New technologies for a multimedia project: the virtual reconstruction of the Ancient Rome in the fourth century A.C.

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Abstract:: *A virtual reconstruction plan of the City of Rome in the fourth century A.C. has been worked out by the University of Caen.*

This is a multidisciplinary project requiring a team-work.

It has two objectives: research and education.

The topic has international vocation and presents a great cultural interest. It is made up of three parts that widely call up the new technologies : data collecting, data processing and diffusion of results.

Data collecting: they are on very different supports (maps, texts, models, photos) and are rarely digitalized ; authors are specialists (archaeologists, historians, writers, specialists of mechanics).

Data processing: it begins by the digitalisation and the constitution of a documentary database, gathering under an electronic form, bibliographical references, maps, photos, textures, video...

Diffusion of results: they are the most widely diffused using paper and CDROM supports, but new media based on communication networks are privileged. The diffusion on Internet is widely used but the increase of the network flows allows video conferencing and video on demand. Today we have to take stock of the difficulties we encountered, the choices we made, the results we got, the work in progress.

Preface

There has been a tremendous evolution in the field of technology, at the University of Caen (www.unicaen.fr), as in many other universities. I will briefly talk about this, in order to make you perfectly understand how we reached the present situation.

When computer centers were created, they were dedicated to program and make calculation only. On another hand, other services were in charge of the audiovisual areas, printing works, networks and so on... In the mid eighties, with the emergence of office automation and networks, the French Universities had to recognize the importance of the « Centre of Computer Resources », and the border between data procession and other technologies was not as clear as it used to be. The same kind of evolution happened in other fields. Nowadays, the PABX (Private Automatic Branch eXchange) use computers and the printing industry does the same with many different software packages.

The virtual reconstitution of ancient Rome is an excellent example of the evolution of such technologies. The University of Caen already had a 70 m2scale model of Ancient Rome, that is 11×6 m. We decided to develop it and make it stand out with the help of new technologies. The result is excellent and four other multimedia projects are now in progress. The common thing between them is a multidisciplinary approach, and their main objectives are to help people in their research and develop an educational and a mediatical side.

URL of the multidisciplinary consortium: www.unicaen.fr/rome/

A brief panorama

When you start such a project, you are soon overflowed by the huge amount of information you have to deal with. I am going to describe you the different steps which have led us to the realisation of the project.

- First of all, we had to consider that Rome was, and is, international. As a matter of fact, thousand people are interested in Rome, and the specialists of the city are numerous.
- Secondly, as far as Rome is concerned, any kind of information can be involved. It can be geography, architecture, mechanics as well as meteorology, literature...

Then, information exists under many forms:
- maps and plans,
- drawing and sketches,
- texts in various languages,
- contemporary photos and slides,
- photos taken from the satellites,
- scale models,
- bibliographical references in different languages,
- etc.

- Last, but not least, some of theses sources are sometimes mere speculations or hypotheses. As a matter of fact, archeology is a science, always in search of experimentation and the new technologies are extremely useful to answer many question, thanks to simulations.

As you may see, the project is complex, and in order to face its various facets, we decided to focus on some points which are the following:
- First of all, every piece of information must be checked by scientists.
- Afterwards, other specialists have a closer look on each of them and include them in some parts of the city to see if they are relevant.
- For instance, when a willing specialist is in charge of a monument, he gathers any kind of information he can find; if he is not sure of his results, he argues with his coleagues. In the end, they venture a hypothesis.
- The project is very evolutive and sometimes brings us to make some realizations intended to complete the architectural reconstructions, so we reconstituted the mechanisms which allowed to spread out a velum over the Coliseum, and the virtual realization

- of various lifting machines allows to explain the construction of buildings.
- Of course, the main objective is to digitize every piece of information.

Now, all the collected data are going to be treated.

Data processing

Digitization

As we have seen, information comes under many forms and each kind requires its own way. If there is no problem with the digitization of photographs or slides, it is more complex with huge plans or inside photographs of scale models.

