



**Valorisation of EU project results in the area of
access to cultural content**

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D.1.2 – Stock-taking Analysis

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Executive Summary

The eCultValue project examines and encourages new ways to access Cultural Heritage (CH) and experiences offered by cultural resources through the use of new technologies. In order to successfully address these objectives, it is necessary to capture both on-going efforts and existing technologies in EC-funded research projects, national and individual initiatives related to CH.

This deliverable focuses on this goal by presenting the existing technological offer and the status of deployment.

Chapter 1 presents the aims and objectives of the report, while chapter 2 offers the necessary background information about the methodology. In the next two chapters, we introduce, in alphabetical order, the available communication technologies for cultural heritage institutions which are outcomes of EC-funded projects and national initiatives, respectively. Finally, Chapter 5 includes the conclusions drawn on the basis of the presented data.

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1 Aims and Objectives

The main aim of this deliverable is to offer an overview of available technologies and services for Cultural Heritage organizations, intending to become a concrete and useful instrument for users that is in charge of adopting them (museum directors, curators, registrars, educators, librarians), but also for broader groups of people involved in the management of Cultural Heritage (public administrations, local authorities, exhibition managers).

It is not within the scope of this report to present the efforts coming from major and well known museums and CH institutions. The focus of the deliverable is rather to capture the state-of-the-art in Europe bringing to light worth-mentioning efforts and create a point of reference for discovering common patterns, issues identified, peculiarities of specific tools, or countries and also promote the strengths and potential of such efforts. In this context, the report presents the key findings of our research in available technologies and outlines on-going efforts in EC-funded research projects, national initiatives and efforts undertaken by individual institutions, aspiring to unveil “hidden” champions existing in Europe and inspiring success stories of less-known individuals and smaller institutions.

2 Background information

2.1 Methodology

To achieve the aforementioned goals, we carried out a research based on four major sources:

- a. **Desktop research** that refers to projects outcomes, seeking facts, general information, etc. that have been published or exist in public documents. All the above were obtained from the official project websites, factsheets and public deliverables
- b. **Gathering and combining information** coming from links and/or already existing networks with other projects. Likewise, partners’ countries have been the springboard, not only because of ease in collecting related data and “proximity” to data and information, but also due to the fact that this approach ensures that the wide spectrum of examples and efforts has been captured

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c. **Exploited interviews and people we met** in the framework of our previous report, D.1.1 – Interview Summary Report, with technology providers and CH stakeholders. The knowledge we gained was really valuable for this step of the project and, therefore, helped us collect and evaluate the innovation efforts in CH environments

d. Exploited the outcomes of the two **eCult Experts Group** meetings which provided examples of available technologies and also performed a preliminary assessment.

3 Available technologies for Cultural Heritage institutions

3.1 On-going efforts in EC-funded initiatives

In the following we present some of the key efforts that have been funded by the DG Connect in the past years, through the Calls 3, 6, 7, 8 and 9. We would like to stress the fact that there are a number of additional interesting projects which have not been included in this presentation, taking into account that they are only in close proximity and not in the direct focus of our research (e.g. tranScriptorium, PHENICX, REPLAY, SUCCEED, etc).

Artsense

www.artsense.eu

ARtSENSE (Augmented Reality Supported adaptive and personalized Experience in a museum based on processing real-time Sensor Events) was a three-year project implicating seven technological and three museum and cultural heritage partners.

The goal of ARtSENSE was to examine the potential of Augmented Reality for the museum and gallery experience. The project introduced new wearable technologies for sensing continuously and non-intrusively the user's context (visual context, eye-tracking, audio tracking, 3D spatialisation, physiological sensing) in order to determine the user's current interests. With this technology solution, the visitor is equipped with a pair of AR see-through glasses able to track his or her gaze and eye-movements. The visitor can use natural gestures to interact with the multimedia content delivered to the view through the glasses in the form of virtual overlays. Audio augmentations were also provided, as well as 3D sound effects, while the acoustic and affective attention of the visitor is continuously monitored through the use of audio and acoustic sensors. Thus the visitors have the feeling

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that physical objects are directly responding to them; the artworks become active artefacts that react on users' attention and engagement levels. This led to the new generation of mobile museum guides based on the novel concept coined by the consortium, called Adaptive Augmented Reality (A2R).

The ARtSENSE prototype was released and publicly presented in January 2012 and includes following basic features:

- artwork recognition,
- user position estimation,
- acoustic monitoring,
- complex event processing,
- gesture recognition,
- AR overlay, and
- acoustic information.

The ARtSENSE prototype uses glasses that allow artwork recognition and user tracking, i.e. tracking the position of the user and the direction that the user is looking at. Microphones attached to a head band allow acoustic monitoring of the environment. The glasses are used for displaying text, images and videos and acoustic output to headphones. The user can also interact with the system by gestures, e.g. choosing to get more information or remove information.

