with all the exhibits. This is the time when visitors have most interest in the exhibition and when they retain the most information. If there is a clearly defined route, then this generally coincides with the first part of the exhibition, and it is also the best time for learning to take place. Due to the limitation of attraction time within the museum, visits should be prepared in advance, taking advantage of the information that can be acquired on the museum's website (e.g. descriptions of the collections, who made them, techniques used etc…).

22. In the "selection" phase, the visitor is now tired and decides to work out which objects and galleries are worth seeing before leaving. This creates a more accelerated tour around the museum (20 to 40 minutes), to visit the most important displays, and little attention is paid to any additional contextual information. This makes it a lot harder for the visitor to pay sufficient attention to the displays or to retain much of their content.

23. The final "exit" phase is when the visitor decides to make his/her way towards the exit, to buy souvenirs and to meet up with the rest of the group. This phase can last for between 5-10 minutes, and could, to some extent, be reduced by a previous visit to the museum's website or by using a mobile device.

24. Specialist knowledge is gathered together in museums, similar to what happens in the academic world. Therefore problems can sometimes arise in disseminating this knowledge, without taking into account the previous knowledge of the visitors or the appropriate language to be used. ICT can facilitate the understanding of the museum displays by using various multimedia platforms and by creating differentiated itineraries according to the visitor profile.

25. NTs enable more textual and graphic information to be incorporated, depending on the time available to the visitor. Visitors can get used to printing out information rather than reading it on screen.

26. Itineraries can be organised for different visitor profiles according to age or previous knowledge. These can be organised hierarchically or laid out using different icons.

27. Special environments can be created, suitable for individual interactive games, but which also allow group interaction.

28. Special contents can be developed for each object.

29. Programs and/or materials can be prepared in advance for teachers, students and other visitor groups.

30. Measures (e.g. signage) can be produced to aid orientation inside the museum and also on-line services.

31. Themes and objects can be contextualised (e.g. graphic surrounds, virtual reality…).

32. Manual interactivity or inspiring emotion (**Hands-on**): these are museums or exhibitions which have objects to aid in the understanding of events or processes and to distinguish between which are fundamental and which are secondary (e.g. Science and technology museums).

33. Mental interactivity or comprehensible emotion (**Minds-on**): the creation of experiments in a museum which aid in explaining everyday occurrences (e.g. Science museums).

34. Cultural interactivity or cultural emotion (Heart-on): prioritising the creation of collective identities. This includes exhibitions aimed at stimulating the collective feelings of a group of people, but which all people can relate to.

THE IMPACT OF NEW TECHNOLOGIES IN EUROPEAN MUSEUMS

Disadvantages associated with the use of new technologies
The need to adapt to a changing society.

Despite having made huge advances, we are still far from having education services in museums that follow a specific philosophy and included educational or learning objectives. Frequently, education services are limited to coordinating different types of visits and in the creation of didactic materials. The educational or didactic services continue to be the poor servant of museums, with small budgets and are often only carried out in order to understand or interpret a specific exhibition. This service is also frequently "outsourced", i.e. an external company is contracted to manage this service and which has almost complete control over the aims and objectives. This outsourcing of services is not always a bad thing, especially when the institution has a clear idea of its goals and monitors these services to see that they are being fulfilled.

Evaluations, through visitor studies, are necessary – of students as well as teachers – as this enables museums to see whether the objectives of the

education-learning processes are being fulfilled. If poor findings are recorded then this can influence any changes that are needed to be made.

It is also necessary for museums to keep up with any changes to the national school curriculum, so that the services offered can be adapted to the needs of the curriculum. But this adaptation cannot just be limited exclusively to official announcements by the related government department; it has to go further than that. Current society has to be analysed and a vision of the future is required. Concepts such as globalisation, local-global perspectives, and a multicultural society have to stop being just the domain of academics or the press, but become part of what museums have to offer as cultural spaces for the better understanding of the modern world. We must think in a framework of the next five or ten years, in the profiles of future primary and secondary students that will visit museums and cultural spaces. How can the children of immigrant families be integrated into a common culture without damaging their own cultures? What elements can be used to show more the similarities between cultures, rather than the differences? These are some of the questions that cultural institutions as well as museums must also begin to ask themselves in order to help the creation of a more mature and responsible society.

To end this section, it should be noted that museums are involved more and more directly in the teaching of science. This is because teachers do not have the time to carry out sufficient research into scientific matters or because they consider that they do not have a sufficient understanding to do so.

The introduction of ICT does not signify a solution to everything; its use does not resolve all the problems that exits in museums, and sometimes, its use may actually be counterproductive. Therefore, before championing its widespread use in museums, its shortcomings should be considered:

~~DESVENTAJAS DEL USO DE LAS NT EN LOS MUSEOS~~

1. There is a general ignorance of New Technologies in museums. Museums should not only understand NTs but also known how to use them. Bad practices or misuse can lead to the excessive influence and dependence on NTs, instead of museums concentrating on transmitting the message wanted.

2. If insufficient attention is paid to studying the collection within an objective, serious and well documented framework, then this can have grave repercussions in terms of time and costs.

3. NTs can be very rigid and it is impossible for changes to be introduced.

4. There is a “coldness” associated with this new means of communication that cannot be changed. However much the installation which you interact with is emotionally stimulating, the visitor is always interacting with a machine.

5. A scholarly design: for the community but without community engagement. Audiovisual presentations are created based on the premise that we know what the visitor wants, and if in fact this is not the case then it is the visitor’s problem. We must start by knowing exactly what the visitor wants, and therefore base our designs on this.

6. Out of date technology. Unnecessary problems can ensue because things that can be done now may become outdated in four years time. Some may continue to be valid but overall this factor can have an important impact on the use of NTs.

7. A legal framework for the use of NTs in European museums doesn’t exist.

8. A large amount of pre-planning is required.

9. Large economic resources are required for NT projects to go ahead.

10. Without the use of good technology to transfer data, NTs cannot be developed.

11. NTs require continual updating.

12. NTs are not accessible to the whole world. Previous technological knowledge is required.

13. NTs have a limited life span.

14. At the same time as improving the displays of medium and low quality collections, NTs can generate competition amongst museums to use the most up to date technology. This can result in less emphasis being made on quality objects.

