I
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The impossible challenge

When I agreed to write this paper about Applications in Museums for ICHIM'93, I did not realise I booked a one way ticket to hell; I mean intellectually, of course. Since I decided to base this text on a study I conducted in 1993 about hypermedia and interactivity in American museums, I recognised that before going to hell, I had a glimpse of heaven. You must wonder: What did he see? Where was heaven?

Well, the real problem is that I actually saw almost nothing, compared to the potential of interactive multimedia. Almost nothing besides a few realisations - some of them great - and a lot of people inside or outside museums fighting to defend their projects which remain tied up with funding, administrative or museum policy problems.

"The trip is the reward". I had a really good time doing this study, because it gave me the opportunity to meet nice people, to travel in the States and to visit great museums! Heaven was there, and certainly not in the streets were I felt bad to be so lucky, seeing much more homeless people and poverty that you can imagine by the time you are reading this.

Why all this hype about what... technology?

I wonder if anyone's background would be suited to give a global overview nowadays about applications in museums. My experience is more with computer software design, science of communication studies, and production of multimedia interactive content than with art history, culture and education, I suppose one should have to talk to museum specialists. I imagine this idea is linked to the feeling that some museums give to their visitors: that they are sacred places, a bit scary sometimes (Foucault's pendulum syndrome!)[1], and that finally you might not be able to understand or appreciate anything.

According to the American Association of Museums (AAM), the United States had about 5000 museums in 1984. Each case is specific, and each establishment has its own different objectives, educational policy and approach. Therefore, I cannot even structure this paper

1 cf. Umberto Eco. *Foucoult's pendulum:* translated from the Italian by William Weaver, Pendolo di Foucault. San Diego: Harcourt Brace Jovanovich, 1989.

by dividing applications for usual categories of museums such as Art, History, Science, Children, etc. If the current evolution of information technology will become a basis for a larger use, reliable and low cost multimedia platforms are already available from several vendors. It is these platforms we will focus on.

A clear way of thinking about multimedia applications in museums might be to keep in mind that a computer is a meta-medium, a representations-making machine as Alan Kay said. By an interaction as user-friendly as possible with the computer, the user gets information as a response from the system. In fact interactivity links the user with the author(s) of the content, at least the presumed author, and/or some programmed set of functions (database, artificial intelligence) in a communication process. The user - museum professional or visitor - is always aware that the real relationship is not between him/her and technology. If you believed a similar thing about films, we would go see projectors instead of movies says Brenda Laurel[2].

If the availability of a user-friendly interactive interface is the first step to success, the main issue is the design of a content - from database structures to fancy virtual worlds - which will allow the user to express his/her intentions and give him/her back information which matches his/her expectations in an interactive communication process. Besides these design considerations stands the problem of a new perspective for authoring, and copyrights issues. One big breakthrough of multimedia is that its content has often to be created by several authors, and that the user might also become an author by providing content or changing it. A basic example is a permanent poll at the Smithsonian's Age of Information exhibit (Allison & Gwaltney, 1991), where the answer of every user is taken in account in real time, and cumulatively with the former responses, to display a new result.

Defining the concept of his Virtual Museum, Glen H. Hoptman (1992) puts it as true interactivity, as opposed to the drone-like programming whose structural metaphors continue to dominate the electronic media. He describes it as a mean to provide one "visitor" easy access to artefacts, material and information that would be found under very different subject headings and in several different museums. In fact the Virtual Museum would be the nexus of many linked digitised collections used as a resource to organise "exhibitions" customised for the user expectations and interests.

Before we get rid of general and technology matters in this paper, I wonder if you have noticed that multimedia belongs to the past? We are still using the word, but we should really say *unimedia*, as all the so-called media (text, sounds, images, graphic animations, or video) are all digital data. Today we have a few strange systems with analogue video but it should not be long until they disappear, for better or worse. One good hope for publishers and museums would be that a common HDTV, computer industry and consumer market digital standard could be set soon. But there is no need to wait for that before starting projects on a museum scale.

