



## VIRTUAL STONEHENGE RECONSTRUCTION

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### Abstract:

Visual and spatial technologies are increasingly revolutionising how archaeology and many other disciplines understand the past in relation to the contemporary world. From digital objects to landscapes, through geophysics, geographical imaging systems and the creation of virtual worlds, new technology provides alternative routes to seeing and understanding both past and present. This research paper describes an interdisciplinary art and design approach to rebuilding and visualising phase 3vi of the Stonehenge site for interactive cultural heritage applications in the 21<sup>st</sup> Century. A 3D digital research team based at the School of Art, Design & Architecture collaborated with music technologists, sculptors and game designers to gather, interpret, re-imagine and digitally re-model historical and contemporary data on Stonehenge to create a virtual 3D reconstruction of Stonehenge phase 3vi. The researchers discuss the range of digital data, tools, methods used in this phase of the Virtual Stonehenge reconstruction project.

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## PERSONALIZED MULTIMEDIA EXPERIENCES IN TECHNOLOGY MUSEUMS

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### Abstract:

It is quite obvious that museum visitors as well as exhibition or event participants really make profit of the information available. Although most of the information guides are currently paper-based, this solution is not the more appropriate one, as these guides are not reusable once the exhibition is over. Moreover, they are not sustainable or environmental-friendly due to the use of paper. MULTIPOD aims at implementing a system that allows visitors to design their own multimedia guide for the visit, with personalized contents about the artworks that best fit his/her preferences using their personal mobile device. The system allows downloading the multimedia contents to the devices of the user connecting to a Web URL or using QR codes available at the exhibition. MULTIPOD has been validated in a Technology Museum in the Basque Country.

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## CATALOGING INTANGIBLE CULTURAL HERITAGE ON THE WEB

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### Abstract:

The E.C.H.I. project involves the definition, implementation, population and search of a Register of the intangible cultural legacy of trans-border Italo-Suisse heritage, aiming to design such a register in line with the new heritage paradigm proposed by Unesco. In this paper we will present the ICH cataloging card for the inventory of intangible cultural heritage on the web, which is one of the results of the E.C.H.I. project, integrated in the AESS database that stores information concerning the oral history of the Italian Lombardy territory.



## **SURVEYING MASONRY STRUCTURES BY SEMANTICALLY ENRICHED 2.5D TEXTURES: A NEW APPROACH.**

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### **Abstract :**

The present paper describes a methodology based on the development of a new semantic tool for the graphical representation and interpretation of archaeological data: semantically enriched 2.5D textures. This is a custom-designed solution that supports stratigraphic analysis obtained from the combination of depth map and orthophoto, drawn from 3D photogrammetric surveying and modelling. The aim of this research is to create a tool that solves the existing 3D data interpretation problems and to introduce a new cognitive model.

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## **PROCESS MODELING AND PHOTOGRAMMETRIC PRODUCTION FOR STRUCTURAL INVESTIGATIONS CONCERNING TO THE COLLAPSE OF PALAZZO EDILIZIA IN SALERNO (ITALY)**

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### **Abstract:**

We present some results of a survey aimed to representation of collapse of a building and the feasibility of the modulation as support of structure analysis. The survey was made on a building in Salerno, built in Art Nouveau style, named after the “Società Anonima per l’Edilizia”, which undertook its construction. The city has considerable public and residential buildings in an eclectic style, and Liberty. In June 2007 the corner part of Palazzo Edilizia fell down suddenly. The collapse occurred at the sunup, but no victims or injured people were caused only because that part of the building contained living rooms of apartments, rather than bedrooms. Was realized an integrated survey with topographic, photogrammetric and terrestrial laser scanner techniques in order to obtain the 3D model, plans and prospects and the particular of area collapsed. The results has been an aid for the structural engineers.

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## A GOOGLE CLOUD APPROACH TO IMPLEMENT A GRAPHICAL DATA ACCESS INTERFACE BINDING HETEROGENEOUS CULTURAL REPOSITORIES

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### Abstract:

The paper describes a prototype system based on Google Earth that can display cultural heritage data superimposed on the landscape. The prototype employs OAI-PMH protocol (Open Archives Initiative Protocol for Metadata Harvesting) to connect to data repositories. This work is part of the multi-disciplinary ParSJAd project and involves IBACN (Emilia-Romagna Regional Directorate for Cultural Heritage) DIPARCH (Archaeological Department, University of Bologna) and Cineca Interuniversity consortium.

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## INTERACTION FOR A SHARED KNOWLEDGE WITH REPERIO: THE CARDANO CASE

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### Abstract:

Reperio, a collaborative, modular and customizable web work environment, provides tools to support research and study in the field of Cultural Heritage and Humanities (editor of ontologies, ontology population, management and editing of texts and images with the possibility of annotations, comments, variations, confrontation between several witnesses, etc.). The vision and mission of Reperio is to help to eliminate isolation within different research communities by facilitating collaborative ways of working and sharing content and resources, while respecting the intellectual property of the individual scholar. Reperio's characteristics are described on the basis of the significant experience of the *Girolamo Cardano Project: The knowledge and arts of the Renaissance*.