15. NTs can become too attractive a medium. Visitors may end up enjoying the technology more than the actual content of the display.

16. Selection of suitable technology. An effort is required to select the most suitable medium for the effective transmission of the message. The use of new technologies opens up an array of opportunities and the skill is in knowing which one is the most useful for each situation.

17. Choice of suitable providers. Contracting suitable experienced professionals can influence the success of a project. The simplest option is

to turn to companies which provide complete project packages. By knowing their previous work a better understanding of the end product can be had. By working in a more piecemeal fashion, contracting companies for different areas of the work, more problems can occur, but it will reduce costs, and if carried out well, can notably increase the quality of the end product.

18. Maintenance. There are various and sometimes complicated problems that are associated with using multimedia technology in museums. Numerous pieces of equipment have to run smoothly, therefore it is necessary to have all areas of maintenance covered. This is especially important during the launch and in the first period of operation.

19. Creating "easy to use" technology. Although the technology used may be complex and developed by specialists, its daily use should be simple and not require any specific skills or experiences that are not normally found in daily life. This is especially true with regard to the limited economic resources that cultural institutions in general, and museums in particular, have. Ideally, even the most inexpert hands should be able to manipulate the technology.

20. Celebration of technology: When very attractive pioneering technology is in use, it is easy to fall into the trap where by the message that the museum wants to convey is outshone by the technology used. The aim of the exhibition can be lost when the message and the medium used to transmit it become confused.

21. Running costs. After the initial investment the running costs have to be taken into account. This includes utility costs and the costs of replacing parts.

22. The *aesthetic experience* gained by seeing an object in a collection first-hand cannot be rivalled. Its look, feel, what is sounds like or even how it smells can all be reproduced, but the enjoyment of seeing an object first-hand is impossible to replicate in a digital setting. This is especially true in art museums and galleries, where this individual aesthetic experience, usually through the sense of sight (without any other medium), can only be achieved in the museum. ICTs are only able to produce a replica that allows the physical characteristics of an object from a collection to be visualised, but they cannot produce the overall experience.

23. In the near future, it does not seem that an alternative, equivalent to the aesthetic experience of a first-hand visit, will be developed. Therefore, the object continues to be a great "treasure" kept in the museum and which cannot be reproduced in another setting.

24. A participatory visit to a museum can be understood in terms of being a *social experience*, where the experience or any learning that occurs is carried out in a collective way in a group or in a guided visit. This is especially important for family or school visits, when parents or teachers take up the role of mediators, and take advantage of free time to engage their children in formative activities or to reinforce personal or family bonds. This collective experience, of sharing information and ideas, also cannot be reproduced using ICTs. However, they can to some degree complement the post visit experience, for example, through visiting forums or virtual communities to exchange experiences.

25. With respect to the *emotive experience* that can emerge from a visit to a museum, "new museology" has created more engaging theatrical atmospheres and audiovisual productions, that, with some difficulties can be reproduced using ICTs. Specific areas for young audiences or absorbing settings can take advantage of the space, the objects and the audiovisual platforms to generate fictitious situations in which the visitor can identify clearly with the people who used the objects on display.

TYPES OF NEW TECHNOLOGY

I. MAGNETIC-OPTIC MEDIUMS

Mediatechs
Mediatechs are spaces designed for storage, to provide lending services, to use different audio-visual, video, music, CD ROM materials and to connect to the Internet etc….

Information Points
The Information Points or booths are merely computers within museums which are used to run multimedia application from the hard drive or CD Rom drives. There are many types of Info Points, which can provide general information on the museum (opening times, a summary of the collections) or can cover more specific themes and provide a more didactic service with information on exhibitions or the museum's collection.

CD-ROM

A CD-ROM (**C**ompact **D**isc – **R**ead **O**nly **M**emory) is a compact optical disc used to store non volatile data, that can be read using a computer CD-ROM drive. The standard that defines the format of the standard CD-ROM is known as the **Yellow Book** and was established in 1985 by Sony and Philips. It is part of a collection of standards known as Rainbow Books that contain the technical specifications for all formats of compact discs. Microsoft and Apple were enthusiastic promoters of CD-ROM. John Sculley, who was the CEO of Apple, declared in 1987 that the CD-ROM would revolutionise the use of personal computers.
In fact nowadays, it is being substituted in PCs by DVDs – read only and rewritable. This is mainly due to do with the fact that a DVD-ROM can store much larger amounts of data than a CD-ROM. This format can be used for catalogues, books, encyclopaedias and electronic games.

CD-I
The **CD-I** or **Compact Disc Interactive** is the name of the interactive multimedia CD player developed and marketed by Royal Philips Electronics N.V. CD-i also refers to the multimedia CD standard used by the consoles, also known as the Green Book, which was co-developed by Philips and Sony in 1986. The first Philips CD-I player, launched in 1991, was capable of reading CD-Is, Photo CDs, Audio CDs, CD+Gs (CD+Graphics), Karaoke CDs and Video CDs (VCDs), although the latter required a cartridge (depending on the model) to decode MPEG-1 files.

DVD
The DVD (also known as **"Digital Versatile Disc"**, or as **"Digital Video Disc"**, due to its popular use for films) is an optical format of storage that can be used to store data, including films with high image and sound quality. It is identical to compact discs in size (12 or 8 cm diam.), but it is coded in a different format and has a much higher density. In comparison to CDs all DVDs store data using the UDF (Universal Disk Format) file system, which is an extension of the standard ISO 9660, used for data CDs. The DVD Forum (a consortium made up of all the organisations that have participated in creating the format) is responsible for keeping up to date the DVD technical specifications.

Video

Video technology is used to electronically capture, record, process, store, transmit and reconstruct a sequence of images that represent scenes in motion. Video technology was first developed for use in the television industry, but various formats have been developed enabling it to be used for more general public video recording, which can also be viewed on the Internet.

II. INFORMATION & COMMUNICATION TECHNOLOGIES (ICT)

Information and Communication Technology (ICT), is the study, development, implementation, storage and distribution of information using hardware and software as a medium of information systems.
Information and communication technologies are part of the emerging technologies that are usually identified by the acronym ICT and which refer to the use of computer technology to store, process and transmit all types of information or processes of educational instruction.
According to the Information Technology Association of America (ITAA) it is "the study, design, development, implementation, support or management of, in particular, computer-based information systems (though the most versatile there are other formats), including all non computer systems, for example mobile phones, television, radio and digital newspapers.
In general, Information and communication technologies describe the use of computers and other technological applications to transform, store, manage, protect, disseminate and localise all information necessary for any human activity.