What we could expect and what I saw

Let's try to figure out the objectives of a museum - for instance an art museum - to imagine what kind of applications we could expect it to need:

- Managing the collection
- Providing support and diffusion of scholarly researches and studies

2 Interviewed by the northern California's computer magazine *Microtimes* (#109), May 31, 1993, P.74

- Providing resources, content and education guidelines for schools
- Welcoming visitors and giving them access to a selected, combined sets of artworks and information
- Producing special exhibits,
- Publishing content related to the collection or the aim of the museum (education, promotion, fund-raising, etc.).

Note that none of these objectives relies specifically on computers. So far you can easily imagine a team of specialists, working in each of these areas. When it comes to multimedia the borders might fade away. In order to use the technology efficiently one must share the data with others. As it has been in a lot of companies or administrations, this break is a big brake which slows the implementation of new applications in museums. I said "data" and not "information", just to remind you that information is the meaning you attribute to data depending on your background and aims. There is a big misunderstanding in museums about the consequences of implementing computer-based tools such as general databases. Most of any museum employee's work consists in using his/her knowledge to make data becoming meaningful information to other people (visitors, students, colleagues). To do so, interactive multimedia can be, in several cases, at least as efficient as telephone, cardboard shoe boxes, labels, video or walls (often used to hang artworks for display).

Besides the Smithsonian Institution, museums in the United States are mostly privately funded. This explains why they all make the automation of their membership and development activity to acquire funds and promote events a priority. But when it comes to interactive multimedia, we will not see any big boom unless there is a proven economic benefit (Bearman, 1993). In this paper I keep the idea of an imaginative best use of technology, not dependent on these money considerations but relative to the museums' tasks listed above, and I compare it to what I saw in American museum in the beginning of 1993.

Collection

A first step of a sensitive museum policy toward multimedia technology should be to set up a visual database referencing the museum collections and related information. Gathering images and digitising them might be a huge and expensive task. The good news is when that is done, it is done, if you choose a satisfactory standard for image quality. Such a database would provide a main source of content for other multimedia applications. This is as simple as it is uncommon. No museum in the US seems to have really launched such a program, except the Henry Ford Museum and the Art Institute of Chicago. The database of the Lucy Study Centre, American Department of the Metropolitan Museum in New York City, is probably the biggest database a single collection in the States, but it does not include any images! A problematic issue is that, for many museums, available image databases on videodisk or CD-ROM come from third parties.

When you look at the US market in June 1993, it is surprising that all off-the-shelf digital collection management softwares that include images use them only as an illustration field you can see, like we would do with a book (Wright & Bearman, 1992). This could change soon: some companies are improving their old products for awaited further releases; other ones are working on new applications with a design centred on images. A large project, called MIP for Museum Informatics Project, conducted by Tom Duncan, University of California at Berkeley, is an effort to coordinate the application of information technology in museums and other organised, non-book collections. MIP gathers faculty, collections managers and curators to develop data models, system

architectures and demonstration systems. MIP wishes to provide a more visual education, and access on-line to several databases sharing common relational data modelling structures. To complete these aims, MIP works with some sixty specialised collections from the campus, statewide Californian organisations and similar projects at Harvard University, Cornell University, and the Association of Systematics Collections, among others. A first realisation is SMASH, Specimen Management for California Herbaria, implementing a database that documents the classification and distribution of vascular plants in California. It is accessible on a local area Ethernet network connected to the Berkeley campus network, the Bay Area Regional Research Network and the NSFNet.

A shared image (plus sounds, movies and graphic animation) database, with specific information for each department of a museum, could be used for conservation tasks, for publication, for exhibition, to scholarship works or visitors experience of the museum.

