

# MAS2006 Program



## DAY 1: Friday, October 13th, 2006

### 10:30am Welcome & Registration

Room: [Palazzina Lagorio, Savona Campus](#)

### 11:00am-12:30am Session:Modelling Application - I

Chair: Marina Massei

Room: [Palazzina Lagorio, Savona Campus](#)

MAS2006-018

Logistics for Supporting Vessel Management  
Simonluca Poggi, Liophant Simulation, Italy

MAS2006-016

National Crisis Impact on Road Transportation  
Agostino Bruzzone, MISS, University of Genova, Italy

MAS2006\_003

Power Plant Service based on pool logistics  
Enrico Briano, Liophant Simulation, Italy

MAS2006-011

Logistics and process solution for supply chain of fresh food in retail  
Marina Massei, MISS, University of Genova/ Liophant Simulation, Italy

### 12:30am-2:00pm Lunch

### 2:00pm-3:30pm Session:Modelling Application - II

Chair:

Room: [Palazzina Lagorio, Savona Campus](#)

MAS2006-008

Movements And attrition for Crowd Control  
Attilio Rocca, Studio Brandolini Rocca e Briano , Italy

MAS2006-019

Logistics Solutions for Quick Response to Store Demand in Retail Business  
Chiara Briano, Studio Brandolini Briano & Briano, Italy

MAS2006\_005

Simulation of the supply chain risks  
Matteo Brandolini, Studio Brandolini Rocca & Briano, Italy

### 3:30pm-4:00pm Coffee Break

### 4:00pm-5:30pm Session:Modelling Application - III

Chair:

Room: [Palazzina Lagorio, Savona Campus](#)

MAS2006-010

SURESIM: a model to predict time-dependent structural reliability using discrete-event simulation  
Angel A. Juan, Javier Faulin, Carles Serrat, Alicia Vila, Technical University of Catalonia/Public University of Navarra/Open Universi

MAS2006\_002

Estimation of the manufactured elements in reliability in small series  
H.Meglouli, E.Bouali, I. Habi, M. Bougara, M'Hamed Bouguera University, Algeria

MAS2006-014

Study of solutions for visualization of the project: entrances, flags and paulista symbols in a three-dimensional vision of the publi  
Aurélio Antonio Mendes Nogueira, Marcelo Knörich Zuffo, Roseli de Deus Lopes, Federal University of Rio de Janeiro/University of São F

MAS2006-006

Spreadsheet Based Tools for Supporting Inventory Management in Distribution Center  
Francesco Longo, UniCal, Italia

### 7:30pm-11:00pm Gala Dinner

## DAY 2: Saturday, October 14th, 2006

### 9:30am-10:30am Session:INNOVARE Workshop - Sviluppo Intermodale Novara e Vercelli Abilita' Risorse Umane - Equal

Room: [Claudio Congress Center, Bergeggi](#)

Chair: Marina Massei, Liophant

Project Meeting for CYBERSAR Stakeholders

### 10:30am-11:00am Coffee Break

### 11:00am-12:30am Session:Project RESET Workshop: River Equal Ship Simulation in Extensive Training

Room: [Claudio Congress Center, Bergeggi](#)

Chair: Marina Massei, Liophant Simulation

Project Meeting for RESET Technical Development Group



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## **The Curriculum of the Authors**

Aurélio Antonio Mendes Nogueira (1)

He is adjunct teacher of Fine Arts School of the Federal University of Rio de Janeiro, urban architect for UGF in 1983, Scenographer, Master in History and Architecture Theory for PROARQ/FAU/UFRJ in 1995, Doctor in Civil Engineering for COOPE/PEC/UFRJ in 2005, post-doc in Electric Engineering for POLI/LSI/USP.

Marcelo Knörich Zuffo (2)

He is free-educational professor of the Department of Engineering of Electronic Systems of the Polytechnic School in USP. Electrical engineer for EPUSP in 1988, Master in Electric Engineering for EPUSP in 1993, Doctor in Electric Engineering for EPUSP in 1997, Educational Free Professor in Electric Engineering, in specialty, Interactive Electronic Means for EPUSP in 2001. Nowadays, he is Group Coordinating of Interactive Electronic Means of the Laboratory of Systems Integrated.

Roseli de Deus Lopes (2)

He is adjunct teacher of the Department of Engineering of Electronic Systems of the Polytechnic School in USP. Electrical engineer for EPUSP in 1987, Master in Electric Engineering for EPUSP in 1993, in Electric Engineering for EPUSP in 1998. Nowadays he is developing researches in the Group of Interactive Electronic Means of the Laboratory of Integrated Systems.

# **Study of solutions for visualization of the project: Entrances, flags and paulista symbols in a three-dimensional vision of the public works of Victor Brecheret from Sculpture to Architecture.**

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## **Summary:**

This work talks about a study for the application, use and solution of some Virtual Reality (VR) techniques in the Virtual Heritage System (VH) for the construction of virtual environments of the project paulistas' entrances, flags and symbols in a three-dimensional vision of the public works of Victor Brecheret from Sculpture to the Architecture.

## **Word Key:**

Virtual Reality (VR), Virtual Heritage (VH), Victor Brecheret, Architecture, Sculpture, Three-dimensional Visualization.