ARtSENSE has also developed a themed adaptation scenario using biosensing. In this specific tool the user is wired up to a wearable biosensor (Nexus Mk II) and runs through an adaptive audio narration scenario (i.e. audio changes according to physiological response to current content) using museum content. For the ARtSENSE trials this content has been provided by the Museo Nacional de Artes Decorativas (MNAD). It was shown how the biosensors would be used to track the museum visitors' psychophysiology and adapt content in real-time.

Axes

www.axes-project.eu

The goal of AXES is to develop tools that provide various types of users with new engaging ways to interact with audiovisual libraries, helping them discover, browse, navigate, search

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and enrich archives. In particular, apart from a search-oriented scheme, the project explores how suggestions for audiovisual content exploration can be generated via a myriad of information trails crossing the archive. This will be approached from three perspectives (or axes): users, content, and technology.

Based on an existing Open Source service platform for digital libraries, Axes will offer novel navigation and search functionalities via interfaces tuned to user profiles and workflow. To this end, AXES will develop tools for content analysis deploying weakly supervised classification methods. Information in scripts, audio tracks, wikis or blogs will be used for the cross-modal detection of people, places, events, etc., and for link generation between audiovisual content. Users will be engaged in the annotation process: with the support of selection and feedback tools, they will enable the gradual improvement of tagging performance.

Chess

www.chessexperience.eu

CHES (Cultural Heritage Experiences through Socio-personal interactions and Storytelling) proposes to create narrative-driven cultural “adventures” through hybrid structures, which adapt continuously to their visitors, extend over space and time, and involve multiple users with different interfaces.

To achieve this, CHES integrates interdisciplinary research in personalization and adaptivity, digital storytelling, interaction methodologies, and narrative-oriented mobile and mixed reality technologies, with a sound theoretical basis in the museological, cognitive, and learning sciences. This tightly integrated framework has been applied and tested in different types of cultural heritage sites; most notably the New Acropolis Museum and the Cité de l’Espace in France. Access to end-users will be further enhanced through the international User Group, a diverse body of cultural institutions and organisations.

Cultar

www.cultar.eu

CultAR (Culturally Enhanced Augmented Realities) will provide a mobile platform that has two main aims: (a) to actively increase users' awareness of their cultural surroundings with advanced, adaptable and personalized interfaces, and (b) to increase users' social

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engagement with culture via a leap in social media technologies and contextual inference methods. To reach these goals, CultAR will advance the State of the Art in mobile 3D, augmented reality and tactile technologies, combining them into a completely new mobile experience interface. The CultAR platform achieves personalised and engaging digital cultural experiences through enhanced representation, hybrid space mediation, social engagement and awareness.

Cultura

www.cultura-strep.eu

CULTURA project (Cultivating Understanding and Research through Adaptivity) aims at personalisation and community-aware adaptivity for Digital Humanities through the implementation of innovative adaptive services in an interactive environment. The intention is to offer genuine user empowerment and different levels of engagement with digital cultural heritage collections and communities.

CULTURA advances and integrates the following key technologies:

- Cutting edge natural language processing, which normalises ambiguities in noisy historical texts
- Entity and relationship extraction, which highlights the key individuals, events, dates and other entities and relationships within unstructured text
- Social network analysis of the entities and relationships within the content, and also of the individuals and broader community of users engaging with the content
- Multi-model adaptivity to support dynamic reconciliation of multiple dimensions of personalization.

The advanced tools offered in CULTURA for working with collections of documents are Normalisation, Annotation, Entity-oriented Search and Visualisation. The project is helping to quickly make sense of digitised archives, clean up inconsistencies in the language, draw links between historical events, people and objects, and make Europe's rich cultural and historical heritage more accessible to all.

To make sense of the 'noisy' historical texts and begin linking references, the CULTURA team uses state-of-the-art natural language processing software to 'normalise' the language and give it semantic meaning that can be understood by computers as well as

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humans.

Powerful algorithms are employed to automatically extract entities and their relationships from the content in order to highlight the key individuals, events, dates and other entities and relationships. From there, the tools developed by the team analyse the connections between entities and relationships within the content - developing a kind of historical social network that helps place historical events and figures in context and makes them much easier to visualise and comprehend.

The approach works not only with text-based content, but also with images. In this case, metadata associated with the images, and annotated during digitisation, is used to provide semantic meaning.

Significantly, the CULTURA system provides not just content-aware adaptivity depending on the materials being studied, but it also adapts to the needs of each user and user community. For example, a university researcher who has in-depth knowledge of a certain subject or collection of materials might use the system to look for a very specific reference. Alternatively, a member of the general public curious about a particular period of history may be looking for a much broader view.

The CULTURA platform can meet the needs of many types of users through an innovative personalisation process that takes into account user profiles and the context in which they are searching for or accessing information. Furthermore, the system can provide dynamic storylines around certain events, dates, places or people, generating an easy to follow narrative for any user, which adapts dynamically to the user's profile and usage history.

Several of the partners plan to continue supporting the platform after the end of the project with a view to expanding its use to other collections, while individual partners are looking to commercialise different parts of the technology that make up the system.