In the conservation area, beyond text and figures from a database, a digitised image itself can be a great help for curators and specialists. Besides a highly specialised digital System for Interactive Image Analysis in Museums (SIAM) developed in Europe with the EC funding project VASARI, and which remains available only for its partners, Alan B. Newman (1992) from the Art Institute of Chicago has shown how an off-the-shelf product like PhotoShop could be used for:

- dynamic clarification of image details
- predicting restoration's effect by preevaluating colour changes
- editing visual intrusion from radiographs
- previewing framing alternatives before fabrication
- planning restoration of a damaged painting
- creating mosaics from infra-red video more easily
- improving the analysis of ultra-violet images with light balances
- overlaying X-ray images onto photographs of surface of paintings
- electronic image analysis in microscopy.

Remote access to other museums databases might be also very effective for conservation tasks including authentification.

Scholar research and studies

A basic and efficient support to scholars or student researchers would be to allow them to use a computer screen workspace with:

- access to local and remote image databases
- access to library catalogues, electronic mail, other scholars' available studies or material, and regular networked services
- word processor, featuring image pasting ability
- access to dictionary, encyclopaedia and quotations
- ability to save user's multimedia work and to create links to retrieve, structure information or to produce hypermedia presentations.

There is no technical difficulty in setting up such a configuration. Up-to-date operating platforms, like NeXTStep, already includes almost all these features without add-on software. Once again technology is ready and it is up to museums and universities to imagine their digital revolution.

Schools

Multimedia can be a support for student activities before and after a scheduled visit, if by any chance the class can use a videodisk like the *National Gallery of Art* or a CD-I like *Treasures of the Smithsonian*. One of the most advanced experience happens in New York at the Dalton School. Its New Laboratory for Teaching and Learning (NLTL), directed by Frank A. Moretti and Luyen Chou, is redefining both how we learn and how we teach when one can access networked multimedia tools and content. The specific NLTL's approach leads the Dalton School students from all grades to work together on collaborative projects. They build on their own, with help from a developer and from the project's adviser (teacher), a cumulative multimedia curriculum.

Multimedia computers and public networks can become a communication tool between schools and museums. Kristina Hooper Woolsey from Apple Computer and the staff of the Exploratorium's Centre for Media & Communication have developed an impressive video bulletin board prototype to link an elementary class with the specialists from a museum. The children used the billboard for ten weeks to ask questions or make remarks about their understanding of weather phenomena. Messages they posted were video sequences they shot themselves with a camcorder and then digitised as QuickTime movies. This project has shown a creative use of broad-band public networks, even if the unavailability of a common ISDN connection in the area of the school was a major problem.

Visitors and exhibits

Among the first applications of multimedia to be seen in museums were directories, orientation and tour oriented contents to enhance the welcoming of visitors.

I was pleased when I entered into the Smithsonian's castle to find a system which works in several languages, the only one designed for French speaking people which I ever saw in the US. I could easily prepare my first day of visiting this huge institution. But I was disappointed not to find the same service in any of its 14 museums. Another orientation tool I had the opportunity to use was a feature of ViewPoint at the Seattle Art Museum. But once again, even if SAM is a smaller four-story museum, visitors can only use two stations.

Simulation of real phenomena, experience of virtual world or artefacts, diffusion of audiovisual content, location and directories of the artefacts and the exhibitions, orientation in the museum, related documentation to the collection, quiz, games and learning activities are the classical applications we can expect from multimedia in museums.

The IBM Gallery of Science and Art in New York has set up a cluster of several multimedia stations. Each of them is dedicated to a specific topic. If the museum goers did not have a specific purpose for their visit, I noted that they generally used the first available station to learn how the system worked and then chose a subject, even if they had to wait in line. You find another kind of ambiance in the Exploratorium where kids gather a glimpse of content from one screen to another. In this science museum, most of the stations only deliver information. Most of the interactives consist of hands-on experiments with real stuff.

Hands-on interactives would be rather difficult at the Air and Space Museum in Washington, DC. In its Computer Gallery, visitor can use 12 stations dedicated to specific activities, plus 2 Macintoshes with gallery guide and glossary. On the day of my visit 4 out of 14 configurations were out of order, but others were under whelmed with solicitations

from the museum goers. One of the top choices seems to have been Conducting a Test, developed on a DEC Micro Vax II by the Naval Air Test Centre with Patuxent River Corp and NASA. This two screen installation allows you to choose a mission of which a video movie is displayed on the left screen. While you watch the real images you can choose a point of view and the system computes what you would see and outputs graphic images on the right screen. Most of the stations ran specific developments, but one of them features a customised release of Microsoft's Flight Simulator.