## **1 Introduction**

This project has been developed in the Laboratory of the Integrated Systems of Engineering Dept. of Electronic Systems of Polytechnical School in the University of São Paulo by the researchers. This project has the support of the institute of Victor Brecheret Institute for the research and identification accomplishments, of the public works allocated in the project, of the academic support of Graphical Techniques Departments of Fine Arts School, of the Federal University of Rio De Janeiro and it counts on with the exchange of technological information with the Applied Virtual Reality Group of the Laboratory of Computational Methods in Engineering of Post-graduation Program in Civil Engineering of the Coordination of Post-graduation Programs of Engineering of Federal University of Rio de Janeiro.

The project in development presents as a purpose to a consolidation of paulista and brazilian cultural patrimony, providing a contribution for the maintenance of part of paulista cultural identity, through the study of Victor Brecheret works (sculptures) in public exhibitions in the São Paulo city.

It will be created panoramas of 360° and three-dimensional models with the use of some applications to represent Victor Brecheret' public works in the different periods of his life. In this manner, this project can be published in printed traditional ways and conjugated multimedia of hypertexts, three-dimensional panoramas and images and WEB, making possible with this studying material the utilization of the Virtual Reality techniques (VR) for the visualization in the digital caves of USP/POLI/LSI and, afterwards, they can be transferred to other visualization centers.

In this context, the researchers had looked for to tell part of their researches that are divided among: the specific purposes of the project, the biography of Victor Brecheret, briefing concept of Virtual Reality (VR) and Virtual Heritage System (VH) and the possible commercial techniques to be applicable to the project.

## **2 The specific purposes**

The objectives can be expressed in providing to many users, in any part, information related to the virtual art collection of Brecheret artist, with three-dimensional visualization, data and images; to create a digital and cultural inclusion; to come back the memory of Brecheret work; to elabotare an instrument of investigation with images, information about Brecheret's collections and references of enlace with other institutions; to form a public center of forms and linear debates to foment the communication among users; to preserve the natural catastrophes works (earthquakes and floodings), and human interventions (wars and vandalism); to help in future restorations; to promote the technique formation, of educators and instructors from distance; to amplify the Brecheret's expositions to present purposes that can not be exposed (workmanship of collectors); to create an interactive virtual museum, using the Virtual Reality resources; to establish contacts with other researchers from other institutions about the Brecheret work; to fill out divulgation gaps about Brecheret work; to stimulate the development of other things that can be applied; to stimulate the creation of this area with other artists as well as the presentation of Brecheret' artistic works and of other brazilian artists in the Digital Cave®<sup>1</sup> (Cave<sup>2</sup>)systems from Brazil and other countries.

## **3 Biography of Victor Brecheret**

Born in Fernese di Castro, Italy, on December 15, 1894. After his parents death, he immigrated to Brazil to live with his uncles in São Paulo.

He was a essential figure of our modernism, Brecheret was fight flag, along with Anita Malfatti, young futuristic of São Paulo, in the years that had preceded the Week of 22. The artist developed, from 1919 until his death in 1955, a long and loving relation with the city, at different moments and places, answering with the eloquence of his sculptures for the paulistana sensitivities and utopias (PECCININI, 2004).

In 1912, he started to frequent the Liceu de Arte e Ofício course at night, while he worked at the morning.. In the year of 1913, he went to Europe bound for Italy for the Naples city. Here he was supported by his uncles

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<sup>1</sup>. CAVE Digital® is the name of the system of visualization of USP/POLI/LSI

<sup>2</sup> That system is known in the United States as Cave (Cave Automatic Virtual Environment) and in Europe as Cube.

and there he became an apprentice of the Arturo Dazzi sculptor, practicing tasks as kneading adobe and to making scaffoldings (GONÇALVES, 1920)

After two years, he dedicated to work alone. In 1914, he traveled to Paris, where he started to get interest about Rodin, whose workmanship he searched intensely. In 1916, he obtained favorable commentaries in the exposition of Amatori and Cultori, with his work "To Awake". He returned to São Paulo in 1919, where he worked alone until 1920. After this period, he had an opportunity to join with other modernists in São Paulo. Here, he achieved some articles with compliments, conceiving in this period, the Monuments to the Flags (DIÁRIO POPULAR, 1919; PERIODICAL OF I DEAL IT, 1920; POPULAR DIÁRIO, 1920; PERIODICAL OF THE COMMERCE, 1920; POST OFFICE PAULISTANO, 1920).

In this good period in his professional life, Victor Brecheret acquired a great respect in the area of the arts. In 1921, in Brazil, he got a scholarship during 5 years with the Minister of the Interior Alarico Silveira to study in Paris (ANDRADE, 1921).

In Paris, in 1923, he was rewarded in the Salon d'Automne and after this, he made successful individual expositions in 1926, 1930, 1935 in São Paulo and in 1934 in Rio de Janeiro. In this meantime (1936), he decided to return to Brazil. In 1941, he gained the competition for the Caxias Monument. In this period he searched for other works, because of the lack of human resources and substances for execution of the big workmanships (DIÁRIO OF São Paulo, 1941).