In this particular case, we need a large scanner, or an endoscopic and digital camera. Some of the pieces of information already exist under a digital form, but in some cases, the scale is not good, or the centring does not suit.

Modelling

This is the next step and it consists in studying each part of a building, and finding its main features and resemblances. If there are many columns in a temple, each one has a base, a shaft and a capital. The point is to make them stand out, and repeat them if needed.

These operations are realised with specific computer programs, which help to build a frame, the so-called « structure in wire ».

Up to this point, the building is made of hundreds or thousands of facets, which need **Mapping** with different materials such as tile, marble or wood. The materials usually come from real photographs or computer-generated images.

The last step is a matter of **lightening** in order to have a proper highlight. In fact, you « just » have to set carefully the light and take into account, not only the position of the building, but also sunlight which varies from one hour to the other, and from one season to another.

Animation

Once the virtual reconstruction has been done, it is possible to animate the series of images.

Two possibilities exist:
- on one hand, you can organize the visit,
- on the other hand, you can let the visitor choose his own way.

That is the real virtual visit. Of course the latter is the best but it is also the most difficult to realize because every and each image has to be processed in real time. That operation requires a powerful processor.

Moreover, other elements are essential in this operation, such as a Geographical Information System (GIS) which links different sources of information, like chronology or different themes...

It is also important to have a data base to deal with the text, images, video, sound...

The following techniques are usually used in that process :
- word processing,
- vectoriel treatment,
- image treatment,
- video processing,
- sound processing,
- documentation analysis.

People who work on that field are :
- computer graphic designers,
- documentalists,
- audiovisual specialists,
- geographers,
- architects,
- town planners,
- computer scientists,
- jurists for copyright's problems.

The different means of communication

After being checked by scientists, these elements form an important database which will be used in research, pedagogy, but also in the media. First of all, information will be printed, and also spread thanks to the videos, CD-Roms and Internet. Every means can be used for a lecture.

If the **printing** is used in magazines, masters and theses, the **videos** are made for a larger audiance, who can see how Rome was in the fourth century, thanks to the virtual scenes.

The first educational **CD-Roms** were published by the Presses Universitaires de Caen. Before anything else, it was made for teachers or the general public. That does not mean a lack in quality. It is exactly on the same level than others.

As for **Internet**, important progress have been made thanks to the creation of the **W3 server** in 1996. Nowadays, the data throughout is much more rapid. But, if we get excellent results as far as quality is concerned, the size of information needed is too important, especially for the visual scenes. In fact, we have to find a means which will keep the quality of images and improve the speed of the Internet Services Provider (ISP).

As far as research is concerned, it is a different matter. The University of Caen is linked to **RENATER**, the national research network. For its part, **RENATER** is linked at a wide flow to other Euopean networks, like **GEANT**. From a local point of view, thanks to local authorities, every school uses Internet and has a direct access to the **W3 server**. We have been asked to make a copy to get another educational **CD-Rom**, but it is occasionally done since the project is always moving.

The present situation

Structure of the project:

It is based on an international scientific committee of 22 members that join together every other year (http://www.unicaen.fr/rome/comite2000.html).

The direction of the project is insured collectively by Ph. Fleury and G. Jean-François, both are members of the Scientific Council of the University of Caen.

Basic competence is permanently insured by technical staff for:
- the document retrieval,
- the data base,
- the modelling,
- the cartography,
- web techniques,
- the audio-visual (photography, video, CD-ROM).

The researches are structured by module. A module can concern a mechanism, a building, a district or a topic. For a given module there is someone responsible who appeals to all the competence he can find to collect the necessary data.

From that time onwards, the technical realization will take place with, in every stage, a scientific validation.

The whole project leans on the resources and the technical competence of the Centre of Computer Resources, for all that concerns networks and operating systems.

Working:

Two persons in charge of the projects ensures a permanent link between all the persons who work on it. Moreover, the ingeneers are all based in Caen. The decisions are weekly argued during our meeting, and the biennial session of the Scientific Comittee approve, or not, these choices. The constant arrival of new pieces of information, the results and all the competence insures a wide continuance.