Decipher

www.decipher-research.eu

DECIPHER (Digital Environment for Cultural Interfaces: Promoting Heritage, Education and Research) is developing new solutions to the whole range of narrative construction, knowledge visualisation and display problems, with a high degree of future proofing. It produces a step change in the process by combining much richer, event-based metadata with causal reasoning models. This results in a reasoning engine, virtual environment and

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interfaces that can present digital heritage objects as part of a coherent narrative, directly related to individual searches and user contexts. This allows the user to interactively assemble, visualise and explore, not just collections of objects, but the knowledge structures that connect and give them meaning.

DECIPHER targets two main categories of users:

- **Museum Professionals:** Curators, Educators and other Cultural Heritage Professionals to mediate their collections and explain cultural objects in context.
- **Ordinary Users and Visitors:** able to explore, visualise, reason with, and add perspective to sets of cultural objects, and to share these in visually attractive narrative interfaces, based on standards, supporting many modalities and on many devices.

In this context, the project has set the objectives below:

- To define and represent curatorial processes that form the basis for cultural narratives
- To research and develop new methods of reasoning about curatorial practice
- To improve methods of identifying and retrieving relevant data and populating a knowledge base from multiple collections and sources
- To design and build a robust system for data gathering, reasoning and narrative generation
- To develop standards-based, context-aware narrative interfaces and visualisation tools
- To demonstrate and evaluate the technologies in experimental use, across different types of cultural objects, collections and platforms.

Decipher delivered the following tangible outcomes:

- Published semantic workflow models and formalised representations of curatorial processes
- Published schema and software tools for describing cultural content in terms of their relationships to events, places, people and themes, and the user's purpose and cognitive profile
- Search, retrieval and aggregation software tools that harvest cultural content from public sources across domains (art, music, dance etc.) in such a way that it can be semi-automatically described with the event schema
- Reasoning-based software tools that support the individual organisation and

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exploration of content across historical periods and cultural domains

- A software Demonstrator built of Open Source components that creates a robust and sustainable repository of narrative that is linked to the collections of digital cultural objects held by partner institutions and external networks
- Standard-based user interfaces that deliver a personalised, rich media experience that use any browser-based device capabilities for visualisation, including 3D and stereo image and sound.

Europeana

www.europeana.eu

Europeana is a catalyst for change in the world of cultural heritage. The Europeana Foundation and its Network create new ways for people to engage with their cultural history, whether it's for work, learning or pleasure. The vision of Europeana is making cultural heritage openly accessible in a digital way, to promote the exchange of ideas and information. This openness will help us all to understand our cultural diversity better and will contribute to a thriving knowledge economy. The objectives of the Europeana Foundation are set out in the Articles of Association. In summary, these are the following:

- to make Europe's cultural and scientific heritage available through a cross-domain portal (Europeana.eu)
- to work with museums, archives, audiovisual archives and libraries to deliver the portal and make it sustainable
- to bring items that have already been digitised into the portal
- to encourage and support the digitisation of more of Europe's cultural and scientific heritage.

Currently several EU projects concerning Cultural Heritage, are supported by the Europeana initiative or are directly related to European portal and outcomes. Europeana distinguishes those efforts into the following main categories.

- Content and Technology Providing Projects (APEX, AthenaPlus, Digitised Manuscripts to Europeana, Europeana Inside and Europeana v2.0).
- Content Providing Projects (ARROW plus, LoCloud, PATHS, PRELIDA).
- Content Providing Projects (3D-ICONS, CARARE, Digitising Contemporary Art, EAGLE,

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eClap, EFG1914, EUscreenXL, Europeana 1914-1918, Europeana 1989, Europeana Collections 1914-1918, Europeana Fashion, Europeana Photography, LinkedHeritage, Natural Europe, OpenUp!, The European Library, ThinkMOTION).

In what follows we present two significant examples of Europeana related projects (PATHS and CARARE). More detailed information about Europeana project can be found on the webpage: pro.europeana.eu/projects.

Europeana project: PATHS

www.paths-project.eu

The PATHS (Personalised Access To cultural Heritage Spaces) project has explored ways of extending and enriching the metadata that is available to offer end users with alternatives to standard search portals as the means of item discovery and exploration. PATHS has developed two prototypes for demonstrations and testing by end users, cultural institutions and others. The first was evaluated by users over the summer of 2012 and led to the development of the second prototype; this uses part of the collection of Europeana.

The main aim has been to demonstrate a collection discovery environment for users which combines search, narrative Pathway and visualisation techniques in an integrated system. The current prototype is based on user requirements gathered early in the project and represents the core part of a flexible and adaptable system. PATHS offers two main ways into collections:

- PATHS – enable users to follow Pathways (or narratives) published by users. Users can follow a Path from beginning to end or they can leave the path at any time by following recommendations and links. Users who are logged in to the system can save items to their workspace and then create, edit, publish and share Pathways.
- EXPLORE - enables users to explore the collections using tools which are being designed to appeal to different user preferences. Exploration can be done using a Map, Thesaurus or tags.

The PATHS prototype incorporates data which have been provided to the project for test purposes by Europeana. The Europeana demonstrator includes around 2 million content items from Spain and the UK. The metadata which was provided has been processed and augmented with additional indexing and linkages before being integrated into the

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prototype application.