The Brecheret artistic way, between Europe and São Paulo, can show us the importance about São Paulo choice as a definitive *locus* from 1936 and it evokes the resonance of his work along to the critics, artists, esthetes and writers, by the presentation of their voices in article excerpts, letters and presentations in catalogues. (PECCININI, 2004)

In 1948, he searched for a retrospect of his workmanship in the decades of 20 and 30. In 1950 he participated in the Biennial of Veneza and in 1952, then he exposed, with other artists, the invitation of the Itamaraty in Chile. He went to Paris and Italy, where he could feel gain his formation way, dying on December 17, 1955 he passed away.

#### **4 Brief conceptualization of Virtual Reality (RV)**

The Virtual Reality (VR) had an enormous scientific and technological impulse in the decade from 90. Equipments that before cost hundreds of thousand of dollar, nowadays are available in a large-scale and in a lower cost for all society most of the time. Examples that deserve prominences are the projectors, eyeglasses, polarizers, computational systems of high graphical and processing performance and digital cameras. Moreover, the movement of free software has allowed that the research and development in VR can be made in any part of the world. At the same time, we can feel in our country a fast incorporation of this technology for the society. Nowadays, Brazil owns centers of excellency in this technology, being emphasized by the petroliferous areas (Petrobras), aeronautics (Embraer) and Automobile (Ford, Volks, among others). It is also important to point out the bubbling in other promising areas as centers and museums, culture, entertainment, education, medicine, energy and weather forecast (ZUFFO, 2004).

Virtual Reality is the technology, being the virtual environment the application, use and solution. At little time behind, it was not an easy task to define the Virtual Reality technology, because it presented an amount of definitions, due to the indiscipline nature of the area (WALNUT, 2003; 2005).

#### **5. The Virtual Heritage system (VH) - Virtual Inheritance.**

Virtual Heritage (VH) presents as an evolution of virtual archaeology pointing the use of techniques based in computation, with the technology of Virtual Reality (RV), simulating an old community with virtual reconstitutions (fig. 1) of a habitat or the representative constructions of important past of the people memory and the culture (MITCHELL; PENDLEBURY, 2004).



Figure 1- Reconstruction of Zeus Temple

The word culture can be defined by Ferreira (2004) as being the complex of behavior patterns, of the beliefs, the institutions, the manifestations artistic, intellectuals, etc, transmitted for everybody and typical of a society.

In this society, the culture consists as the most eminent and permanent institution of a people. It can still be stood out that today, a top technology is a landmark. However, times later, it is surpassed by a new one. Instead of it, the culture remains the same even for a long time, consolidating the roots (base) of a people.

Each people has its spiritual patrimony that reflects its physiomy, fixes its character, surviving without worrying with an amnesia of its past, reaching to understand its present without losing at any moment of its past rescue in a relevant historical continuity feeling.

Culture is all voluntary manifestation or production, individual or collective, that aims, with its communication to the amplification of the knowledge (rational and/or sensitive) through an artistic elaboration of a thought or a scientific research (FEIJÓ, 1983).

Starting with these premises, we can consider a culture conceptualization in four lines, being:

- One about the definition of the own culture;
- The second is to understand how the culture is transmitted;
- The third as being the transmission of the cultural knowledge of a people to the people of another culture.
- A fourth can be used using Virtual Heritage (VH) as the transmission of this cultural knowledge digitally, made by different ways that this technology offers to us in the contemporary world.

In the creating of applied virtual environments in the Virtual Heritage system (VH) must be presented as a considerable description of the past. It should not be looking for to represent it digitally as three-dimensional contemporaneity (3D), like it is done in the presentation of the promotional architecture or simple electronic mockups.

To create a three-dimensional model (3D) it becomes extremely complex in the execution of this task that it requires in an old monument or in a reconstitution, what represents an extremely complicated task. In the execution of this task is necessary a detailed bibliographical survey of the project, iconographic register of the construction or monument, looking for a detailed perception of the work set, of its urban around, equipments, initial architectural plans and with the accomplished modifications in different periods until the current situation, accurate gauging of measures, ratio, sculpture details of low and high relief and other construction components, being these requisites the conditioners of the perfection in the modeling creation, textures and reduction of form polygons to activate the visualization of the monument or construction.

One of the information benefits for the society will be to make easier the culture access information, in particular in the multimedia information on cultural achievements. However, to realize this goal, a stronger global cooperation will be needed to accelerate the digitization of our cultural heritage and to develop coherent technical and organizational systems for management storage and access. International cooperation in this area will provide framework for a new consensus on protection of intellectual property, author's rights and the management and preservation of cultural and linguistic diversity (MULTI-MEDIA ACCESS YOU CULTURAL EUROPE'S HERITAGE, 2003).

The synthetic environments used in the digital reconstruction to study of monuments, must be considered as Virtual Heritage (VH), presenting as an advance of the virtual technology. They do not be restricted for presentations or virtual on line visits, but, they also should be considered to express all potential as a tool and part of the discovering process, where the user makes questionings and obtains answers to understand the studied monument (BARCELÓ, 2000).