Overall I found that there were more and more specific interactive multimedia for exhibits in any kind of museums except art museums.

Publications

A collection database featuring images can be useful in preparing an exhibition catalogue. The Art Institute of Chicago tested a prototype of digital collection management system when it published *A Centennial Picture Book of the Art Institute's History* containing a lot of old daguerreotypes scanned and electronically restored.

The San Francisco Museum of Modern Art is producing a poetic interactive piece from its former exhibition *Origin of a Species* about the photographer-writer Wright Morris. This multimedia allows you to watch Morris' images and hear his voice tell the stories he wrote about them. QuickTime has been used to show sequences of a contemporary interview with the artist. It is hopeful that this piece will be displayed if the exhibition travels, or that it will become a published CD.

Three good examples for general audience

When an interactive production fails it is often obvious why. Among the frequent errors are the weak conception of the project and its integration with the museum; under-estimation of the effort needed for making the content; un-reliable technology choices; bad graphics, images or sounds; inappropriate delay for the user to get feedback from the system; and so on. But when a project succeeds it is not easily explained without being very subjective. Because when you use an hypermedia you can't consider only objective facts. You are very sensitive to its style (even if neither you or the author can name it or classify it), to the taste and the quality of multimedia materials, to the design of the screens, to the evidence of the paths you can take, and to the tempo and the narrative dimension of the session.

As in movies or novels, it would be very surprising if everyone liked the same hypermedia, especially if the piece is less an encyclopaedia form and more an original author(s)'s work. I give here three examples of good realisations I saw in the United States. The first criteria to select them was that they were available for the general public. The second was that the museum goers appreciated them and stayed stuck to the screens, and the last was that I used and liked them.

"**The Electronic Newspaper**". This production of the American Museum of Natural History in New York was sponsored by the New York Times Company Foundation, and realised by the staff of the exhibit department under the direction of Jeff Jones.

The installation uses two kiosks set up near the new exhibition about human history. Each kiosk uses two 19" colour screens - one below for the user, and the other above that lets the visitors have alook on what is available there. A tracker ball allows you to move the cursor on a button, or hot area of the screen, and after a short delay the system considers your choice.

The content is about the evolution of humanity, with a focus on the human brain. As the title suggests, the system is designed to support the addition of very new information like the discovery of prehistoric paintings in southern France. It gives you the feeling that the information you get is always fresh, even if the system is stand alone and not connected to any kind of network. Produced on Macintosh with Macromind Director, the content is very graphic and uses QuickTime movies in two ways. The first one is a regular play of full-motion video sequences, the second way allows the user to "manipulate" in 3-D the representation of different skulls to better understand their differences. Programming the interactivity consisted of choosing which still image should be seen after each one, depending on which "moving" order the user gives (up, down, left, right).

The result is very impressive, especially when you "move" two objects at the same time. A lot of the text you read is also read aloud by the system, and this verbal explanation is very often in synchrony with graphic animations. With these features you even see very young users interested in the whole content. Even if they may not understand everything, one can be sure they get a general understanding and are not simply playing with the system. It is also very helpful for people with reading disabilities or for foreign visitors.

The effort engaged for this first release of the Electronic Newspaper and its interactivity took approximately two months for the design and three months for the production for a total cost of $350 000. Launched in April 93 the Electronic Newspaper will receive, this Autumn, an update of its content.