Europeana project: CARARE

www.carare.eu

CARARE is a best practice network funded by the European Commission’s ICT Policy Support Programme. CARARE brings together heritage agencies and organisations, archaeological museums and research institutions and specialist digital archives from all over Europe to establish a service that will make digital content for Europe's unique archaeological monuments and historic sites interoperable with Europeana. It also brings 3D and Virtual Reality content to Europeana. CARARE will play an important role in ensuring that digital content for Europe's unique archaeological monuments, architecturally important buildings, historic town centres and industrial monuments of World, European and National heritage importance is interoperable with Europeana and accessible alongside items from national libraries, archives, museums and other content providers. CARARE aims to enable 2D and 3D content for heritage places to be brought together in Europeana, creating new functionality for users.

Insidde

www.insidde-fp7.eu

INSIDDE (INtegration of cost-effective Solutions for Imaging, Detection, and Digitisation of hidden Elements in paintings) project is an innovative solution for capturing, imaging, and digitising unknown details of paintings and 3D artworks by means of terahertz technology in a unique approach, with the purpose of going beyond the present knowledge and adding value to the cultural content.

A versatile, easy to configure and affordable prototype – working in different frequency bands within the THz region–provides a complete set of images of the paintings and sealed objects, revealing complementary information about its hidden features – such as underlying contents, pigment/substance identification, brushstroke texture, defects – through various processing techniques.

The resulting enriched images and 3D models will be exploited in two manners: integrating them into the professional knowledge-sharing platform Europeana and developing an innovative smartphone application based on Augmented Reality.

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Although curators and art researches will benefit from our works, the key of INSIDDE lies in improving the experience of visitors at European museums and through the internet by increasing the digital resources at their disposal, leading to a more attractive interaction.

Experts from academia, technological research centres, SMEs and end-users with large experience collaborating in international research projects constitute a well-balanced consortium, in which the participation of museums definitely plays an irreplaceable role and makes the difference between theoretical and applied results.

i-Treasures

www.i-treasures.eu

The main objective of i-Treasures (Intangible Treasures - Capturing the Intangible Cultural Heritage and Learning the Rare Know-How of Living Human Treasures) is to develop an open and extendable platform to provide access to ICH resources, enable knowledge exchange between researchers and contribute to the transmission of rare know-how from Living Human Treasures to apprentices. To this end, the project aims to go beyond the mere digitization of cultural content. Its main contribution is the creation of new knowledge by proposing novel methodologies and new technological paradigms for the analysis and modelling of ICH. One of the main objectives of the proposal is the development of an appropriate methodology based on multisensory technology for the creation of information (intangible treasures) that has never been analyzed or studied before.

Within the i-Treasures project, the usability of the platform will be demonstrated in four different case studies: a) Rare Traditional Songs, b) Rare Dance Interactions, c) Traditional Craftsmanship and d) Contemporary Music Composition

An interesting feature of I-Treasures is a live demo of an innovative methodology for multimodal voice and gesture analysis based on state-of-the-art sensors and data fusion techniques. The i-Treasures project has designed a hyper-helmet, equipped with lightweight sensors, e.g. ultrasound miniaturised transducer, optical camera, microphone etc in order to investigate the capacities of the human voice apparatus during singing. This technology has been demonstrated in different traditional European singing techniques of the UNESCO Inventory of Intangible Cultural (e.g. «cantu in paghjella» of Corsica, «canto a tenore» from Sardinia or Byzantine hymns from Mount Athos).

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MeSch

www.mesch-project.eu

MeSch (Material EncounterS with digital Cultural Heritage) has the goal of designing, developing and deploying tools for the creation of tangible interactive experiences that connect the physical dimension of museums and exhibitions with relevant digital cross-media information in novel ways. The project runs from February 2013 to January 2017 and counts on an international consortium composed by 12 partners and coordinated by the Sheffield Hallam University.

In particular, meSch will deliver a platform to enable curators, artists, designers and cultural heritage professionals in general to create smart objects and intelligent spaces. Smart objects (like a magnifying glass or a replica) are enriched with digital technology while intelligent spaces embed sensors: both react to people, spaces and smart objects. A bespoke application will adapt the content and the behaviour of the object or space to visitors, their social context and the environment.

The project is already delivering its first outputs: the meSch team at Sheffield Hallam University has designed and developed a prototype of a book-like device, named *Companion Novel* that allows visitors of an outdoor heritage to select a theme and then receive personalised information at specific points of interest.

When the book detects that a point of interest is nearby, a sound is played to attract the attention. When the visitor is closer a story is played. The loudspeakers are lodged in purpose-made encases that fit with the environment: the ornamental wreath for the first point of interest and the bird box for the second.

The meSch approach is grounded on principles of co-design: the participation of designers, developers and stake-holders into the process of creation and evaluation as equal partners, and on a Do-It-Yourself philosophy of making and experimenting. Three large-scale case studies in different museums provide test beds for the real-world evaluation of meSch technology with the public and cultural heritage stakeholders.