The use of technology is a priority in communication today, as communication technologies signify the difference between a developed region and another that is developing. This technology aids communication between people as it removes any geographical or time barriers.
Technology intrinsically has a dual nature, as its impact is affected by whoever uses it. For example it can be used to help a rural community to learn – through the medium of television, but it can also be used to explode a bomb – through the use of a mobile phone. This technology can be used to communicate information as well as for entertainment.
In both aspects, it all depends on the users to provide quality contents, as it is the audience which determines and demands the type of content they want. Therefore, the use of this technology can be seen within the framework of social-construction. The audience needs to have some level of creative foundation; so that it can demand quality products and the marginalisation of the market is eliminated. This is because program planning –television and radio – is directed only to certain consumers.

Web Pages
A **Web Page** is an information resource adapted to the World Wide Web (WWW) and accessed through a web browser. The information is generally presented in HTML format and can contain hyperlinks to other web pages, creating a net which is linked to the World Wide Web.
Contrary to common opinion, the World Wide Web (WWW or "the Web") is not a synonym of the Internet, but is one of its features of it - one of many services offered on the Internet. The Web is a much more recent information system, developed initially by Tim Berners Lee in 1989. The WWW uses the Internet as its means of transferring information. Web pages can be retrieved from a PC or a local or remote computer system, called a Web server, which acts as a HOST. The web server can restrict access to a private network, for example, an intranet, or it can publish pages on the World Wide Web. Web pages are requested and

transferred from the servers using Hypertext Transfer Protocol – HTTP. The HOST Server can store or host a web page, which is known as “HOSTING”.
Web pages can consist of files of static text or a series of coded files that can be read, instructing the server how to construct the HTML for each page requested, known as Dynamic Web Pages.

HTML

HTML, the acronym for **H**yper**T**ext **M**arkup **L**anguage, is a markup language designed to structure texts and to present them in a form of hypertext, which is the standard format for web pages. Thanks to the Internet and web browsers such as Internet Explorer, Opera, Firefox, Netscape or Safari, HTML has become one of the most popular and easy to learn formats for the creation of web documents.

XML

XML, the acronym for E**xt**ensible **M**arkup **L**anguage, is an extensible meta-language developed by the World Wide Web Consortium (W3C). It is a simplified and adapted version of SGML and enables the grammar of specific languages to be defined (in the same way that HTML is itself a language defined by SGML). XML is not really a language in its self, but is a way of defining languages for different needs. Some of the languages that are defined by XML include XHTML, SVG and MathML.
XML was not just created for its use on the Internet, but it was proposed as a standard for the exchange of information on different platforms. It can be used in data bases, for publishing text, calculation sheets and for nearly any application imaginable.
XML is a simple technology that is surrounded by others that complement it and which make it much larger, with many more possibilities. It is very important today as it enables different systems to be compatible and share information in a secure, reliable and easy way.

XSLT

XSLT or **XSL Transformations** (Extensible Stylesheet Language Transformations) is a standard format of the W3C organisation. It is used to transform XML into other types of documents, including non XML formats. The **XSLT** style sheets (although the term style sheets is not applied directly to the function of XSLT) transform documents using one or various template rules. By linking to the source document to be transformed, these template rules guide the XSLT processor, which carries out the transformations required, producing an output file, or, as in the case of a web page, directly into a presentation device, such as the user’s monitor.
Today, **XSLT** is used extensively in web publishing, generating HTML or XHTML pages. The union of XML and **XSLT** allows the content and presentation to be separated, therefore increasing the productivity.

The Internet

The Internet is a decentralised series of interconnected networks of computers communicating through the TCP/IP protocol suite. It guarantees that the heterogeneous physical networks function as one logical network, accessible to the world. Its origins date back to 1969, when the first computer network, known as ARPANET, was established between three North American universities in California and one in Utah.

Some of the services available on the Internet, in addition to the Web, through its upgraded Web 2.0 version and web operative systems (WebOS and EyeOs), are: remote access to other machines (SSH and telnet), file transfer (FTP), email (SMTP and POP), electronic updates (news or newsgroups), online chat (IRC and ICQ), instant messages, file sharing (P2P, P2M, Direct Download), radio on demand (Podcasts), video on demand (P2PTV, Miro, Joost, Videocast) and online gaming.

Moodle

Moodle is an e-learning platform, also known as a course management system (CMS), which helps educators create online learning communities.

Moodle was created by Martin Dougiamas, a WebCT administrator at the Curtin University of Technology (Australia). He based his design on constructivist learning theories, which state that understanding is constructed in the mind of the learner, rather than being transmitted directly from books or teaching, and through collaborative learning. A teacher who uses this approach creates a student-centred learning environment which helps knowledge construction from a base of the student's own skills and knowledge, rather than simply publishing and transmitting the information that is considered to be what the students should know.

The first version of moodle appeared on 20th August 2002 and since then new versions have regularly appeared. As of December 2006, it had a user base of more than 19,000 sites throughout the world and it is translated into more than 60 languages. The largest site is said to have more than 170,000 students.

Moodle promotes social constructivist learning (collaboration, activities, critical feedback, etc…). Its structure and tools are suitable for on line classes, as well as a complement to school based classes. It has a very simple, light and compatible interface for browsing.

Installation is simple, requiring a platform that supports PHP and the availability of a data base. Moodle uses a database abstraction layer making it compatible with the principle types of databases.

An emphasis on tight security for the whole learning platform has been developed and all the formulas are revised and the cookies encrypted, etc.… The majority of text introduction areas (materials, forum messages, diary entries, etc.) can be edited using an HTML editor, just like any other Windows based text editor.

Bluetooth devices

Bluetooth is an industrial specification for Wireless Personal Area Networks (WPANs) used to connect and transfer voice and data between different devices,

using a secure globally unlicensed radio frequency (2.4 GHz). The main applications of Bluetooth are to:

- facilitate communication between mobile and fixed devices
- remove the need for cables and connectors between devices
- offer the possibility of creating small wireless networks and facititate the synchronisation of data between personal devices.