"**ViewPoint**". This electronic visitor guide to the Seattle Art Museum was made as a donation by the Continuum Productions company, and its content was designed and produced with the involvement of the museum staff. ViewPoint was done with MacroMind Director, but without QuickTime, which was not commercially available by the time of the design and which lacks the quality of resolution required by the designers. Instead of full-motion video, the system uses synchronised sounds and slide show effects to display still images. ViewPoint mainly features four guided tours, a large selection of works of art, an art atlas, the floors plans and a glossary. Joe Matthews, who was in charge of the interactivity, did an outstanding job; operating ViewPoint is very easy and intuitive. A large touch screen is provided for museum-goers and when they begin to use the system they are greeted by an audio welcoming message which explain the few things you need to know (or guess).

Among the comments in the guest book of ViewPoint I noticed this remark: "Really like it. Excellent idea. Well placed for impatient men in front of the women restroom!".

Some users complain they want much more information, like guided tours or a more exhaustive coverage of the collection. This is maybe where ViewPoint finds its balance and its interest. It is not only a flat database, but its content and the way it displays it is the result of a selection process (the task of a museum), and the way you access the information is always short but informative. In addition, the glossary is available in a pop-up window at any time. It contains key words which link its content from one item to another, and it also provides the right pronunciation of a lot of exotic terms. You can enter the glossary from a button on the main screen or via the text itself when it is underlined in red. When you access a work of art, or the location of a gallery from the floor plan, you often get a "see also" which contains direct buttons to jump to a few works of art selected by a curator. Developing ViewPoint was a nine-month effort which involved almost twenty people. No evolution of the system is scheduled.

"**US Holocaust Memorial Museum Interactive Encyclopaedia**". Since its opening in April 1993, the Holocaust Memorial Museum in Washington DC offers to its visitors what might be the biggest multimedia encyclopaedia in the world. The content about the Holocaust of Jewish people during World War II by the Nazis is only limited by the timeline but covers

an incredible amount of relative and contextual information. Yeachim Halevy, who directed the project was involved in one of the earlier uses of a computer in a museum (1978, Israel). He overcome the challenge that "even American visitors" could be interested in spending time in front of a computer.

What they see in the learning centre are only wide touch screens, and nothing else. What is hidden are regular IBM 486 PCs with a DVI board, and a hard-drive containing the help messages, the OS and the client software. A dedicated Netframe 486 PC with 60 Gigabytes on-line contains six specialised databases (text, audio, graphics, animated graphics, photo archives, full motion video), a special common database which describes the organisation of the whole content, and a retrieval/engine. The system was designed and developed in house with Foxpro and C. The development took place from December 89 to February 93. At its peak, the technical crew had ten people, and the content people were almost forty to feed the system. Two hundred end-users tested the encyclopaedia during the two months before the opening, and the only technical problem that occurred since was a power shortage.

The data structure process revealed itself as slow and tedious. Writing the links between pieces of information while taking care of the context is a huge work which will not be completed until this fall, according to what is expected (one could also consider it as en endless process). Producing the content was also drawing more than 1000 different maps on which some location has more than 10 different names, digitising more than 12,000 still pictures, and recording an unusual and unique collection of music pieces composed or played during the Holocaust.

Very soon the museum goers will be able to print for free on a laserprinter any information they want besides photos, until some way is found to solve the copyright problem. It is also planned to publish an electronic atlas of the Holocaust with all the maps made in house. The production cost of the interactive encyclopaedia in its first release is under the $5 million grant it received. The project also received donations from all the vendors involved.

The future of interactive applications in museums

In the implementation and design of current applications we have not yet begin to reach the boundaries and limits of available technology. But if we want to imagine what could be done tomorrow, we should not stop our minds at the frame of today's technology with its usual features. We have to think smaller, bigger, faster, closer, further. We also must find out what the industry and the researchers are talking about.

We still have to improve the user-friendliness of the applications and their information retrieval processes: we can do better than keyword searches, indexes and thesauri, which all come from our two-dimensional print environment. To access large databases Ben Schneiderman's Human-Computer Interaction Laboratory at the University of Maryland has produced a set of Dynamic Queries prototypes which are a step beyond database languages. One prototype in development is a Movie Finder which is close to an art museum's needs. The Dynamic Query approach is based on filtering tools with continuous visual display of information, reversible control of the query which is made by pointing rather than typing. It offers many advantages for museum environment as it encourages exploration behaviour.