Replete of a spiritual message of the past, the monumental works of the people are, in the present life, the alive certification of their secular traditions. The humanity, who each day takes conscience of human values unit, considers the monumental works as a common patrimony, and recognizes solidarity responsible for their safeguards front to the future generations, which it must transmit this human valeus unit with all the wealth of its authenticity (LETTER OF VENICE, 1964).

In the theory the digital reconstructions of the monuments represent an excellent tool for Virtual Heritage (VH) inquiries, where the simulation and computational interactivity change into an ideal method for the professionals of the Historic patrimony and Artistic area, in reason of the opportunity to be used to accomplish three-dimension visualizations (3D) that permit the observation of a set that will be studied, and also allow to accomplish other different experiments.

The cultural and scientific heritage of Europe have the significant impact on its social and economical development. Digitisation of these resources becomes to major activity, goes increasing and improving citizens access for information and, it goes preserving European cultural heritage. Furthermore, the cultural Europe diversity can receive an important boost from the availability of digital assets, which can play the main point in several fields: education, tourism and measured elaborate. They can also be very effective in promoting cultural diversity and enhancing understanding of cultural different, ethnic or religious backgrounds of communities across Europe (MINERVA EUROPA, 2006).

Another source for use of this tool is the use for educators that visualize the rebuilding in 3D, as a way to do the history teaching more comprehensible and pleasant.

Culture heritage consists of those aspects of the past that people preserve, cultivate, study, and pass on to the next generation. Those achievements are embodied in material or "built" forms-sites, buildings, land-use, monuments, art and objects in non-material forms like social practices and language. (WORLD BANK, 2003).

Virtual Heritage (VH) has many potential uses. It can be used in an education context of all of the level school. In a higher level it can be used to amplifying the information in the history fields and in archeology for researchers, restoring, architects, planners and public and private administrators, besides allowing its use in the virtual tourism.

One project that should be mentioned is the project of the National Museum of Fine arts, in Rio de Janeiro (fig. 2), in execution phase, where the researchers of GRVa/Lamce/PEC/COPPE and the administrators of the museum are interested in incorporating virtual walkarounds of their on-line and off-line spaces to other means, as multimedia to make possible virtual access to his collection.

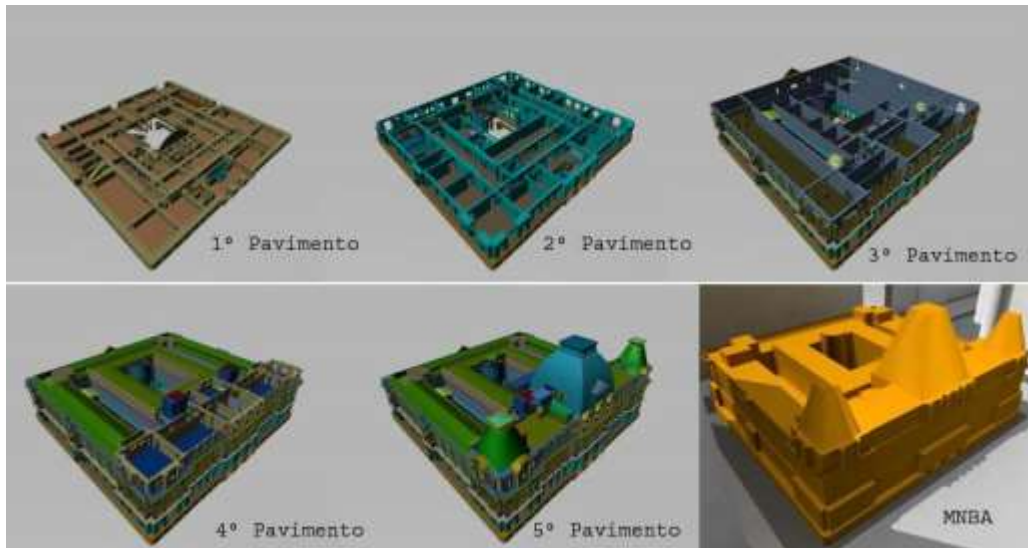


Figure 2 - National Museum project of Fine Arts- Museum's Interior and External

In the popularization of digital reconstructions for the studies of monuments in Virtual Heritage (VH), the internet can be a good allied that offers a easy mechanism of accessibility to the interested user in visiting certain monument, making possible in a limitless way the reduction of threats and damages to the existent real space with the distribution of the additional information as: hypertexts containing material about the monument; and the interaction with the three-dimensional model trying the virtual visit to the monument with better way. For instance, the users can explore the virtual monument rebuilt in a digital manner without crowds or lines and in its own rhythm, 24 hours a day.

It is important to consider that the virtual model of a monument should present enough realistic details, creating the user's interest in staying in the synthetic environment, as we can see in the Paraty project (fig. 3).

For the researchers that work in Virtual Heritage (VH) area, a virtual model can be used in a way to point out its important characteristics or even to remove the undesirable characteristics, such as modern objects of our contemporary world added by people with no sense of its patrimonial value.

The maintenance of the consolidated institutions with a great cultural prestige, being almost all of them located in the capitals, they translated the political intention manifest to preserve the protection of the public power on the legacy of each 'national culture', remaining, the State, not only as main source of support and financing to the Arts, but also as entrepreneur in the legitimate domains of cultural production (MICELI; MARIA, 1985).