Thanks to this protocol, devices that use Bluetooth are able to communicate with each other when they are within range.
Communication is by radio-frequency so that the devices do not have to be in line of sight of each other and can even be in separate rooms if the transmission signal is strong enough.
The devices that use this technology the most are those in the telecommunication and personal computing industries and include: PDAs, mobile phones, laptops, PCs, printers and digital cameras.
Bluetooth devices are classified in three groups; “Class 1”, “Class 2” and “Class 3”. The only difference between them is the signal strength of the device, and they are all completely compatible with each other.

IRDA devices

The **Infrared Data Association** (**IrDA**) defines the physical standards for transmitting and receiving data by infrared light. IrDA was created in 1993 by HP, IBM, Sharp and other companies.
This technology is based on bright lights which move in an infrared spectrum. The IrDA standards support a range of computerized and electronic devices, and enable two way communication between two devices at velocities which vary from 9,600 bps to 4 Mbps. This technology is used in many laptops and in a growing number of mobile phones, especially in the leading manufacturers Nokia and Ericsson.
FIR (Fast Infrared) is currently under trial and theoretically can reach speeds up to 16 Mbps.

Palm Devices

Palm or **PDA** (**P**ersonal **D**igital **A**ssistant) are handheld computers originally designed as electronic diaries (calendar, contact list, note pad and alerts) with a writing recognition system. Today, they can be used like a home computer to watch films, create documents, play games, email, surf the Internet, etc...
The emergence of Microsoft Windows CE (2000) and Windows Mobile (2003) in the sector has provided PDAs with more multimedia and connectivity capabilities and above all has incorporated well known programmes already used by the public, which are now found in the reduced version.
Smartphones (hybrids of PDA and mobile phones) signify a return to the operative systems that had been abandoned by the PDA and handheld computer market, in favour of mobile phones, for example the OS Symbian. PDAs today use many types of wireless communication (Bluetooth, WiFi, IrDA, GPS…) which makes them extremely attractive even for such unlikely uses as home automation or GPS navigation systems.

3G Technology

3G or 3-G is an abbreviation for third generation mobile telephones. The services associated with these provide communication of voice data (a telephone call) and non-voice data (such as downloading programs, sending/receiving emails, instant messages).

The initial installation of 3G networks was relatively slow due to the requirement of operators to have an additional spectrum license as 3G uses different frequencies to the previous 2G technology. The first country to have a large scale commercial 3G network was Japan. Today, 164 commercial networks exist in 73 countries, using WCDMA technology.

RFID

RDID (**R**adio **F**requency **I**dentification) is a system of storing and receiving remote data using devices known as **RFID tags** or **transponders**. The main purpose of RFID technology is to automatically transmit the identity of an object (similar to objects having a unique serial number) using radio waves. RFID technology is part of the technology known as **Auto ID** (Automatic Identification).

A RFID tag is a small device, similar to a sticker, which can be applied or incorporated into a product, animal or person. It contains antennae to receive and respond to queries by radio-frequency from a RFID sender-receiver. Passive RDID tags do not have an internal power source, whilst Active tags do. One of the advantages of using radio-frequency (instead of, for example, infrared) is that it does not require a direct line of sight between sender and receiver.

M-Learning

M- learning is a method of teaching and learning using portable or mobile devices, such as laptops, mobile phones, electronic diaries, Tablet PCs, Pocket PCs, i-pods and other hand held devices that use some form of wireless connection.

Education is rapidly incorporating the different forms of new information and communication technologies. Various terms are used to describe this type of education, depending on the technology used: CAI (Computer Assisted Instruction), multimedia education, TeleEducation, Web based teaching, e-learning, etc…

The use of computers and other multimedia platforms, as well as the Internet and local networks have all aided teaching-learning processes in all its different forms and aspects.

Recently, mobile technology has become a more important feature of our lives, and with it, what is known as **mobile learning** or m-learning using electronic devices to learn, is becoming more widespread.

This is generating great expectations in the education sector and a number of interesting initiatives are being developed by businesses and through research projects.

Web Quest

Web Quest is a search-orientated method, in which nearly all the resources used come from the Web. The Web Quest model was developed by Bernie Dodge in 1995 who defined it as an "enquiry-orientated activity in which some or all of the information that learners interact with comes from resources on the internet".
Web Quests are being used more and more as a didactic resource by teachers, as they promote the skills approach of managing information, part of cognitive modelling. This is a response to the educational goals of learning and understanding proposed by UNESCO to face the challenge of educating a highly computerised society.

A Web Quest is constructed around an attractive task which provokes higher processes of thinking and actively engages the information. Thinking can be creative or critical and involve problem solving, critical evaluation, analysis or synthesis. The task should involve more than just answering simple questions or reproducing what there is on the screen. Ideally, it should correspond to something that people do in normal life outside school.
A Web Quest includes:

- Introduction
- Task
- Process
- Resources
- Evaluation
- Conclusion
- Authors

To develop a Web Quest it is necessary to create a web site (which can be constructed with an HTML editor), a blog service and also a text editor which can save files such as a web page.
A Web Quest shouldn't be confused with a "treasure hunt", which can also be used as an educational resource, but is a lot simpler. In "treasure hunts" a series of questions are asked on a theme which can be answered by visiting various links to other associated pages. Often a final question is asked at the end to check that the theme has been understood.

III. MULTIMEDIA APPLICATIONS

Multimedia
Multimedia, from the Latin Multum + Medium, is a term that is applied to a media that uses a combination of different forms of informative content, such as text, sound, animation and video, to inform or entertain the user. Electronic media devices (and other devices) used to store and present a multimedia content can also be described as *multimedia*.

Diaporama
Diaporama is a French term, dating to the 1950s, which is applied to a form of audiovisual slideshow presentation. Photographic works could be viewed through

the crossed projection of slide images on one or various screens, juxtaposed in a synchronized way manually or using a magnet, and which were accompanied by a sound track.
Diaporamas are also referred to in general as any succession of images or files, linked by effects and, when possible, with sound.
Since the development of video projectors, a diaporama can also refer to a presentation created in a file format using such software as Microsoft PowerPoint or Beamer. It can be used for professional conferences or public shows using just photographs.
According to the main image processing softwares, a non projected diaporama slideshow can also refer to the continuous procession of images across the screen.