## PRESERVING MONUMENTS' ASTRONOMICAL ORIENTATION BY USING DIFFERENT DATABASES

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### Abstract:

As many studies worldwide have proven, there is a significant reason for the study of a monument. This is the actual orientation that the founders gave to the monument during its foundation. The orientation of a monument, especially a religious one, follows some strict rules according to each religion, tradition and belief. Today, the orientation of a monument may be determined and registered accurately and easily thanks to advanced technology. Especially if astrogeodetic measurement methods are being used then the orientation may be detected with adequate accuracy. This gives future generation's reliable information which can facilitate for a better understanding on the purpose behind the erecting of each monument. This paper presents the results of two research programs, which focused on this subject. In order to disseminate the results of these two projects worldwide, the information, is organized in database. Two different software were used, Macromedia and ArcGIS. The ease of use and the various options of usage will be discussed as will the final results.

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## VIRTUAL RECONSTRUCTION OF THE ANCIENT STATE OF A RUINED CHURCH

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### Abstract:

Three dimensional virtual models can represent both the existing and the already destroyed architectural heritage. This project deals with the 3D reconstruction and representation of the church of San Prudencio's Monastery in La Rioja (Spain) as it is supposed to be during the 15th century. Today the monument is totally in ruins; hence severe reconstruction was needed. This is an exemplary project of close collaboration of different scientific fields. Surveying data of the monument itself and of the wider area around it, but also architectural and archaeological data were collected in situ. It was not possible from the current situation to conclude about the exact form, style and representation of the monument; hence a large part of the project is based on assumptions which have a sound scientific base. Because of the multisource data there was need to define specific criteria by which every data source was evaluated.

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## THE MEMORI TECHNOLOGY - AN INNOVATIVE TOOL FOR THE PROTECTION OF MOVABLE CULTURAL ASSETS

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### Abstract:

The EU FP7 project MEMORI ("Measurement, Effect Assessment and Mitigation of Pollutant Impact on Movable Cultural Assets. Innovative Research for Market Transfer"- MEMORI, Grant Agreement No. 265132) works to supply the conservation market with a new innovative measurement technology for indoor assessment of air quality in cultural heritage buildings. A marketing strategy and business plan will be developed for the MEMORI technology to reach the users and the project will improve the understanding of the degradation of organic materials caused by exposure to organic acids. MEMORI will also undertake research to improve measures for mitigation of degradation caused by organic acids inside enclosures. Results from the project will be integrated into present best practice in preventive conservation strategy. An integral part of MEMORI is the end user group that follows and help to direct the work.

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## TWO INTEGRATED DIGITAL LIBRARIES FOR KNOWLEDGE AND ICONOGRAPHY OF ORTHODOX SAINTS

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### Abstract:

The paper presents the work done within the Encyclopedia Slavica Sanctorum project for building a digital library of medieval and early modern Bulgarian texts about saints in combination with ethnological data and some visual sources. The paper presents the Encyclopedia Slavica Sanctorum environment, its functional specification and software implementation. The paper also presents the integration between the Encyclopedia Slavica Sanctorum and the Virtual Encyclopedia of the Bulgarian Iconography, a digital library keeping rare specimens, private collections of Orthodox icons, wall-paintings and other iconographical objects, selected from hard-to-reach storages, distant churches, chapels, and monasteries, objects in risk environments or unstable conditions.

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## HERITAGE-ORIENTED SPATIAL DATA INFRASTRUCTURES IN SPAIN: WAITING ON THE WORLD TO CHANGE

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### Abstract:

The paper makes an overview on the current state of GIS-based initiatives to share Heritage information in Spain, pointing at some of the issues that explain why this field is still greatly under developed, with the exception of a few regions: fragmentation or arguable policies about data sharing. Contrastingly, demands for a wider access to Heritage data are increasing, and unofficial agents, both from the academic realm or just from the civil society, have begun to fulfill those demands with the development of different web based services. Some examples of these are also presented. The paper ends with some remarks on the current situation and perspectives on future developments.

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## EGI: AN OPEN E-INFRASTRUCTURE ECOSYSTEM FOR THE DIGITAL EUROPEAN RESEARCH AREA AND THE HUMANITIES

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### Abstract:

The European Grid Infrastructure (EGI) is a federation of computing resource providers set up to support collaborative and innovative research projects from all fields of science. Building on a decade of experience in managing distributed computing resources, EGI is a valuable asset for modern science. Expanding the user base, in both absolute numbers and diversity is a key priority for the sustainable future of the e-Infrastructure. EGI is therefore keen to engage with scientists working in the Humanities disciplines, which are currently under-represented in the EGI ecosystem. This paper introduces EGI, its mission and strategy and explores possible avenues of collaboration with the Humanities scientific community.

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## **A METHODOLOGY TO MONITOR THE POLLUTION IMPACT ON HISTORIC BUILDINGS SURFACES: THE TEACH PROJECT**

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### **Abstract:**

The available scenarios of pollutant trends in Europe indicate that the effect of industrial, domestic and transport emissions on corrosion and soiling will continue to constitute a serious threat to Cultural Heritage. Such effects require improved methods for a more accurate diagnosis, monitoring and assessment of the damage. Within this framework, the monitoring methodology applied within the European project TeACH (Technologies and tools to prioritize assessment and diagnosis of air pollution impact on immovable and movable cultural heritage) (2008-2012) allows to assess the impact of the main pollutants on historic buildings. As a part of this approach, a new kit able to monitor the environmental parameters critical for the conservation of architectural surfaces and to evaluate the related damage in terms of surface color change was developed. The monitoring methodology described in the present paper has valuable application potential in the definition of preventive conservation strategies for a wide range of heritage assets.