Presious

www.presious.eu

PRESIOUS (PREdictive digitization, reStoration and degradatiOn assessment of cultUral heritage objects) will digitise Cultural Heritage objects and monuments, analyse their

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degradation and reconstruct object from large numbers of fragments.

Using a common core of geometric processing, analysis and retrieval methods, PRESIOUS aims at predictive geometric augmentation technology with the following scientific objectives:

- a) On-the-fly auto-completion for 3D digitization that exploits similar template models to allow gradual shape prediction from partially digitized objects. Such a breakthrough system opens a whole new range of possibilities for decreased acquisition times and simplified procedures, leading to an order of magnitude reduction in effort and cost. This technology is a prime candidate for exploitation by our industrial partner.
- b) Estimation and prediction of monument degradation. The project will investigate models for forward and inverse erosion prediction based on targeted high-accuracy surface scans, allowing one to essentially move the artefact's surface condition and visualize and measure the dynamic state of the deteriorating object. This tool is also likely to be applicable in areas outside CH, such as civil engineering.
- c) 3D CH fractured object restoration and completion (missing parts synthesis). Automated, predictive reconstruction from fragmented CH objects that goes beyond reassembly by proposing the synthesis of missing parts using geometry auto-completion. This will aid the physical and virtual restoration process.

Rovina

www.rovina-project.eu

ROVINA (Robots for Exploration, Digital Preservation and Visualization of Archaeological Sites) aims at extending the research related to the mapping and digitizing archaeological sites, with respect to reliability, accuracy and autonomy. This will enable a novel application scenario of autonomously mapping of areas with high archaeological value that are hardly accessible to the public. Current systems for digitizing sites typically build upon static 3D laser scanning technology that is brought into archaeological sites by humans. This is acceptable in general, but prevents the digitization of sites that are inaccessible by humans. In the field of robotics, however, there has recently been a tremendous progress in the development of autonomous robots that can access hazardous areas.

ROVINA will develop methods for building accurate, textured 3D models of large sites

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including annotations and semantic information. To construct the detailed model, it will combine innovative techniques to interpret vision and depth data. ROVINA will furthermore develop advanced techniques for the safe navigation in the cultural heritage site. To actively control the robot, ROVINA will provide interfaces with different levels of robot autonomy. Already during the exploration mission, the project team will visualize relevant environmental aspects to the end-users so that they can appropriately interact and provide direct feedback. The system will allow experts, virtual tourists and potentially construction companies to carefully inspect otherwise inaccessible historic sites. The International Council on Monuments and Sites will exploit the 3D models and technology. The ROVINA consortium is targeted at developing novel methods that will, besides the indicated goal, also open new perspectives for applications where autonomy and perception matters, such as robotics. To simplify the exploitation, all components developed in this project will be released as open source software as well as under a commercial license.

Tag Cloud

www.tagcloudproject.eu

TagCloud (Technologies lead to Adaptability & lifelong enGagement with culture throughout the CLOUD) aims at generating lifelong engagement with cultural heritage through social media, augmented reality and storytelling applications based on the cloud. The project aims to increase the active participation of general public in cultural events and experiences, by inviting them to become participants in their own cultural experiences, contributing with new content, opinions, as well as sharing information with other people and heritage institutions, curators and researchers in the cultural area before, during and after the visit. It will be designed to be dynamically personalized and adaptive to the needs, preferences and interests of the individuals and the communities. Existing systems, devices and algorithms used worldwide by cultural heritage institutions and relevant social media will be reviewed to draw the preliminary specifications of TAG CLOUD system. The aim is to develop the appropriate applications and tools that will enable the adaptive cultural experience using augmented reality, storytelling software and social media. It also provides mechanisms that allow cultural researchers and curators to measure the trends and preferences of the public in social networks. Additionally, it will develop the UI elements to adapt the systems according to the personalised interaction.

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Techcooltour

www.techcooltour.com

TECHCOOLTOUR (TECH -TOUR Technology and Tourism: Augmented Reality for Promotion of Roman and Byzantine Itineraries) aims to promote two historical trans-national EU cultural routes exploiting developed ICT tools and exploring new media potential in promotion of cultural heritage. Retracing the history of influences, exchanges and developments of two great empires, Roman and Byzantine, which shaped the cultural landscape of Europe, the project aims at defining the common thread that link places and regions and helps represent the richness and uniqueness of European cultural identity.

The main objectives of the project are the following:

- Mapping and promoting two cultural routes focusing on their interrelation in creating common European identity
- Showing the potential of mobile technologies for the development of innovative communication at cultural heritage sites
- Supporting innovation in cultural tourism services
- Supporting local economies through an enhanced visibility

In this context, TECHCOOLTOUR aims to promote two historical trans-national EU cultural routes by

- marking specific points of cultural and historical value along the routes
- exploiting developed ICT tools (Augmented Reality) and creating cross media communication platform TECHCOOLTOUR
- placing twelve interactive info boards and transforming the routes into virtual open-air museums

The final goal is to create an innovative concept for the promotion of the cultural heritage by implementation of new ICT applications, ad-hoc marketing strategies and trans-national cooperation of the participating countries.