Audioguides
These are relatively well known devices where information in an audio format is made available in different languages to visitors. The visitor carries the audioguide around the museum which enables more information about the museum to be accessed.

Sign or Visual Guides
These are carried by the visitor in the same way as audioguides. However, in contrast to audioguides they contain a screen which offers graphic or audiovisual content. These aid people with auditory problems to understand the museum visit, and provide all visitors with a more advanced presentation of information.

Interactives
This encompasses all computerized applications which provide visitors with graphical, textual or audiovisual content in an interactive way. They can include touch screens and audiovisual presentations that respond to visitor actions or movements, etc…

Audiovisual Presentations
These include all productions that contain audio and/or video and which are shown in a specific area. In the case of video presentations, they are watched on screens or surfaces of the museum, as well as on monitors.

LED
A **LED**, abbreviation of **L**ight-**E**mitting **D**iode is a semiconductor device (diode) that emits quasi-monochromatic light (i.e. a very narrow spectrum light) when it is directly forward biased by an electric current. The colour of the emitted light depends on the semi-conductor material used to make the diode, and can vary from ultraviolet, through the visible light spectrum to infrared, called **IRED** (**I**nfra-**R**ed **E**mitting **D**iode).
Semi-conductor diodes are commonly encased in a plastic covering which has a higher resistance to those of glass, usually used in incandescent lamps. Although

the plastic may be coloured, it is only for aesthetic reasons, and it does not affect the colour of the light emitted.

Infrared diodes (IRED) have been used since the middle of the 20th century in television remote controllers, having been mainly used in other electronic domestic appliances, in remote control devices in general, as well as in movement sensors.
LEDs are commonly used as status indicators (on/off), in signals (traffic and emergency lights, etc...) and in information panels. They are also used as backlighting for liquid-crystal screens of mobile phones, calculators, electronic diaries, etc…, as well as for bicycle lights and other lighting uses. There are also LED printers.
The use of LED lamps for lighting (including traffic signals) is predicted to increase in the future, as, although its spec lies in between incandescent lamps and fluorescent lamps, LEDs have a number of advantages: being longer lasting, more robust and better energy dissipaters. Also, for the same light output LEDs can produce colour light, whilst those used up to now require a filter, which reduces their output notably.
White LEDs are the most recent development and are an attempt to establish a substitute for the current light bulb in used today, as LED lamps are much more efficient energy wise.

Virtual Reality
The latest revolution within the field of computer technology has been in the manipulation of the digital image. This has occurred with the emergence of programming languages which have enabled the creation of two dimensional (2D) graphics or three dimensional (3D) models of extraordinary quality and realism. Some of the most outstanding applications of this technology have been in the field of cinematography, however, each day its use is extended into other fields, such as that of interpretation.
In the technology sector, virtual reality is changing rapidly, and in a few years its programming will not require such specialised expertise. Today, VRML (Virtual Reality Meta Language) is the common programming language, however, future innovations in Java 3D are expected. Using this technology, strips of digital video (AVI and MOV formats) can be obtained, which include a narrative script, or 3D still images (180-360º), which allows internal navigation, like a graphic section within a hypertext. To view these files on line, plug-in programmes such as QTVR or Live Picture are normally required.
Many experts believe that the almost realistic reproduction of objects and buildings is not virtual reality's main contribution, but it is the relationship that exits between the objects and the space which surrounds them. Virtual reality can be used on computers within museums or it can be incorporated onto the Internet. However, its use on the internet does have certain limitations as the resulting files are very large and there can be problems associated with uploading them online.

The limitations of working on the Internet appear to be gradually being resolved and more and more examples are now on the net.

Virtual environments have been classified into three groups due to their level of realism, i.e. their approximation to real models:

Hyper realities: these try to present the real world in all its complexities in the maximum amount of detail. Therefore, the designer is completely limited, as an environment that actually exists is being reproduced.

Selective realities: these are simplified realities or a combination of different realities in one unique space. To create these virtual environments, the designer decides on and combines the scenes, objects and buildings as required, creating completely new and original environments.

Abstract realities: these are imaginary non-existent environments which have real and physically impossible elements. They are virtual spaces open to the interpretation of the designer, who has taken and used abstracts from the information provided.

Augmented Reality
This consists of devices which add virtual data to the physical information that already exists. This is the main difference between Augmented Reality and Virtual Reality, as it does not substitute the physical reality, but lays computer generated data over the top on to the real world.

IV. VIRTUAL MUSEUMS

A **virtual museum** is a museum which uses digital mediums to display, preserve, reconstruct, disseminate and store cultural material: (paintings, photographs, sculptures, pottery, antiques, textiles, etc…) as digital objects and databases which are kept in the Virtual Museum's server.
The digital devices can also be a production on CD-ROM or a web page that displays specific collections, a general sample of the collection, as well as, educational material for cultural and educational purposes. A Virtual Museum makes it possible for far away places to access science, culture and the arts. According to research, this type of resource can be classified in the following ways:

- Learning Museums. These are web sites that provide on line learning resources creating opportunities for repeat visits for research and exploration.
- Marketing Museums. These are web sites created principally for marketing purposes. They area a form of communication to increase the number of visitors to the real or physical museum, by providing information on the collections and special events organised.
- Virtual museums which display digitalised art works providing access to them for people who live far away, in order to increase their interest in viewing them first-hand.

- Virtual Galleries. These are museums without a physical home, which only exist in electronic form and which exclusively contain cyber-art. They are a method of diffusing a new type of contemporary art, “cyber creation”, which only exists on the Internet.

Virtual Tours

Although there are scarcely any virtual tours known in European museums and cultural institutions, there are examples of virtual tours of cities, in the form of “museum towns”. This consists of the creation of virtual environments of the most important lost and vanished buildings and monuments in a town. These types of virtual environments have been produced on a number of occasions and have been used as part of an exhibition or on the Internet.

The tour is carried out as if the user is actually visiting the site and can see everything that is of particular interest to that user. This is because the user normally controls the program in the same way that they would carry out a real life visit by looking at everything in a site or town with their eyes.