Figure 3- Reconstruction of Paraty Historical Center- Rio de Janeiro.



The digital models can also be used to show a reconstitution of a damaged monument or to reflect about changes in its physical space or in its spill with passing of the time.

Today, the reconstruction and applications in Virtual Heritage (VH) present a fast growth with the use of the Virtual Reality (RV) technology, with expressive potential in prehistoric archaeology areas, in the military blockhouses architecture, in the civil architecture, in the religious architecture, medieval cities, cities or destroyed monuments in wars or because of the time pass.

These models can be created again as virtual models, and must be examined with possibility of access and exploration in their interior.

The Virtual Heritage (VH) can be considered as one of the systems of the Virtual Reality (VR) technology (RV), presenting with the visualization of old constructions. It shows several conservation made by some factors (bad weather, lack of maintenance, depredation, vandalisms, catastrophes, abandonment for the public and private power). So that, they can be observed, studied in future or current generations, as we can observe in the accomplished architectural intervention, at May 8 Square in Coimbra in 1996, Portugal, of the Professor Fernando Távora authorship.

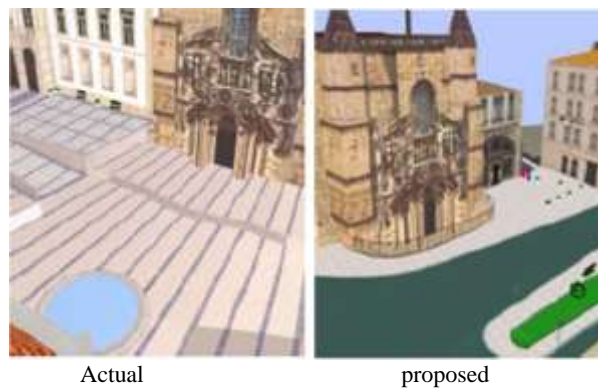


Figure 4 - Visualization of architectural intervention at the Square May 6 in Coimbra.

The Virtual Heritage applications (VH) have some distinctive characteristics in comparison to other applications of Virtual Reality (RV). Among them, we can point out:

- a way to promote the democratization, with the information amplification, of cultural inheritance of a country or of a people;
- economic way of preserve and enlarge the cultural legacy of a people;
- realism level in what it is being shaped of a real structure of the past or present;
- the interaction level of the user;
- provision of supplemental material through of digital reconstruction for research accomplishments;
- in the restoration and preservation of patrimonies;
- creation of a immersive environment in digital caves, visualization rooms or in PC;
- project of evaluation of the monument and its spill;
- a way to visualize big areas (lands) with several monuments;
- tool to create 3D databases Geo-temporary;
- remote detention and GIS for the culture;
- applications in museums;
- explanation of the place that will be study;
- exploration of new manners of interact with the obtained information of the studied monument;
- exploration of a three-dimension model with details, such as accurate dimensions and characteristics.

## **6 Study for the application, use and solution of some used commercial techniques in the Virtual Reality (VR) technology in the Virtual Heritage system (VH).**

The computation of high performance and the digitized photograph techniques created conditions that can optimize the services and make better a project construction of visualization of a historical monument. Though some of these techniques still present with high cost.

The 3D Scanner, of high fidelity of presentation and great accuracy, requests specialized people to be handled and it has a high cost for acquisition. Because of this, other techniques of medium and low cost have been developed in several places in the world with applicatory starting from, 2D digitized images to 3D digitized images, reducing costs in tools and in specialized people in its use.

To proceed, we will describe the necessary stages for the application of this digitized technique in the photogrammetry, panoramic, 3D Scanner by Laser and of satellite images with use in Virtual Heritage (VH).

The photogrammetry talks about the quantitative analysis of measures, starting from pictures, or, in a more general way, photogrammes (pictures, videos, digital images, etc.).

Starting from these documents, technically registered in the cellulose and/or in inphotographies, it possible to work with the obtained data in field, using computing programs, without to need to return to the origin place.

The photographic process supplies information in several scales of the work object, with excellent visual quality and with minimum margins of errors. Besides, it is possible to measure the objects without touching them (for that the photogrammetric has frequently been denominated as remote sensing).

### **6.1. The photogrammetry**

The photogrammetry talks about the quantitative analysis of measures, starting from pictures, or, in a more general way, photogrammes (pictures, videos, digital images, etc.).

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A photographic image is a Central Perspective. Thus, all luminous ray, that reaches the surface of the film during the exposition, passes through camera's lens, mathematically considered as an unique point- perspective center. With the purpose to measure the photograph objects, the rays must be reconstituted. Therefore, the internal geometry of the used camera (defined for the focal length, the main point position and the distortion of the lens) must necessarily be known. The focal length is the "main distance", that it is the center distance of projection to the main point of the image plan.

These images must be obtained in a way that they can assume some premises, so that they can produce a 3D model from the 2D images. In this manner, in photographs, it can assume that the camera produces a perfect center projection, that it does not have deflected light rays passing through the camera's lens, and that the image in the focal plan of the camera is a glide rigid surface. So, then that the mathematical relation between the object and the image is known as the principle of the Linear, for which the center of perspective of the image, data point of the image and the corresponding point of the object of the world are liners.