## **MACEDONIA FROM FRAGMENTS TO PIXELS: A PERMANENT EXHIBITION OF INTERACTIVE SYSTEMS AT THE ARCHAEOLOGICAL MUSEUM OF THESSALONIKI**

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### **Abstract:**

The theme of this paper is an exhibition of prototypical interactive systems with subjects drawn from ancient Macedonia, named "Macedonia from fragments to pixels". Since 2010, the exhibition is hosted by the Archaeological Museum of Thessaloniki and is open daily to the general public. Up to now, more than 165.000 people have visited it. The exhibition comprises 7 interactive systems which are based on some research outcomes of the Ambient Intelligence Programme of the Institute of Computer Science, Foundation for Research and Technology - Hellas. The digital content of these systems includes objects from the Museum's permanent collection and from Macedonia.



## **IDENTIFYING SEMANTIC RELATIONSHIPS IN DIGITAL LIBRARIES OF CULTURAL HERITAGE**

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### **Abstract:**

In this paper we deal with the interoperability of digital libraries concerned with identification of hidden or invisible relationships within various data sources. By means of semantic processing and reasoning techniques we attempt to find the answers to sophisticated questions which are sometimes difficult also for human experts. Our initial interest was to analyze data from art museums, where we have found interesting information concerning artists, their life and work. We proceeded further to the national library databases, where we have been looking for additional information about these artists and we performed further investigation. The next step was to enrich existing records by additional useful information using web services of other libraries. By analyzing these enriched data, we could identify semantic relationships among the records, which can help us understand how these artists were influenced by each other, we can find an artist that performed in the same area as the given one, etc. This paper describes our method of processing core data, identification of semantic relationships and the experiments we have performed.

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## THE SAURUS PROJECT: DESIGN OF NEW AUTONOMOUS UNDERWATER VEHICLES FOR DOCUMENTATION AND PROTECTION OF UNDERWATER ARCHAEOLOGICAL SITES

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### Abstract:

The Thesaurus Project, funded by the Regione Toscana, combines humanistic and technological research aiming at developing a new generation of cooperating Autonomous Underwater Vehicles and at documenting ancient and modern Tuscany shipwrecks. Technological research will allow performing an archaeological exploration mission through the use of a swarm of autonomous, smart and self-organizing underwater vehicles. Using acoustic communications, these vehicles will be able to exchange each other data related to the state of the exploration and then to adapt their behavior to improve the survey. The archival research and archaeological survey aim at collecting all reports related to the underwater evidences and the events of sinking occurred in the sea of Tuscany. The collected data will be organized in a specific database suitably modeled.

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## A METHODOLOGY FOR INTEGRATIVE DOCUMENTATION AND CHARACTERIZATION OF CULTURALLY IMPORTANT STATUES TO SUPPORT SEISMIC ANALYSIS

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### Abstract:

Motivated by observations from recent earthquakes, and in an effort to understand the seismic response of culturally important statues, a methodology is proposed for an integrative approach to document culturally important statues, which combines both engineering parameters and visualization. Documentation includes surface and material, geometric and visual, and boundary condition surveys as well as three dimensional digital reconstructions. Reconstruction facilitates attainment of geometric and mass



properties using data from terrestrial laser scanning and structure-from-motion three dimensional reconstruction. The proposed methodology is applied to a representative number (24) of statues in Florence, Italy using a field survey in 2011. The majority of the statues are determined to be freestanding on rough pedestals with high aspect ratios and limited motion restriction. Using the documentation and simplified characterization obtained from these studies, it is envisioned that the seismic vulnerability and response of statues may be estimated, knowing the statues' locations and anticipated earthquake demands at the site (building or free-field).

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## CHARACTERIZING CRACKS IN THE FRESCOES OF SALA DEGLI ELEMENTI WITHIN FLORENCE'S PALAZZO VECCHIO

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### Abstract:

On the upper floors of the *Palazzo Vecchio's* southeast corner, *Saladegli Elementi* is experiencing significant cracking on its interior walls creating extensive fresco damage. The location of *Sala degli Elementi* is the nearest to the corner of *Via della Ninna* and *Via dei Leoni*. The *Palazzo Vecchio* is an historical building where many of the walls support culturally important frescos. The cracks in the frescoes need to be assessed and understood such that the mechanisms for their development are known to assist in the preservation. The history of continued construction activity of the *Palazzo Vecchio* has resulted in extensive building discontinuities and use of different building materials. As a result, the age of construction varies, leaving an uncertain state of its present day condition. Due to the damage of the frescoes and known structural differences and modifications, a field survey is performed to assess the state of cracking.

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## COSCH - COLOUR AND SPACE IN CULTURAL HERITAGE, A NEW COST ACTION

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### Abstract:

True, precise and complete documentation of artefacts is essential for conservation and preservation of our cultural heritage (CH). By ensuring access to the best possible documentation of artefacts this COST Action contributes to the enhanced understanding of material CH and help its long-term preservation. Documentation of CH involves researchers, scientists and professionals from multiple disciplines and industries. There is a need to promote research, development and application of non-contact optical measurement techniques (spectral and spatial) – adapted to the needs of heritage documentation – on a concerted European level, in order to protect, preserve, analyse understand, model, virtually reproduce, document and publish important CH in Europe and beyond. Research in this field typically relies on nationally-funded projects with little interaction between stakeholders. This Action will provide a stimulating framework for articulating and clarifying problems, sharing solutions and skills, standardising methodologies and protocols, encouraging a common understanding, widening applications and dissemination. The Action will foster open standards for state-of-the-art documentation of CH. It will simplify the usage of high-resolution optical techniques in CH and define good practice and stimulate research.