Virtual Visits

A Virtual visit is a route through exhibition or monumental spaces using technology applied to multimedia: a 360º panoramic photograph. “Exhibition spaces” are understood as galleries in museums and outstanding areas in archaeological sites and monuments, and “monumental” for areas of a marked historical-artistic character.

A panoramic photograph is just a set of photographs that are taken by moving the camera 360º around a vertical axis. These frames are then joined together using software to create one continuous image. By just simply moving the computer mouse, a user can move around the panoramic image.

Virtual Theatres

The concept of “virtual theatre”, “hyperdrama” or “cyberdrama” is not very well established yet, and the terms have various meanings. “Virtual Theatre” has been defined by some, such as the Electronic Literature Organization as the on line collective creation of theatrical texts, sometimes based on already defined parameters and using some form of new technology resource (e.g. Hypertext).

However, in recent years, and above all in computer gaming, the term “Virtual Theatre” has been used to refer to fictional virtual environments where users are transformed into characters and interact with other users.

The earliest examples of these are called MUDs (Multi-User Dungeons or Domains) and later derivatives are known as MOOs (MUD Object Orientated). These are similar to the early graphic adventures which used text commands, in stead of a visual interface, which is what is used in the more modern examples. *A*n example of a MUD is the role play game *Balzhur*. MOOs contain a wider variety of themes and a more user friendly interface, however they tend to maintain the fictional settings of the MUDs.

The most modern equivalent of MUDs and MOOs are the computer games in which the user can adopt a fictitious identity and interact in a virtual world, such as

in Myst or the Sims. This type of game has lately developed considerably with authentic parallel lives in virtual worlds being created, for example in Second Life or World of Warcraft.
In this same context, although in a much broader sense, authors, such as Janet Murray, have used the term “cyberdrama” to describe “cyberdramatic” experiences (and future experiences) that computers can provide in the form of videogames, virtual, encyclopaedic, interactive and spatial environments, in which the user has a much greater capacity of action. According to these ideas, not shared by all videogame analysts, this could open new narrative possibilities that could take over from all other traditional forms, especially books.

Pepper’s Ghost
Pepper’s Ghost is an illusionary technique used in the theatre and in many magic tricks. Using a glass plate and special lighting techniques, objects can be made to appear or disappear, or to seem to transform into other objects.
For the illusion to work, the spectator must be able to see into the main room but not the room where the hidden mirror is placed. The edge of the glass can be hidden by clever patterns on the floor. Both rooms may be identical mirror images and this method is useful to make objects seem to appear or disappear. This affect can also be used to make an actor, reflected in the mirror, appear to transform into an actor behind the mirror (or vice versa). This is the principal that is behind the trick found in many haunted house attractions. The mirror room must be painted black and have only light coloured objects. When the light is cast on the objects, they reflect strongly on the glass, making them appear as ghostly images superimposed in the room.

LIST OF RECOMENDATIONS OF THE M M N

THE IMPACT OF NEW TECHNOLOGIES ON EUROPEAN MUSUEMS

The members of the Mercator Museums Network (MMN) believe that, once all the information from the meetings and discussions, which have taken place during the project, is collated, the following recommendations on the use of New Technologies in European museums should be presented.

The MMN would like to put on record that these recommendations have been drawn from the experiences and knowledge of the members of the working group and that they are to be presented as a "list of recommendations". This could be considered as providing a correct approach to planning the use of new technologies in today's museums and which will serve as a guide to future projects in European museums.

As a first consideration, the MMN believes that, as a priority, it should establish that museums have a very important role to fulfil as centres of cultural dynamism and experimentation. Museum administrators must always be provided with sufficient resources so that museums can always be seen as a point of reference for society in the future. To achieve this, museums must contain a range of disciples which correspond to the requirements of a more "horizontal society", i.e. they have to be able to direct their potential to all sections of society: schools, universities, urban and rural communities, the elderly, etc…

To achieve these aspects, museums, which generally have the best staff and specialists with their associated knowledge, cannot only direct these resources internally within the museum but must also make them available and accessible to society in general. This is because they form an essential part of the global culture in which we are changing.

We are all conscious that in general terms, culture does not generate positive benefits in a short space of time. However, culture is unique in its ability to dynamise a society which is so completely under the influence of mass media. We are very used to confusing the means with the purpose behind them, and vice versa.

Therefore it is essential that all museum professionals accept that there are difficult challenges ahead, associated with the dynamic role of museums in the future. We live in a competitive society, when fundamentally what we should be aiming for is to live together in a responsible society. The difference between the two models of society is fundamental: a competitive society lives off the weaknesses and errors of others, whereas a responsible society lives without any dependencies.

From this perspective, we believe that today, the concepts and ideas that shape our everyday reality as a global society are acquiring more importance in our society. Therefore we firmly believe that museums are not cut off from this reality, but what is more, a new generation of museums is emerging which are incorporating the ideologies and concepts of modern everyday life. Intangible concepts such as peace, violence, fear, etc..., which are important features in all sectors of society, are now finding a place in the physical and virtual environments of today's museums – the Museum of Peace, of Violence, of Fear etc... In this way, the museum is acquiring an important role, not so much for the traditional concept of a museum, but for these new intangible collections that our future museums must offer their future audiences.

It is here where the new technologies that are being developed in today's museums will acquire special importance. Until now, museum collections, artefacts, works of art, the traditional displays of curiosities or collections of scientific materials, made up the base of what information was to be used to form the underlying concept of the museographic design of museums. The present displays its own visible reality.

Today, with the emergence of such broad and complex concepts as Peace, Violence, Fear, Renaissance, Enlightenment, etc…, we are moving towards portraying concepts whose material and physical content make it impossible to do so by traditional methods. However, new technologies can create emotionally stimulating experiences which can communicate the message of these new concepts using a variety of different digital platforms that are available today. Furthermore, the establishment of Virtual Museums allows collections from different geographical spaces to join together in a large virtual display that provides access to a global society that is increasingly demanding quality products that can communicate its reality to the world, and vice versa.