The beginning of the Linear embraces the six steps of freedom of the camera: 3 translations and 3 rotations. Deflects of the central projection can be modeled as systematic mistakes in the linear condition. They concern to the distortions caused by the lens, and they can be calculated known this parameter of the used camera. Starting from these foundations and of geometric calculations based on triangulation. It can settle down the position of the points in the 2D image, in a 3D coordinates system that describes the corresponding world.

It is evident, for the report above, that the relative's information to the calibration of the camera are fundamental to establish these correspondences among points of the several images and of the 3D world to be modeled. Moreover, it is necessary that this calibration needs to be the same among the different images. After all, the ambiguities, that just an 2D image cannot solve, are overcome by the information supplied by the several images of the same space, but only if they can be put in accuracy geometric relationship.

The fundamental steps for the technique use are involved with:

- Acquisition of Photographic Images.
- Marking a mark and reference: to locate in the obtained images the basic characteristics (objectives, borders, songs, etc.), putting them in correspondence and scale
- Computation of the 3D location of the corresponding points, rebuilding the scene in this system of coordinates.

For the image acquisitions, two important aspects should be observed:

- Relative positioning of the camera in the generation of the different images: in order to overcome the ambiguities, it is desirable that any point of the world can be visible at least in two points, if possible three photographs, with different perspectives, for the purpose to allow the coordinates intersection. Ideally, therefore, for each level of studied details of the scene, it is necessary to take pictures, at least, in 3 different angles of vision, the nearest as possible as the perpendicular among them, but still maintaining each one of the visible fundamental points in more than an image.
- Camera's characteristics: Such as the camera calibration, its resolution also should be maintained constant among the several images. The pictures can be obtained by several types of camera, they can be analogical or digital. In the first case, the images should be, afterward, digitized, so that, they can be processed in computational form. This step can interfere in the resolution and in the image qualities. The use of camera digital, if possible, is more suitable. It is faster and it generates less mistakes.

The work with the pictures in photo modeling software's involves, first of all, the definition of lines and scene surfaces, from the demarcation of reference points in the different images. After this, the points of the different images that correspond same points of the real space, they are marked, allowing the program can establish geometric relationship among them, through the resolution specifications and of focus of the used camera. These data allow to establish the camera positions corresponding to each image, establishing which its perspective. For geometry, these data can generate the 3D space relationships of the demarcated points. The surfaces are filled out by corresponding transformations in the textures found in the photographs.

Among the programs based on the photogrammetry, it can be cited: Photo Modeler, Shape can be mentioned Captures, Canoma, Photo 3D, among others.

An important aspect, for analysis and subsequent studies of the image, is its scale, regarding to the real world that it represents. It is important the registration of the knowledge of the real distance among, at least, two points that appear in all of the pictures. These points also aid in the establishment of the reconstruction precision. This is one more reason for the use of digital cameras.

## **6.2 Panoramas**

Several no photographic panoramas were created in Europe of the centuries XVIII and XIX, they were built inside of the constructions, in internal walls in cylindrical format. When the resident or visitor ascended to another construction pavement, he or she confronted with the immersion sensation.

With the discovery of the photographic and with its improvement, it was possible the dissemination of the cameras. In this manner, it gave possibilities of several photographers start to try the photographic sequence creation that it forms panoramas.

A panorama is an image type in which we can visualize a big angle of that is been portrayed. It can reach an angle from 180° to 360°, where the angle rotates around the point of view chosen by the photographer (fig. 5).

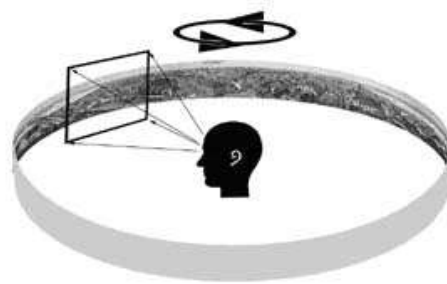


Figure 5 - The beginning of an infinite presentation of the rotation of a circular panorama (circulate room or a computer screen and a panorama viewfinder).

In this sequence, specific techniques were developed for manipulation of these traditional photographic images in paper, getting the correlation of the different contained perspectives in each one of the pictures of a same sequence providing several panoramas.

With the passing of times and the evolution of the computational technologies the traditional paper pictures started to be digital photographic images. In this phase these images started to compose files of the most different extensions, such as: jpg, tif, Tga, Png, Psd, among others. To manipulate the images of different extensions, several programs were developed with nodes creation, with the purpose to attribute some determined navigation functions in several means.

In the digital era RIGG (2005) a panorama is defined as being a prolonged image that provides a larger vision field than one we can see, presenting the image behind the observer (fig.6)



Figure 6-- illustrative Outline –Lateral of the Building of Letters at UFRJ

To form a panorama of 360°, it is necessary to generate pictures that are taken at a single place (fig. 7 and 8), in which the camera is positioned in point on a tripod and rotated around of the own.