## **ARCHITECTURAL PHOTOGRAMMETRY BY NON-METRIC CAMERAS: CAD-BASED 2D DRAWING OF FACADES FROM RECTIFIED PHOTOS**

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### **Abstract:**

Architectural photogrammetry enhances documentation of historical buildings. Image rectification can generate an Ortho-photo from flat surfaces of sophisticated shapes of historical facades. Consequently the rectified photo can be scaled and a digit vector can overlay it to prepare 2D architectural drawings. As part of digital documentation of Masoudiyeh Historical Palace in Tehran, we used a low cost photogrammetry system (PhotoModeler) to record the facades of Divankhaneh Building with ornaments such as parget or damages such as cracks. We implemented the tool's self-calibration function for verifying the parameters of a non-metric camera. We photographed the facades according to a sketched geometry. Consequently we prepared several rectified photos and completed the façade's CAD-based 2D drawings.

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## **THE EUROPEANA NEWSPAPERS – A GATEWAY TO EUROPEAN NEWSPAPERS ONLINE**

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### **Abstract:**

The paper introduces the Europeana Newspapers project, funded by the European Commission. It describes its potential social impact on examples of stakeholders groups and the way of the project coordination, together with description of project activities. It also provides an overview of technologies used within the project. The paper also briefly gives an idea on the future outlook and activities of the project



## **PANNA PROJECT – PLASMA AND NANO FOR NEW AGE SOFT CONSERVATION. DEVELOPMENT OF A FULL-LIFE PROTOCOL FOR THE CONSERVATION OF CULTURAL HERITAGE.**

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### **Abstract:**

EU PANNA project started on November 2011 and aims at integrating a novel atmospheric plasma technique for surface cleaning and two innovative coating typologies (self-diagnostic protective coatings and identification marker coating) in a full-life protocol spanning surface cleaning, deposition of coatings and their complete removal. The validation of the protocol will be achieved through the cooperation between conservation scientists and technological companies. In the project, the development and testing of the protocol will be performed on two categories of substrates: metals (bronze and silver) and stone and stone-like materials (limestone, sandstone and wall paintings). The development will be performed on laboratory prepared samples (dummy or replica or mock ups) and also on real objects.

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## **A PROPOSAL FOR MOBILE GAME BASED LEARNING TO PROMOTE KNOWLEDGE OF THE A FAMOSA FORTRESS**

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### **Abstract:**

The A Famosa fortress in Melaka is an important historical site which offers a significant insight into the history of Melaka and Malaysia. A research project was carried out over the period between 2007 to 2010 in order to develop a conjectural layout of the original fortress with the aim of developing a 3D model for use in future conservation and heritage projects. Based on the results of an evaluation of the final output, it was found that the 3D model had the potential to improve users' knowledge of the fortress. From this context, the current research is aimed at an investigation of how a Game Based Learning methodology could be utilised to support an enhanced learning environment in respect of delivering accessible knowledge regarding the site and its heritage. The objective of this project is to present the history of A Famosa in a more effective and exciting way. The 3D model of the fortress will be integrated into online mapping and a game storyline will be developed. Multimedia elements such as audio, video and text will be embedded in the game-play. We will propose how this application is structured, its game play, features and future recommendations. In addition, illustrations and a proposal as to how this application could be implemented on site are also presented.

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## **AN INTEGRATED MANAGEMENT SYSTEM FOR HISTORICAL BUILDINGS: THE CASE OF DIHUA HISTORICAL STREET DISTRICTS IN TAIWAN**

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### **Abstract:**

Dihua Street, a celebrated historic district in Taiwan, was chosen as the subject of the current study. Through three-dimensional (3D) modeling, namely point clouds and reverse engineering, featured in 3D laser scanners, the researcher restored the appearance of cultural heritage and enhanced authenticity in historical preservation. Besides, on the basis of the Taiwan Cultural Heritage Conservation Law, the researcher planned the framework of a digital database and developed a safety monitoring system and a management platform for 3D digital data. As a result, they serve as an application of digital preservation of historical sites in Taiwan as well as contribute to the integrated management of historical rehabilitation.

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## ADAPTIVE AUGMENTED REALITY FOR CULTURAL HERITAGE: ARTSENSE PROJECT

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### Abstract:

The paper presents the new concept of Adaptive Augmented Reality (A<sup>2</sup>R), employed within the context of the creation of an AR guide for the museum visit, that is being developed in the context of an EU research project. The main objective of the project is to provide a prototype that enables a personalized experience for every individual visitor by adapting to the psychological state of the visitor the content presented through an augmented reality museum guidance system.

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## COMPUTED TOMOGRAPHY STUDIES APPLIED TO POLYCHROMED SCULPTURE. THE MAKING PROCESS IN THREE DIFFERENT TIMES

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### Abstract:

The Instituto Valenciano de Conservación y Restauración de Bienes Culturales (IVC+R), in collaboration with the Servicio de Restauración de la Diputación de Castellón and Consorcio Hospitalario Provincial de Castellón, is developing a line of research in polychromed sculpture by medical computed tomography (CT). Using this technique, the making process, degradation and structural diagnostics of different sculptures from different periods, are being studied. Furthermore, the information given by CT and is an important support in the intervention and restoration processes. We analyzed 20 wood sculptures from different times. In this paper we show some examples. The ultimate aim of the project is being carried out is to recover, document and classify the different making process of sculpture over time and in different workshops.