However, as museum professionals, we also believe that we have to establish not only these concepts, but the form to embody them in. In this "new era of museology" that we are facing, the use of information and communication technologies plays a part, but it is in fact the decisions that surround choosing this new technology which are more important rather than the actual technology itself. For example, a film clip can be stored on a standard DVD or on a hard drive; it can be shown in high definition or simply in PAL and it can be watched on a normal television screen or on a plasma screen. Everything depends on the size of the display required and on the funds that are available. The film clip remains the same and the most important underlying concern is that the message, which it was conceived with, is communicated successfully and creatively. Therefore, the technology chosen will have to be the most suitable for each different situation.

We believe that this difficult balance between content and media platform, is an area in which museums must be strengthened by the creation of multi-disciplinary teams able to provide suitable solutions to each situation. Team work and the bringing together of the various assets of all the professional disciplines involved, will shape, the already well defined, three fundamental principles of creating a museum: Concept (the museological project), Content (the museographic project), Space (the building project). These principles are still valid to face the challenge of creating museums in the future.

The MMN considers that a well designed museographical plan is fundamental as a base point, from which all other specialist work, required in the creation of a museum, can be developed from. It is important to highlight that this is the point in the project when decisions are made on whether or not to incorporate aspects relating to research, conservation and restoration, into the

museum design. The incorporation of these will largely define the rest of the disciplines that are to be involved. This process will require a great mental effort, and an important change in the way museum professionals and politicians think, so that they become aware of the importance of the agreed approach.

Once the desired museographical design has been established, we must begin with the museum's collection in order to begin to define the display's layout and its chronology. In this aspect it is important to highlight that the incorporation of the three elements; research, conservation and restoration, may substantially change the layout of the museum.

Once the museum has decided what concepts it wants to convey, and what collections it has available, any areas missing from the design plan can be identified and solutions to resolve them can be looked into. It is here that the technological and communication specialists can become involved in producing the communicative aspect of the project. These are the professionals mentioned above, and included set designers, engineers, lighting specialists, documentation officers, script writers, audiovisual makers, etc.…

There are a large number of resources available to create a suitable visual and aesthetic display of the objects. However, we believe that it is important to highlight that museums should not be overfilled with objects as this will not result in the visitors' better understanding of them.

If an appropriate museum design concept is in place, then the visitor flow through the museum can be more orderly, as the plan enables the museum to be able to focus visitors on those features which interests them most. To achieve this, it is necessary that the visitor does not perceive all at once the dimensions of the museographic space or its composition, as this would automatically devaluate the individual value of what is on display.

A suitable form of language is required which will aid in communicating the desired concepts or subject matter. To achieve this, we believe the use of a straight forward style of language is needed, removing all artificial content and excessive academia, as well as the assumption that the visitor has some previous knowledge on what is on display. In this respect, it does not seem like good practice to engage visitors with ideas to reflect on, when they are not going to be provided with answers to until much later.

If we consider that one of the roles of museums is to provide their visitors with an "experience", then this can be more successfully achieved if it is carried out in a collective way, as the "emotive effect" can be shared and the "emotive value" of the experience will increase. At the end of the visit, a common space should be provided where the visitor can relax and reflect on the architectonic richness of the building as well as on the objects on display.

The display of objects, like the use of appropriate language, is another important aspect to review. In that respect, we believe that to transform a museum into a type of "jewellers" with thousands of objects on display, would devalue the objects displayed and would exceed the capacity of the visitors to assimilate them. Therefore, we recommend that, only the most significant objects should be displayed and that the rest of the collection should be used for temporary exhibitions or for inter-museum loans.

We believe that, along with the use of appropriate language and the display of objects, it is important to introduce here, the use of new technologies. In this respect, it is fundamental that these are always integrated into the proposed museographic design. We believe it is very important to insist that the visit to a museum does not begin on arrival, but some time before, when the decision is taken to visit the museum. Pre-visit, visit and post-visit planning allows the museum experience to be extended. This can be done through, for example, web sites, which must also incorporate the same concepts and language used in the museum.

In this respect, we consider that it is fundamental that these new technologies interact with the traditional methods of visiting the museum. At the moment, it seems clear that the live explanation of a guided visit to a museum cannot be replaced. The two forms may be made to work together but not be mutually supportive. New technologies can be used as a tool to aid the guides in their work, rather than an obstacle.

In this way, new technologies must be adapted to the visitor's needs and not the other way around. New technologies can enable museums to take into account the likes and interests of their visitors and to be able to modify the routes depending on the knowledge levels and on the time available to them. This is because the new technologies that are available today have been developed for this, although they have not yet been used to their maximum potential. Some new technologies, carried around the museum by the visitor, can sense a change in a context and modify their function to reflect these changes. These are becoming real possibilities now and are being developed on a small and experimental scale in European museums. In this context, the portable new technologies are an enormous benefit.

Today, as has been highlighted in earlier paragraphs on the strengths and weaknesses of using new technologies in museums, there is a limit to their use. This is because their installation requires huge technological resources, which were conceived for their use in the large spaces which today's museums now contain. Perhaps, a parallel form of technology at the lower end of the spectrum is required, which would be more accessible and enable the it to be implemented in galleries in a few days rather than involve months or years of work.

At the same time, we believe that these new technological productions are ready to be used for procedural, constructivist and experimental learning. Today, it

is clear that these are perceived as a barrier for museum professionals in their daily work. We believe that we bombard visitors with too much information, which is taken as gospel, and provide them with few opportunities to create their own understanding and learning. We believe, that to make concepts more understandable, we have stripped away the causes from the past, thereby converting the past into everyday scenes. However, by doing this we still require the imagination of the visitor to recreate this history. We can create working models, real or virtual, that represent past technologies and which could be used to help in understanding, for example, how the Roman plough ploughed deeper than other ploughs. However, educational specialists have been telling us for a long time that understanding based on experimentation is much better consolidated by learners, whilst knowledge obtained by imagination is more likely to be forgotten. If the experimentation is fun, then it is consolidated even better – for example doing a fun hands-on activity. This life experience generates elemental information which is etched onto the minds of visitors. Didactic experiences have to be carried out in real contexts. For example if we are learning about the Romans, visiting a specific site, a scenographic display or a virtual environment, can be used as a base for pedagogical understanding.