For its project Gita-Govinda, "Museum of the Future", Ranjit Makkuni at the Xerox Palo Alto Research Parc is developing analysis tools which are going beyond text based techniques to go toward graphical gesture and musical notation. For example a "drum" device should allow you to retrieve a musical or dance piece when you hit the rhythm of a

sequence you remember. At the Canadian Centre of Architecture in Montréal, Howard Besser is linking a database about building permits to a 3D-modelling tool which will allow you to walk not only through a few places in Montréal, but also, once a point of view is selected, throughout time to see the evolution of the city in the past.

To enhance the visitors experience and to improve the museum educational role we must not forget the narrative dimension. We have to rediscover in the digital world the power of storytelling antique myths which are still a successful mean of knowledge transmission. "Crude, explicit, button-pushing interaction breaks the spell of engagement and makes it hard to present complex information that unfolds in careful sequence" writes Max Whitby, in his article "Is Interactive dead?" for the first issue of the US magazine Wired in 1993. It is expected that more subtle forms of interaction based on simulation and spatial metaphor will lead us to successful communication process. This is where the so- called virtual reality (VR) begins.

There are many notions about what VR is, or will be. In the field of museums it is intended to be a means to display collections in a designed world. VR sets you free of real world material problems such as distance, time and space. When you design a world you can simply play God, and make a door in a Louvre's Gallery that leads the user into the Metropolitan in New York.

Carl Loeffler from the STUDIO for Creative Inquiry at Carnegie Mellon University designed his Networked Virtual Art Museum as a place you can share with other visitors located anywhere in the real world. Within the immersion environment the system provides objectification of yourself that others see and that you can appreciate in front of a virtual mirror. You interact with other virtual museum goers in real time, like keeping a door open for them or waving your hand. "Waving hands is a basic and highly communicative form of human expression" says Carl Loeffler. You can also have interaction with agents which have "artificial intelligence". What is also remarkable about Carl Loeffer's project on the technology side is that even if his current prototypes are developed with state-of-the art workstations, they are designed to be downsized and run on hardware standards such as 486 PCs with modems and ordinary telephone lines. This feature shows that applications will be soon possible in, or for, small museums, small budget organisations, schools or individuals. Curators and other professionals will find in multi-user VR a powerful tool for designing traditional exhibitions.

I can already hear museum fans and professionals complaining. No mediated experience of a museum or its collections will ever be as impressive and delightful as a physical visit, especially when you really wanted to and you had to stay in line in the heat or under the rain for several hours to get to the box-office. It is just another experience, like reading a museum printed guide or catalogue.

We have to redefine the role and means of museums in this information age, and to find new ways to use their humankind treasures to give something which is obviously missing in today's world, maybe dreaming. Museums can find in computer-based applications very good tools to stress their entertaining and educational purposes. As a conclusion of her 1992 research project about the use of interactive technology in American museum exhibits, Stephanie Koester (forthcoming, 1993) wrote: "The museums in this study are becoming particularly active in and adept at addressing social, economic, and environmental issues, and more are using technology to help model our world and communicate the significance of these issues to the visitor. Individuals, and specifically educators, should not forget that the facts and formulas of math, English, and science are not enough for a person to get by a world full of drugs, homelessness, and other complex problems".

We keep talking about computers one can see. As powerful central units become smaller and smaller they could be embodied anywhere and in anything, and, among awaited devices, huge flat colour displays are expected soon. So we have to imagine interactive buildings or exhibitions in which the user is not always aware he/she interacts with a computer. Anyway, the matter will still be the communication process. In her 1991 study about Multimedia in American Art Museums, Sandy Naime (1992) noticed that "The rhetorical question is frequently asked : what more is needed for display of great art than clean white walls, high security and natural light from above?". Because I am confident in the use museums will make of technology I am convinced the question will remain the same by the next century. Followed by the implicit request for precision : That wall, what authoring and operating systems?