Techcooltour Augmented Reality Mobile Application

Within the project, twelve archaeological sites in four countries are marked with Augmented Reality infoboards. When viewed through smart phone, the boards trigger virtual presentations and offer additional info to visitors, thus transforming the routes into virtual open air museum.

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V-city

www.vcity.diginext.fr

The V-City project aims to research, develop and validate an innovative system integrating the latest advances in Computer Vision, 3D Modelling and Virtual Reality for the rapid and cost-effective reconstruction, visualisation and exploitation of complete, large-scale and interactive urban environments. The focus of the project on urban environments is not only made possible by the latest technological advances, but also justified. Urban environments represent one of the most important and valuable cultural heritage as acknowledged by the UNESCO.

This system enables historians, architects or archaeologists to reconstruct from existing data, study, understand, preserve or document urban environments using an innovative interactive 3D user interface.

V-city is based on following components:

The V-City Builder

vcity.diginext.fr/EN/index.html

This tool automatically reconstructs large-scale urban environments at high quality from input cadastral data, aerial oblique images and ground pictures. First, building data from multiple input sources is processed and a textured mass model is generated for each building. Second, topological and semantic information is automatically extracted and put into a compact procedural representation of the facades.

The V-City Map Table

vcity.diginext.fr/EN/index.html

The V-City map table is intended as a multitouch, multiuser, stereoscopic interface to allow both the visualization and interaction with the massive urban data that are displayed by the V-City Explorer. It had to cope with specific constraints such as the real-time display of 3D data, the intuitive and efficient manipulation and edition of the content, as well as to provide collaborative visualization capabilities. Two technologies have been identified, which are the immersive 3D visualization equipment and multitouch tactile input. They have been brought together into the V-City map table.

The V-City Explorer

vcity.diginext.fr/EN/index.html

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The V-City Explorer is a next-generation globe viewer based on Diginext's future VirtualGeo3 system offering unprecedented rendering capabilities. It can display massive and extremely detailed urban environments, seamlessly integrated into the 3D landscape. Thanks to the BlockMap technology, developed expressly for this project by CNR and CRS4, the V-City Explorer can navigate through massive cities, complete with picture-perfect facades and architectural details, at breakneck speeds.

Although globe viewers are becoming more and more common, cities are rarely shown in 3D, let alone with accurate facades and architectural details. With the V-City Explorer, you can fly through a city in 3D, experiencing it in unprecedented detail, and visualising the city evolution along the time. The Explorer can even take you *inside* buildings, where you can discover the same hallways, rooms, and furniture that existed or still exists in real life!

The V-City Explorer is not just a simple browser, but a powerful tool for architects, historians, land planners, and other professionals. It encourages collaboration as it offers multi-platform support, working on Windows and Linux. It includes sophisticated querying, analysis, or measurement tools and image capture. Professionals can analyze virtual cities with sufficient precision to draw accurate conclusions without having to leave the tool to consult other sources.

The V-City Server

vcity.diginext.fr/EN/index.html

The V-City server is the part of the V-City system in charge of transforming large scale representations of urban environments into good quality low-bitrate multiresolution representations suitable for streaming and rendering. It automatically optimises compresses and stores the geographical and architectural data published by the V-City Builder and streams in real time these data over a network connection with the V-City Explorer.

V-must.net

www.v-must.net

V-MUST.NET aims to provide the heritage sector with the tools and support to develop Virtual Museums that are educational, enjoyable, long-lasting and easy to maintain. V-MUST.NET is coordinated by CNR and it has 18 partners, coming from 13 different Countries and several Associated Members. The project runs for 4 years (1st of February

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2011 - 31st of January 2015).

Within V-MUST.NET following tools and technologies have been developed:

Cloud Gaming

www.v-must.net/technology/observatory/cloud-gaming

The cloud gaming is an interactive on-line streaming service on demand. The infrastructure allows to choose, rent or buy hundreds of games and 3d content. All the content is computed on the cloud and streamed directly on the user's device: no game installation, just a thin client. For this reason the cloud gaming could be performed in whatever kind of device.

Leap, pleasure without touch

www.v-must.net/technology/observatory/leap-pleasure-without-touch

Leap is a touch-free, gesture based, 3d controller. It seems to be in some aspects a completely new approach. The small dimensions of the device and the proximity of the interaction to the screen are crucial features for a desk-enabled workspace capable to replace the traditional mouse and keyboard approach.

Meshlab

www.v-must.net/technology/tools/meshlab-03-aug-12-new-release-132-available

MeshLab is an open source, portable, and extensible system for the processing and editing of unstructured 3D triangular meshes. The system is aimed to help the processing of the typical not-so-small unstructured models arising in 3D scanning, providing a set of tools for editing, cleaning, healing, inspecting, rendering and converting this kind of meshes. It is developed by CNR ISTI VCG Lab. It is extensively used in the museum and virtual museum domains.