It has been less than 15 years since these new technological resources were introduced into our museums. But in this short period of time, their trends and affects have already been noticed, and a review is called for. Right away, a number of factors emerge: just like in real life new needs have been generated, that didn't exist before. Technological equipment is expensive, as are the consumables they use; they require continuous maintenance and can even become obsolete before their time.
The 1990s were the heyday for slideshow audiovisual productions and the newness and quality of the image produces was well worth the inconvenience of the continual clicking of the rewinding of the slide carriage. Similar to two centuries before, but at a much faster pace, the possibilities of using still images was exploited, to produce unsuspected effects and textures. However, the audiovisual industry is never satisfied with such out of date technology, and in the last few years of the 1990s video projectors appeared on the market and with them began a new way and a new period of creating exhibition installations. The initial resolution was very poor, but it improved with each generation of machine. However, it is thought that, although we have gained in versatility, we have lost in image quality and tone. Of course, the experts always assure us that this will be solved with the next model of projector or screen which is about to appear on the market.

These associated problems would not be a concern if museums were profit making institutions per se. After all, production and communication medias do need to be upgraded periodically. But the profitability of a museum is measured by non economic parameters, and the political patrons, who so vigorously support the creation of museums equipped with new technologies, are rather less obliging at the time of guaranteeing their continual maintenance. Malfunctions and problems

do occur from time to time in museums, and this brings with it the wider issues or concerns regarding the expiry date of museums, which before were believed to have been created *sine die mortis*. The confidence in the technological system used is the key to its reproduction. Therefore, if at the end of the 19th century this was directed at the ever increasing size of the steam powered machines, at the beginning of the 21st century it is the opposite, with technology's invisibility being the best proof of its existence. The mobile phone network and the Web, that enables global communication of computers, are invisible. Technology is invisible. Therefore, when telephone lines are down in an area for a period of time, chaos, confusion and a sense of vulnerability is created. In the same way, the words "out of order" in front of any technological exhibit in a museum destroys the magic that surrounds it and returns the visitor back to the reality of a traditional style exhibition, which they have no memory of how to use.

The relation between the user and new technologies should be examined. Evaluations confirm that communication has improved and the attraction and the "pulling power" of displays have increased. However, more importantly this is due to the fact that museums are able to transmit and communicate ideas in a simpler way and through less formal channels. In this sense, multimedia technologies have no equal, and soon nor will there be an alternative. The power of the image is omnipresent in our lives; it is all around us, part of our work, leisure and education. The new generations of children are able to use these new technology resources much better than the purer forms of communication such as reading or the spoken word. Therefore, the possibility of using methods to transmit ideas, that are superior to those usually used by the mass-media, is an outstanding resource. In Post-Industrial Western society, making good use of free time is an essential part of life, and the leisure industry fights to fill as much of this free time as possible. The museums which are able to communicate successfully with their visitors have a great advantage, in this respect, on their rivals.

To talk about the didacticism of museums is to enter realms of fantasy. We frequently consider museums with audiovisual resources as being didactic museums. This is based on the assumption that everything we see is more easily assimilated, but this is not certain. Undoubtedly, virtual reality, dioramas or audiovisual presentations of historical settings enable the construction of messages that are easier to understand than those generated by conventional means of display. This is because they are more relevant to the personal context of the visitor, who is able to put himself/herself in the situation and combine the content of the display being explained with some references to his/her cultural context. To understand the first detail, we must know the context. The problem is that the cultural context of a visitor it is not only formed by academic style learning but by information from books, museums, educational institutions, all mixed together with that from television, cinema, the Internet and the dominating cultural environment of the visitor. One result of this could be the misinterpretation of the information. Therefore, before museums teach ideas, they should teach how the world should be perceived. Multimedia technology is a good aid to achieve this,

but it is not the overall solution. For a while now, learning theories have called for the use of a procedural style of learning in museums, which goes much further than the simply pushing buttons. Within this learning framework, social person to person learning becomes essential. New technologies have provided a good range of didactic resources, but the intervention of an interpreter who knows how to apply them is essential.

The final thoughts are on the "democratising" nature of new technologies. The large museums have done much to create their collections, and today it would be impossible to create, for example, a new Victoria & Albert museum, as the world heritage is now more generally spread out. Despite some unsuspected archaeological finds, the only areas of heritage that remain to be collected are modern art and the "new heritages" (intangible, oral, digital…). However, putting these to one side, the museums created *ex novo* in the last few decades do not possess a patrimony of any great value. This is a grey but essential area of collecting. Museums continue to be an important feature of community cohesion, and an important patrimony, of a more personal and domestic nature is being developed. It may be small in economic terms but has a very high symbolic value, which means that it must be collected and documented before it is lost. Museums can play an important role in the conservation of identity, and in time, in the formation of an awareness of living together and multiculturalism. But museums, which are defined more by their social function rather than by their collections, require a share of the market, a share of the public. For this purpose, multimedia resources could well become an effective ally.

At the beginning of this dossier a section was dedicated to the pioneering innovations in the field of the "image" which preceded the invention of cinematography. With out a doubt, at that time these formed part of a technological vanguard, but which for the majority of people was simply a type of show. 19th century European or North American citizens, devote believers in progress, went to see with pride the proliferation of inventions and the continuous variations and developments of those inventions. Capitalism had discovered the concept of "trends" and began to skilfully manage the desires of the public.

The magic lantern required more than a century of projecting ghostly images before it was realised that resorting to shocking images to attract an audience wasn't necessary. Cinematography only flirted with this at the beginning, until it understood that nobody was scared of the projection of a train rushing towards the cinema stalls. This was its liberation. From then, an extensive creative world was opened up, and a century after the Lumières, a large area still remains to be explored. The animated image ceased being a spectacle at the fair ground and became a way of diffusion and the communication of ideas.

Multimedia technologies applied to museums have only just overcome this shock value. Year after year, museum after museum, the resources used previously, become obsolete. Visual effects quickly go out of fashion and

installations take another step forward with technology (or in reality the reverse occurs). Museum professionals are in the hands of the technological industry, but are deserving of it. Whilst visitors continue to perceive museums as cabinets of curiosities or as temples of objects, the latest technological innovations will continue to be viewed with more curiosity. In the moment when museums assume their role as communicators, the medium used to carry this out, be it new technologies or display resources, will finally become dependant on the message communicated.