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## THE EUROMED 4 PROJECT “ELAICH”: E-TOOLS FOR A TEACHING ENVIRONMENT ON EU MEDITERRANEAN CULTURAL HERITAGE.

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### Abstract:

The world’s cultural heritage is frequently subject to misuse and vandalism by the general public. However, while a lack of knowledge, unawareness of the heritage values and the importance of its preservation are demonstrated in the real “tangible world” of historic monuments and sites, the general public, and especially youth, have proved to be sophisticated visitors to “intangible” virtual reality. The Euromed Heritage 4 Project “ELAICH” (Educational Linkage Approach In Cultural Heritage) provided an e-tool for increasing “*awareness of the importance of Cultural Heritage ... and its conservation by ... the general public*” - the eLAICH Educational Toolkit, which was developed and made accessible to the general public through the eLAICH e-learning platform, using Learning Management System (LMS), Content Management System (CMS) and Information and Communication Technologies (ICT). This paper provides an overview of the project’s organization, computerized support, and e-results.

## PROTOCOLS AND ASSISTED TOOLS FOR EFFECTIVE IMAGE-BASED MODELING OF ARCHITECTURAL ELEMENTS

Nicolas Nony<sup>1</sup>, Livio De Luca<sup>1</sup>, Aymeric Godet<sup>1,2</sup>, Marc Pierrot-Deseilligny<sup>2</sup>,  
Fabio Remondino<sup>3</sup>, Alexandre Van Dongen<sup>1</sup>, Mauro Vincitore<sup>1</sup>

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<sup>2</sup>MATIS, IGN Paris, France

<sup>3</sup>3D Optical Metrology (3DOM), Bruno Kessler Foundation (FBK), Trento, Italy

### Abstract:

Domains related to documentation, conservation, restoration and enhancement of heritage objects use more and more digital 3D surveying. Image-based methods, due to their low-cost and accessibility, constitute an interesting alternative to traditional laser scanning surveys. However, these tools, often based on computer vision methods, are either difficult to use or not sufficiently accurate for scientific purposes. Within this context, this paper presents a photogrammetric pipeline in order to prove every heritage agent with a suitable and efficient solution for digitizing architectural and archaeological elements, taking into account the entire process, from the acquisition to the 3D result.



## **MODELLING THE PAST: DIGITAL TECHNOLOGIES AND EXCAVATIONS IN POLIS, CYPRUS**

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### **Abstract:**

This research and educational project aimed to create virtual 3-D walkthroughs of four principal buildings from the Princeton University excavations at Polis Chrysochous, Cyprus. The structures date from the Cypro-Archaic period beginning in the 7th century BCE to the Late Antique period of the 7th century CE. The project was conceived together with a special exhibition, a long-term exhibition in Cyprus, and a presentation on the web. In a joint Computer Science and Art and Archaeology seminar in the spring of 2012, students created reconstructions and populated them with 3-D scanned objects. The challenge was to find appropriate visual metaphors for conveying uncertainty and change in these 3-D visualizations as well as to create a computer-animated movie focused on the buildings, their spatial relationships, and possible reconstructions consistent with the excavations.

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## **THE USE OF GIS IN THE NATIONAL SYSTEM FOR CULTURAL HERITAGE MANAGEMENT AND DISSEMINATION TO THE GENERAL PUBLIC IN NORWAY: CASE STUDY: THE HERITAGE MANAGEMENT DATABASE “ASKELADDEN” AND THE SYSTEM FOR DISSEMINATION TO THE PUBLIC, “KULTURMINNESØK”**

Evy Berg

### **Abstract:**

This paper summarizes the use of a GIS-platform as a platform for cultural heritage management of sites, buildings and monuments in Norway. The purpose of this paper is to describe the database system for managing cultural heritage monuments and sites. The system uses both database and GIS functionality, and it aims to integrate all data relating to immovable sites and monuments that are in some way protected by the Cultural Heritage Act. . GIS functions and the need for standards will be focussed in the paper. The public version of the database will also be described.

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## **HISTORIC ENVIRONMENT AND INSPIRE – A VIEW FROM SCOTLAND**

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### **Abstract:**

INSPIRE provides a roadmap for the publication of metadata, view and download services for a wide range of spatial information. Although an ideal tool for promoting data about the historic environment, in most instances the timetabled approach of public sector organizations focuses on publishing statutory data. RCAHMS has adopted the principles behind INSPIRE to publish information about the wider historic environment and the specialist datasets it curates. However, much archaeological information is created outside the public sector by academia and commercial archaeological companies. There is thus a need to encourage these primary data creators in contributing to archaeological Spatial Data Infrastructures (SDIs). Online reporting, through OASIS, offers a



potential solution through the systematic reporting of archaeological fieldwork, including specialist remote sensing techniques via online forms. The challenge remains to establish a common infrastructure, agreed terminologies and to encourage the archaeological community to value spatial data.

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## DIGITIZATION OF CYPRIOT FOLK DANCES

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### Abstract:

In this article an initiative to preserve the Cypriot folk dance heritage is reported. The project aims to create a publicly accessible digital archive of folk dances that does not only include video recordings, commonly used to document dance performances. In addition to rare video material held by local cultural institutions, state-of-the-art motion capture technologies are utilized to record and archive high quality motion data of expert dancers performing these traditional dances. Apart from the goal of preserving this intangible cultural heritage by digitizing it, the project is interested in increasing the awareness of the local community to its dance heritage. To achieve this a 3D video game for children is developed to teach these folk dances to the younger generations.