3D-COFORM

www.3d-coform.eu

The 3D-COFORM project was established to advance the state-of-the-art in 3D-digitisation and make 3D-documentation available as a practical choice for digital documentation campaigns in the cultural heritage sector. The project has addressed the integration of all stages of the workflow involved in such campaign and in the subsequent use of digital assets in research and dissemination to the public and professional alike.

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The project was established in a context where 3D-digitisation was capable of capturing surface properties of artefacts with restricted characteristics of their optical and geometrical surface properties.

The planning of the project has been based around three strands of technical work:

- 3D capture/acquisition and processing
- Integration of 3D Digital Objects, with metadata and related textual information
- Generative modelling and visualisation.

The 3D-COFORM consortium brought together prestigious Cultural Heritage organizations, organizations tasked at a national level with helping museums move in the above directions and technological institutes with 3D competences.

3d-pitoti

3d-pitoti.eu

The 3D-PITOTI, 3D acquisition, processing and presentation of prehistoric European rock-art, involves a multidisciplinary team of over 30 scientists from across Europe and focuses on rock art in the Valcamonica Valley, Italy. This UNESCO World Heritage site in the Lombardy region of northern Italy has the largest group of this ‘rock art’ in Europe. Tens of thousands of images span a period from many centuries BC into medieval times.

The project will significantly advance both the state of the art in rock-art research methodology and the 3D recording of rock art in general. Moreover it will not only ‘take the rock-art to people’ for the first time but will convey Pitoti (the local term knowledge to a much wider audience in interactive and engaging ways.

The main goals of the project are:

- To build an affordable and portable multi-scale 3D scanning toolkit for high resolution acquisition of Pitoti figures and their natural context
- Develop intelligent data processing technologies to enrich the scanned 3D data by classification, clustering and retrieval techniques
- Create interactive 3D visualisation and presentation techniques to provide access to the enriched high resolution digital rock-art for scientists, museum visitors, school children and web users.

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4 Views from European countries

In this section we include some of the worth-mentioning national and regional initiatives and projects that produce technologies for CH institutions, as well as on-going efforts and products initiated by individuals and companies (large and SMEs). Working in the frame of collecting and presenting current efforts that are not widely known Europe-or World-wide, one can easily notice the diversity and heterogeneity of those efforts. The following initiatives vary from private companies that are technology providers, to museums that make good use of technologies; from institutions and organisations that have a longer multidisciplinary character and history, to youngest communities that have a more social, and digital-native profile. Concerning the outcomes of those efforts, diversity is also notable, as the efforts range from specific, reusable tools or products that can be used by different CH organisations, after customization, to methodologies and best practices, or projects that are site-specific and highly related to the profile of the CH institutions involved. This diversity also brings to light the fact that good examples of ICT for CH include at least two main necessary ingredients of success: the first one is technology innovation, the excellence of design and development of the tools, and the second one is the usage within the CH frame, taking also into account the social and economical impact. The different analogies of those success-key ingredients can lead to many different examples, as shown in what follows. Finally, we present those efforts categorized by countries to underline the importance of the socio-cultural, and economical environment and the particular characteristics of what CH means for those different environments.

France

Research and Innovation institute at Centre Pompidou (IRI)

www.iri.centrepompidou.fr

The IRI primarily explores the field of digital studies, in the sense of a new « organology of knowledge » appearing with the digital, which requires specific studies and concepts, and which shifts the whole contemporary episteme (as defined by Michel Foucault). More precisely, the institute investigates the field of cultural and cognitive technologies from a digital humanities point of view, which at the IRI is considered to be a specific sector of digital studies. The IRI thus aims at participating in the development of new forms, devices

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and technologies: to address the public, to facilitate contributions and collaborative criticism; to provide solutions for editorial and interconnectivity in the domains of culture and knowledge. To achieve this, the IRI will both theorize and formalize the relevant technologies and the social practices they induce, as well as develop cultural and scientific applications, especially in and around the museum domain, but also more generally as technologies for amateurs.

Research program and innovation LEDEN

leden.org

The digitization of scientific and cultural heritage data and their organization within complex and accessible interactive systems is a major challenge in the development of New Technologies of Information and Communication and an indispensable tool for transmission. Ergonomic, semantic and digital mediation researches open a field of investigation essential to the implementation of innovative editorial productions that meet this challenge.

Museomix

www.museomix.org

Museomix is community with the vision to create an open museum with a place for everyone with the characteristics of a living-lab museum that evolves with its users and develop a networked museum which is in touch with its communities.

The missions of Museomix can be summarized in the following goals:

- Foster collaboration. Museomix creates transdisciplinary opportunities for new ideas and projects to emerge
- Test and lead by example. Museomix creates the conditions to experiment on and within museums showing that it is possible to innovate the museum experience, by doing it
- Bring new ideas to light. Museomix's experiments and meetups are organized so that new ideas are encouraged and pushed forward
- Share freely the projects, technologies, and content that help advance the vision of an open, living, and networked museum, pushing for free and open licensing of all that is produced by this process

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- Build a community that takes care of itself and its members. Having the goal of augmenting the size, the autonomy and the impact of the community the development of all members is encouraged by a virtuous circle of support.