Figure 7 – illustrative plan -internal courtyard of the Rectory building of UFRJ

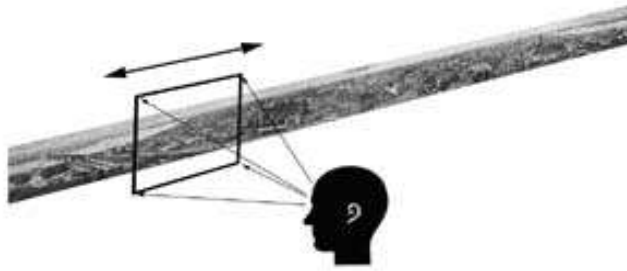


Figure 8 - Lineal presentation of a circular panorama  
Interconnection among two panoramics.

Product made by students of graduation of EBA/UFRJ and published in the VI Annals International Conference on Graphics of Arts and Design - XVII National Symposium of Descriptive Geometry and Technical desing.

In these several facility of the digital technology in the computational era for generation and exhibition of this image type, it can be counted on with several specific programs of panorama treatment and visualization. To exemplify we can mention the programs: 3D Studio sight v-1.8, Realviz Stiler, Quick Time VR (Virtual Reality), Factory, Vr Worx 2.0 and Pixia Pro, among others. The Quick time VR program is based on Apple Quick Time that have a series of codec, forming a library with ISO pattern, for exhibition and production of files of digital and panoramic with use of several platforms (Macintosh, Windows and UNIX).

Another important factor is the use of the digital photographic panoramic in multimedia environments (Cd-rooms, kiosks or in the Internet), besides the possibility to be printed and used in publications or other material supports.

The digital technique allows the use by lay and specialist, presenting a good performance, fidelity of the real environment and interactivity for the user, allowing walks, through visualization Room or digital Cave or even in the Internet, with the aid of a browser and a plug-in in PC, making possible to share and to discuss ideas for, in fast and innovative way, the comprehending of the spaces.

The panorama technique is of low cost, needing at least of:

- A digital camera, preferably with storage with memory card and serial cable for export of the image files to the PC;
- Conjugated Tripod with a panoramic head - Kaidan (KAIDAN, 2005);
- Computer with minimum configuration of: Windows 98, 333 MHz Intel/AMD Processor 128 MB RAM, 50MB available hard drive space, CD-ROM drive, Video display capable of 800x600 pixels with 16 bit colors or higher.



Figure 9 - Illustration of a Digital Cave – University of São Paulo/ Polytechnical school/ Laboratory of Integrated Systems/ Dept. of Engineering of Electronic Systems

### 6.3 Acquisition of Images through Scanner 3D

This acquisition of images is one of the most effective ways to generate a three-dimensional model, however it is still prohibitive in relation the costs. Nowadays, the Petrobras (WALNUT, 2002), is using this resource to build three-dimensionally its platforms (fig. 10).

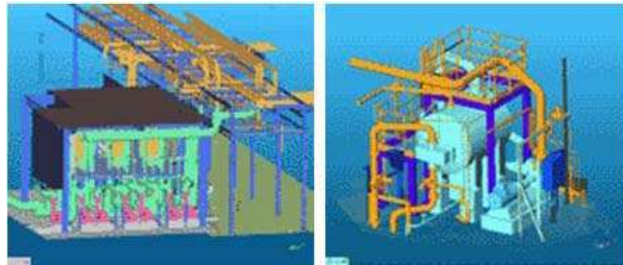


Figura 10 – Clouds produced by 3D Laser Scanner in a offshore platform.

The 3D scanner is an instrument of larger precision, however of excessive cost - specially when is necessary to consider the difficulties found in our country for financing of this type of equipment in a project.

In the acquisition of the images, it is possible to have the contact and without contact techniques; being that the first one requests a physical contact with the surface. It is used with touch probes and measure tools that request the manual contact with the explored surface in the making of 3D, ideal for small pieces, becoming inadequate for big monuments (OLIVEIRA NETO, 2004).

The Second explores energy sources that have already existed or have generated by the own sources (OLIVEIRA NETO, 2004), such as ultrasound or optical radiation, being these driven on the surface of the object, and the return of this energy is measured, in this manner it can rebuild the geometry of the object, pointing out the 3D Scanner by laser (fig. 11) composed of scanner, computer with program for manipulation of the data and treatments (fig. 12 and 13), ideal for monuments with big structure.

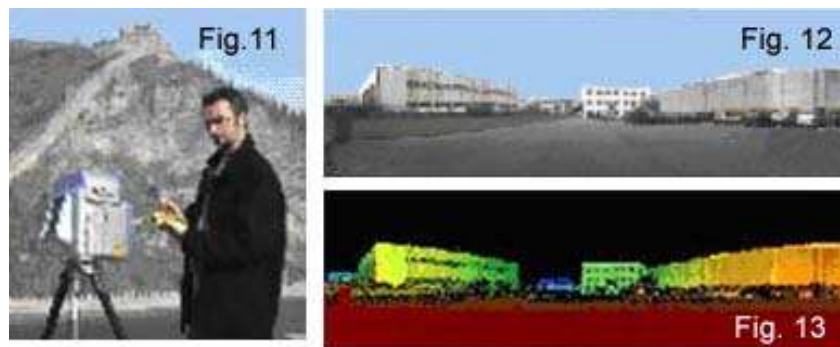


Figure 11, 12, 13 - a -3D Scanner by Laser of mensi/  
b - Place example to be used the 3D Scanner by Laser of Mensi/  
c - Clouds of points made by the Scanner

The 3D Scanner by Laser works by making a sweeping (laser) in certain place as it can be observed in the sequence above. The laser bunch should be addressed several points above of the object with the intention of covering a band. The sweeping system can change according to the manufacturer. The knownest mechanisms are the use of movable mirrors, they produce parallel or in zig.zag lines, and the mirror in a shape of rotating polygon, that it produces parallel lines.