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## RECONSTRUCTION OF EVERYDAY LIFE IN 19TH CENTURY NICOSIA

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### Abstract:

This paper presents the first stages of a larger project concerning the study and realization of a 3D interactive environment of everyday life in 19th century Nicosia. The presented study involves the recreation of the built urban environment (i.e. the architecture of the city) based on historic and archival information taken from the Land Registry documentations taking place on the island at the end of the Ottoman era by British engineers.



## FROM REAL TO VIRTUAL RAPID ARCHITECTURAL PROTOTYPING

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### Abstract:

Can greater visual realism of a real-time architectural virtual walkthrough achieve similar high sensory impact, or qualia, as a fabricated 3D printed scale model of an urban landscape? The aim of this project is to answer that question by allowing a real existing city heritage landscape during a large urban planning project to be 3D modeled and subsequently be studied via a dual output: a fabricated real, physical scale model based on a latest high quality color 3D printer and an equivalent 3D virtual walkthrough of enhanced real-time visual realism based on a recent game engine. Conclusions of this experiment and user study suggest that a virtual, interactive simulation based on specific latest real-time rendering algorithms can indeed convey a similar user experience and feeling of “presence” that an equivalent architectural scale model offers, regarding fast appreciation of both space and structure.

## 3D MULTI-SCALE SCANNING OF THE ARCHAEOLOGICAL CAVE “LES FRAUX” IN DORDOGNE (FRANCE)

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### Abstract:

The archaeological cave « Les Fraux » (Saint-Martin-de-Fressengeas, Dordogne) forms a great network of galleries, characterized by the exceptional richness of its archaeological Bronze Age remains such as domestic fireplaces, ceramic and metal deposits, fingerings incised in the clayey-walls. The cave has been closed according to the collapse of its entrance, at the end of the Bronze Age. The study in progress takes place in a new kind of tool founded by the Institute of Ecology and Environment (INEE): sites dedicated to the study of global ecology. In that framework, we develop new methods of data acquiring based on 3D contact-free measurement techniques, according to an interdisciplinary way. A partnership among archaeologists and surveyors from INSA allow the 3D recording and modelling of the global volume cave. In the same time, we implement the high resolution recording of parietal representations (engravings and fingerings). The aim of this paper is focusing on the complementarity of data which are produced by the different scales of 3D recording used in the cave. Another purpose is to issue a statement of the different 3D technologies tested in “Les Fraux”. Finally, we propose to start a discussion about the way we try to produce an accurate 3D documentation and adapted to the researchers needs.



## THE CULTURA PROJECT: SUPPORTING NEXT GENERATION INTERACTION WITH DIGITAL CULTURAL HERITAGE COLLECTIONS

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### Abstract:

In recent years there has been a marked uptake in the digitisation of cultural heritage collections. Though this has enabled more sources to be made available to experts and the wider public, curators still struggle to instigate and enhance engagement with cultural archives. This is largely due to the monolithic nature of many digital archives; the challenge of understanding large collections, especially if the language is inconsistent; and because users vary in expertise and have different tasks and goals that they are trying to accomplish. This paper describes CULTURA, an FP7 funded project that is addressing these specific issues. The various technologies and approaches being used by CULTURA are discussed, along with the lessons learnt thus far.

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## DEVELOPMENT OF A LOW ALTITUDE AIRBORNE IMAGING SYSTEM FOR SUPPORTING REMOTE SENSING AND PHOTOGRAMMETRIC APPLICATIONS 'THE ICAROS PROJECT' INTENDED FOR ARCHAEOLOGICAL APPLICATIONS IN CYPRUS

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### Abstract:

Research has found that air borne and satellite sensors are the most widely used method for detecting archaeological remains. The study examines the use of a low altitude airborne system incorporating a helium balloon, spectroradiometer, digital and thermal camera in order to measure the reflectance values. This study integrates the use of spectroradiometers, digital cameras, NIR filters and balloons in archaeological sites to measure the reflectance values and detect subsurface archaeological remains. It was found that reflectance values increase according to altitude. This study is part of the ICAROS project, which is under the program "Development of a low altitude airborne remote sensing system for the processing of satellite data for archaeological investigations" and is funded by the Research Promotion Foundation.



## **THREE-DIMENSIONAL VIRTUAL MODELS FOR BETTER COMPREHENSION OF ARCHITECTURAL HERITAGE CONSTRUCTION TECHNIQUES AND ITS MAINTENANCE OVER TIME**

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### **Abstract:**

The paper discusses the use of innovative surveying technologies and modelling techniques not only in terms of digitalization and documentation of cultural architectonic heritage but in function of management and monitoring of buildings and their behaviour over time. The final aim is to identify elements that can contribute to elaborate a shared methodology for 3D content model generation. High precision survey (Terrestrial Laser Scanner, Photogrammetry, Multispectral data integration) was used for the investigation of several vault structures in order to carry out maintenance and structural stability analysis, in support to the comprehension of the behaviour of architectural elements within the whole building organism. Object Content Model and the logic of Building Information Models (BIM) have opened interesting scenarios to be investigated, with a possible large contribution of virtual models to the monitoring and to the life cycle management within the overall framework of planned conservation for architectural heritage.