Moreover, the electronic mail service is a perfect link to keep every participant involved, in such a project.

Results:

At the beginning of the third millennium, it is good to strike the balance of the project of virtual reconstruction of Rome.

The numeric data base occupies 7,5 Go and consists of:
- 3742 images, the size of which varies from a few dozens bytes to a few dozens megabytes with a resolution from 72 to 1400 dpi,
- 220 texts, the size of which varies from a few hundreds bytes to a few dozens megabytes,
- 517 architectural models,
- 50 video sequences of a duration of a few dozens seconds and occupying 480 megabytes,
- 24 monuments,
- 12 mechanisms.

The web serveur:
- It contains 1011 images for a volume of 120 megabytes. It was frequented for year 2000 by 2 170 247 visitors who consulted 2081 pages.
- Since its implementation in January 1996, its rate of consultation increased of almost 100 % a year.

The realized CD-ROM:
- It contains 200 images, 30 reconstructions, 40 pages of bibliography.
- It will be available on the 2ndquarter 2001, at www.unicaen.fr/mrsh/puc/

This project was the object of numerous articles as well in the professional press as in the general public press. It was the object of numerous statements as well in France as abroad, and it was awarded the following rewards:
- Price Aeneas Year 2000,
- 1st price of the Festival Archeo-Virtua 1999 in the internet site category,
- 1st price of the Concours Lanfranc 1998 on the subject : "The Virtual Reconstruction of Hadrien's Temple".

Technical means:

Equipment:

For the 3 dimensions modelling:

The interdisciplinary consortium "TOWN-Architecture, Urbanism and Virtual Picture" has 6 workstations working under operating systems Windows NT or Windows 2000 Professionnal at its disposal.

These machines contain 128 to 512 Mb of RAM and are mono or bi-processors.

The total working space is about 65 Go to which it is necessary to add a space of protected storage (about 36 Go) and a set of files shared and protected (about 18 Go). In this set of shared files, users can find the works considered as finished at a given time as well as cartographic and photographic references to start a new modelling.

For the broadcasting of the information through Internet:

A Web site is settled on a Unix Compaq server accessible 24h/24h.

Software:

For the modelling and the realization of films, different software are used:
- Photoshop of the Adobe Company, for the digitalization of documents and the retouch of pictures,
- 3DStudio Max + Character Studio of the Discreet Company, for the modelling, and the mapping of the reconstituted buildings, the realization of video sequences,
- Premiere of the Adobe Company, for the mounting of video films,
- other technologies are on approval such as QTVR or VRML.

For the web server:
- this one is based on the Apache Server software of the Apache Software Foundation.

Networks:

The 6 NT workstations situated inside the University of Caen are connected to an optical fibre network at a 10 Mbit/s speed; they are isolated from the other machines thanks to a filtering bridge.

The UNIX server is connected at a 100 Mbits/s speed.

The LAN is connected at a 100 Mbits/s speed to the MAN which is connected to the National Research Network (RENATER) at a 155 Mbits/s speed.

Projects:

The ambition is to reconstitute the maximum of monuments and districts but before arriving at the finalisation, we try to give the result of the researches to many people, that's why our next objectives are:
- the generalization of interactive video sequences,
- the implementation of a video server,
- the broadcasting via Mbone of these sequences,
- the live broadcast of conferences made around the real model.

At present, tests are in progress to implement on IP networks the Quality of Service (QoS) required for this kind of project.

CONCLUSION

The new virtual visit of Rome is a success.

Digitization plays an essential part in it thanks to the networks which are becoming more and more efficient. Today, anyone can visit Rome at home.

Thanks to digital means, the visitor can follow the chronology of the city, and its evolution throughout time.

Moreover, Internet is essential for an international collaboration which is indispensable for our project.

In fact, we would have needed more money to go faster, but we have defenitely prefered to work on scientific quality rather than speed of realization.

We chiefly look for new cooperations.