In this technique is necessary to point out that it builds the surface geometry of the monuments, through the creation of a cloud of points, it can be fastened or rotated around of the construction, with an incredible precision of 0.29mm. With the manipulation program of these clouds of points, they will be combined and later passed for generation of 3D model (fig. 15 and 16).

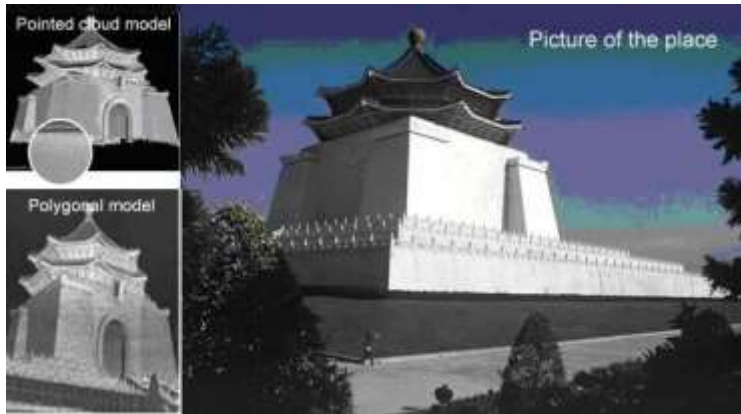


Figure 15 – 3D Scanner by Laser used in the monument Chiang Kai Shek Memorial Hall, Walled, Taiwan.



Figure 16 - Making the sweeping of the Zeus/Poseidon with a Scanner by Laser.

Even with the high precision of the scanner in its sweeping to generate the 3D model. After the treatment of the clouds of points, sometimes is necessary to export this geometry for other 3D applications (3DMax, Maya and others), to complement the 3D mesh of obscure points that it did not get to capture in the scanning of the monument surface. It is very common between the installations and tunnels in the offshore platforms.

Many of the times to execute the use of the 3D Scanner by Laser in monument, it is necessary an infrastructure for its use (scaffolds, movable and fixed platforms, besides of the specialized human resources to operate the equipment).

### 6.5 The use of Satellite Images.

The opportunity to have the earth in an observation of the space makes possible a new level of understanding and a monitoring in the evolution of our planet. Today, the satellites of observation of the earth are, with success, monitoring natural parks and the enrolled reservations in the cultural patrimony of the world, through UNESCO.

A new generation of satellites (Water, Earth, Radasat, among others), it comes to offer an advanced detection, propitiating a monitoring of these spaces and providing us images for the cultural patrimony.

The International University of the Space (IUS), the European Agency of Space (EAS), NASA and the Center of Heritage of the UNESCO World, they accomplished the convention of the patrimony of the UNESO world and of 30 years of civil satellites of detection remote. In this event, were presented lectures of international experts that contribute to the efforts of conservation of the national and world heritage. So, in this way, it was explored the potential of these images in the education, that it was obtained from the bases of resulting data (UNESCO, 1972).

This event contributed to conservation efforts and management of natural and cultural places, including the following topics:

- the uses of satellite images in the monitoring of places of heritage and of foreseeing the natural catastrophes and the accidents done by the man that threaten heritage places;
- the use of geo - positioning with systems of data to help in the digital elaboration of cartography;
- the integration complexity of the relevant data to the heritage, placing them to the management and their organization for the use of a gis tool;
- the development of the facilities and the requested abilities to store, to process data of space applications and also, it can contribute to make easier the use of such data for professionals, responsible for the decisions, the general public and service suppliers;
- the commercialize of images, satellite applications and how to integrate or to add the values of a series of data in the management of cultural and natural of resources;
- the study impacts in archeology and natural science in the instruction.

An example of this process is the Rio De Janeiro Project (fig. 17) of the University of São Paulo of Polytechnical School of the Laboratory of Integrated Systems of Digital Cave.



Figure 17 - Rio de Janeiro Project.

## 7 - Conclusion

The Virtual Reality (RV) technology, through the Virtual Heritage (VH) system, provides the solution, the use, and the application of virtual environments for area of cultural patrimony. It shows as an innovation in this area.

The techniques presented here provide an advance in the study of the cultural patrimony and the use of a series of tools of great technological potential, some of them with lower cost and others with higher cost. These techniques propitiate the union of efforts in the several professional followings or in companies with different specialties that work in groups in a cooperative way, in the improvement of the investigation research, in an exhibited dynamics of the studied work, avoiding constant displacements to the place of the studied work, developmenting and optimizing the works to be accomplished, for the elaboration of technical reports and future restorations in the patrimony area.

## 8 - Gratiudes

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