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## **CONTEMPORARY MUSEUMS IN AN AGE OF MIGRATIONS: THE REINTERPRETATION OF EUROPEAN CULTURAL HERITAGE**

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### **Abstract:**

Looking at European cultural heritage from the perspective of the twenty-first century, the question of its interpretation and reinterpretation is essential. This especially regards the different ways that societies and individuals use museums or other cultural institutions for the conservation and transmission of knowledge. The MeLa project brings a new concept to the core of this cultural problem. *Age of migrations* is a key term for thinking through planetary processes that reveal the deep refashioning of economic, cultural and political spheres under the impact of the accelerated mobility of goods, people, ideas and knowledge. In this context, a reconfiguration of existing museums is needed, especially for museums that are devoted to new themes and topics emerging in this contemporary age, when the great narratives of the modernity have left a multiplicity of stories and voices. The four-year interdisciplinary research MeLa aims at envisioning one such development of contemporary European museums.

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## A CH BASED INTEGRATIVE MANAGEMENT FRAMEWORK ON THE VALUE PRIORITY ASPECT

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### Abstract:

Historic monuments preservation is not only an international trend in the 21st century, but one of the major policies of every country. In the past, it was once categorized under the disciplines of literature, history, artistry, and engineering techniques. Following the advances of digital technology, applications of the technology have been widely adopted by many different fields. However, the use of this technology is rarely included in the historic monuments preservation and integration study. The purpose of this project is to show how the advanced technology can be fully utilized in establishing a more effective way to preserve historic monument for future reuse. This paper is to report a preliminary outcome for a project titled “A CH based integrative management framework on the value priority aspect,” which mainly aims to establish an information exchange platform together with a mobile mechanism for the management of historic monuments and reuse from the perspective of the governmental point of view.

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## THE CATACOMBS OF SAN GIOVANNI IN SYRACUSE: SURVEYING, DIGITAL ENHANCEMENT AND REVITALIZATION OF AN ARCHAEOLOGICAL LANDMARK

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### Abstract:

This study is a cross-disciplinary research carried out by archaeologists, engineers and architects aimed at the knowledge and enhancement of the San Giovanni catacombs complex in Syracuse. The study uses the most innovative 3D surveying and virtual reproduction technologies and methodologies in order to broaden the understanding of the archaeological site's most peculiar features. The digital 3D models of the rooms studied here can be used to enhance the visiting experience and the online presence of the archaeological complex.

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## ARCHES: AN OPEN SOURCE GIS FOR THE INVENTORY AND MANAGEMENT OF IMMOVABLE CULTURAL HERITAGE

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### Abstract:

The Getty Conservation Institute (GCI) and World Monuments Fund (WMF) are collaboratively developing for the international heritage field an open source, web-based GIS purpose-built for inventorying and managing immovable cultural heritage. GCI-WMF will release an “alpha” version of the Arches system as an open source project in December 2012, and a more advanced “beta” version in spring 2013. In parallel to its development for the heritage field, Arches is being customized for use by the City of Los Angeles, USA. It incorporates widely adopted standards (for heritage inventories, heritage data, and information technology) so the core system will offer a solid foundation that heritage institutions may customize to meet their needs. As an open source system, Arches will be available at no cost, and will allow adopters to share resources to enhance it in mutually beneficial ways as well as maintain it.

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## THE GEOMETRY BEHIND THE “FONTANA DI SALA GRANDE” A CASE STUDY OF REVERSE MODELING

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### Abstract:

The work presented here will show the story, the procedures and the methodology operated by our team during the 2010 to rebuild the fountain to the original composition, digitally working of the remains and reconstructing the missing parts, to reach the final result represented by the current, permanent, exhibition of the complete group in the Bargello Museum. Reverse modeling is a special technique implemented in pipelines from the field of design and mechanic engineering and it is aimed at converting meshes from 3D laser scanner in NURBS models. These techniques played an essential role for the reassembling process described in this paper: the missing arch that once connected the statues belonging to the fountain was re-designed inside an interdisciplinary framework where different skills allowed the solving of a difficult and delicate restitution.



## RECONSTRUCTION OF MONUMENTAL PAINTING OF THE CHURCH ON NEREDITSA HILL IN THE CITY NOVGOROD THE GREAT. METHODOLOGY OF PAINTING AND VIRTUAL RECONSTRUCTION COMBINATION

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### Abstract:

There are many architectural monuments that cannot be restored due to different reasons, such as difficulty and complexity of the work or lack of information about the object. Saint-Petersburg State University developed a method of restoration of partially or completely lost monumental paintings. New methodology was applied to fresco paintings of the Church Spas-na-Nereditse in the city Novgorod the Great, which were almost completely destroyed during the Second World War. The extant parts consist of 325,000 pieces and its manual restoration is still very far from completion. In the process of virtual reconstruction researchers have used two methods: computer-based reconstruction and analog pictorial reconstruction. The first method provides plausibility, whereas the second method helps us to simulate the ancient process of painting, to convey the artist's style, reproduce the form, direction and strength of the artist's touch. The methodology may open new possibilities for the restoration of other fresco ensembles.

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## THE REINTEGRATION OF URBAN LACUNAS AT CASTELVECCHIO CALVISIO (AQ) AFTER THE 2009 EARTHQUAKE: THE USE OF GIS 3D AS A PROJECT MONITORING TOOL

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### Abstract:

The paper outlines experimental work undertaken using GIS 3D aimed at verifying the results of a highly complex project, namely the reintegration of architectural and urban lacunae in the historic center of Castelvecchio Calvisio. The research project was undertaken in view of the critical conditions found during preparation of the Reconstruction Plan in the aftermath of the L'Aquila earthquake of April 2009.

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## MICROMETER MULTIREOLUTION LASER SCANNING OF A RENAISSANCE MEDALLION

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### Abstract:

A lead medal attributed to Antonio Averlino known as Filarete, with a portrait of Caesar, is preserved in the Gabinetto Numismatico of the Museo Civico Correr of Venice. This *unicum* presents oxidation coatings on both sides, so it was included in a restoration project of the Foundation of the Venetian Civic Museums. Through the acquisition of the object with high resolution scanning it is possible characterize the changes caused by oxidation coating, identify the particular style and mapping at micrometer scale the areas of degradation. For this purpose, two different laser scanning instruments are used in order to compare different resolution and accuracy and to produce a multi resolution model. The medallion was also replicated using rapid prototyping with ZPrinter 450 machine.



## AUTOMATED VIEW INTEGRATION TECHNIQUES FOR NUMEROUS 3D CLOUDS OF POINTS

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### Abstract:

This paper presents techniques used for integrating numerous 3D directional measurements obtained during digitization of various classes of works of art, with dimensions up to 2000mm x 500mm x 500mm. Most of those measurements are of very high resolution (up to 10000 points per mm<sup>2</sup>) and small volume (50 mm x 50 mm x 20 mm). In this paper, a hybrid method used for integrating those measurements into complete model is described. It is based on geometrical, color and texture features of digitized surface. Global relaxation, performed as a final stage, ensures uniform distribution of fitting errors between measurements within the whole model.

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## SCIENCE IN AID OF EXPERT OPINION: A TELL-TALE ON DISPUTED ARTWORKS

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<sup>3</sup>National Gallery - Alexandros Soutzos Museum, Michalakopoulou 1, Athens, Greece,  
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<sup>4</sup>ARTGNOMON, [www.artgnomon.com](http://www.artgnomon.com),

<sup>5</sup>TAURUS Secure Solutions Ltd, Pipinou 22, 11257 Athens, Greece,  
[www.taurus.com.gr](http://www.taurus.com.gr)

### Abstract:

Nowadays the increase demand for loaning art objects as well as safety, ethical, economical and security issues are forcing curators and conservation experts to undertake challenging and disputable decisions in regards of issuing an artwork accreditation. On the other hand scientific analysis and modern tools in artwork conservation offer a powerful source for objective multidisciplinary choices serving and safeguarding an expert's decision. Hence, strong initiatives and innovative actions are important to be taken to ensure that modern technology serves for cases of dispute, damage, fraud, or mistreatment during transportation of Cultural Heritage. Therefore the paper presents some current results in originality assessment and results from the development of an anti-fraud concept based on an innovative approach of works of art, and application of methodologies and instrumentation. The authors' aim and prior consideration is to respond to such critical aspects of increased importance in cultural heritage preservation, among which to secure proper treatment, to assess possible damage and to fight fraud actions. The paper introduces for the first time to our knowledge the idea of fraud-fighting with development of dedicated "ultimate documentation UD"™.

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## NATURAL LIGHTING AND MEDIEVAL GLASS – SCIENTIFIC DATA ACQUISITION, METHODOLOGY AND PHYSICALLY BASED RENDERING

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### Abstract:

Fundamental optical properties of materials are described by intrinsic parameters that can be concentrated in only one notion: the components of the complex dielectric tensor. Such a notion is relevant in any cases and we shall give examples of applications in the cultural heritage field. Modern glasses characterization and ancient or medieval glasses studies are described in terms of the general methodology exposed. After a great success in application to metals and alloys last 15 years, the limits and advantages of the ellipsometric measurements are described. The interaction of light with materials defined by their intrinsic (fundamental optical properties) and extrinsic (mainly geometrical whatever the scale of observation) properties is the internal engine of the simulation software. The scientific methodology is then called “OCRE”, Optical Constants for Rendering Evaluation. The computed images inserted in the text are obtained with the free and open-source spectral software *Virtuelium*, developed at EcoleCentrale Paris.

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## SOLVING THE CENTRE–PERIPHERY PROBLEM IN CULTURAL HERITAGE BY MEANS OF SITUATED SIMULATIONS

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### Abstract:

In cultural heritage and the museum sector there has always been a conflict between centre and periphery. Relics are removed from their native, often peripheral site, and collected and stored on central locations. There, only to a limited degree, are they made available for access and public display. In the following we discuss and demonstrate how far we have come in solving this Centre–Periphery Problem. Drawing on our own examples and experiments we present experiences with indirect augmented reality, which we have named *situated simulations*.

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## AN INFORMATION SYSTEM TO ANALYZE CULTURAL HERITAGE INFORMATION

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### Abstract:

Managing information related to cultural heritage sites is an important task and much work has been devoted to developing special purpose document management systems. These systems are able to store and retrieve large amounts of documents; however, while this is adequate for some purposes, it is not sufficient for research and conservation work. Researchers need to determine relationships between data, and the most important relationships in cultural heritage information are spatial relationships. A new kind of information system is therefore needed, in which the 3Drepresentation of an object is a blackboard on which all data is represented. This paper proposes the concept of Cultural Heritage Information Systems, and presents our implementation of the system. An example application illustrating the use of the system is also presented.

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