Muzeonum wiki

www.muzeonum.org

Muzeonum is a wiki about new technologies in Museums where currently most information is in French, however, they are developing towards achieving a more international profile. The portal includes a list of blogs about ICT and their usage in Museum, including articles about Best Practices and updated news in the field.

Greece

Foundation of the Hellenic World

www.fhw.gr

The Foundation of the Hellenic World (FHW), which was envisioned, founded and funded by private initiative, is a privately funded not-for-profit cultural institution based in Athens. FHW's mission is the preservation of Hellenic history and tradition, the creation of an awareness of the universal dimension of Hellenism and the promotion of its contribution to cultural evolution. Its aim is the understanding of the past as a point of reference for the formation of the present and future so that contemporary thought may once again be inspired by the Hellenic spirit. The principal objective is the dissemination of Hellenic culture and history in any way possible and through this the aim of the Foundation will be achieved.

FHW's innovative character has already been revealed in its Statutes, one of which prescribes that the materialization of the objectives be based on the possibilities offered by new technologies. As a result, from the very beginning and at the same time as trying to find a place for the creation of the cultural centre, the Foundation's administration put the Internet to use and presented to the Greek and international community the first Greek web sites of historical content. At the same time, it created a pioneering laboratory of three-dimensional reconstructions, the first project of which, presented as a documentary, received the 1st Prize at the Amiens Festival of Archaeological Films. Hellenic Cosmos, FHW's Cultural Centre, was inaugurated in 1998, originally occupying a site of 16,000m². It

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was housed in a former industrial building, which albeit maintaining important elements of its original use, it was transformed into an ultra-modern, living museum that aims to be a source of learning and satisfy the needs of the contemporary "society of knowledge". In March 2006 the construction of the "Tholos" was completed, a building that houses the most perfect, presently, Virtual Reality system of Hellenic Cosmos with a capacity of 130 people. It is a building of specific aesthetic value with advanced technological infrastructure, which hosts the Foundation's digital collections. The "Tholos" resembles a planetarium regarding its natural and morphological characteristics. But essentially their only common element is the semi-spherical shape of the projection surface. The shows are interactive, creating a unique experience of immersion into the virtual world that is characterised by immediate response, originality, flexibility and liveliness. During its operation Hellenic Cosmos has presented numerous activities, which include exhibitions, educational programmes, Virtual Reality programmes, and documentaries produced by FHW. FHW's productions are designed and implemented almost exclusively by a team of permanent collaborators, who, in their majority, work in a building that houses the administrative services, at the Research and Development Centre in Thissio. The staff consists of archaeologists, historians, translators, editors, architects, museologists, museum educators, computer scientists, graphic designers, multimedia designers and creators of 3D digital reconstructions, many of whom have postgraduate titles or doctorates.

Interactive Tour at the Ancient Agora

The spectators visit the site of the Ancient Agora and, under the guidance of a special Museum Educator, they have the opportunity to choose themselves the course they will follow. The representation of the Agora in three different moments in history provides visitors with the opportunity to perceive the development through time and the changes in the site's function from era to era, as it is recorded in its architectural and city-planning differentiations. The Classical Agora (approximately in 400 BC) emphasizes the importance of public administrative buildings and the existence of a large outdoors area for gatherings and athletic activities. During the Hellenistic Period (approximately in 150 BC) the dominant feature is the large commercial buildings (stoas), while emphasis is placed on the beneficiary activity of the Hellenistic rulers. Finally, the Roman aspect of the Agora (approximately in 150 AD) records its gradual weakening as an administrative and commercial centre, something that allowed the development of its religious and cultural

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character, since new temples were constructed, the odeum, the library and the nymphaeum.

A Walk Through Ancient Miletus

The city of Miletus on the western coast of Asia Minor, one of the most important cities in Ionia, comes to life again in the Virtual Reality production “A Walk Through Ancient Miletus”. This production, in the special environment of immersion of “Tholos”, uses some new technical characteristics, which allow the development of multiple directions of digital life in the virtual space and not a predetermined course. A new element is realistic vegetation, which has a dynamically changing behavior based on the respective alternations of the direction and strength of the wind in the area. The production also incorporates a relevant model of dynamic estimate of the position of the sun depending on the latitude and longitude in the specific time in the past.

Battle of Thermopylae

The battle of Thermopylae is an example of interactive virtual reality application, also developed by the Foundation of Hellenic World for the museum of Thermopylae located at the site of the original battle. In this case, storytelling techniques were combined with video gaming principles within a Virtual Environment, dealing with the challenge of presenting a historical event and exploiting the key aspects of gaming culture to achieve clear educative goals. The installation combines an immersive 3D video and an interactive 3D game where the visitors can feel part of the story, while at the same time the presence and support of a human educator and the group character of the visit makes this experience a social activity.

The Piraeus Bank Group Cultural Foundation (private foundation)

www.piop.gr

The Piraeus Bank Group Cultural Foundation (PIOP) is a non-profit institution that represents the Culture Pole of the Piraeus Bank Group. PIOP aims at safeguarding technology and traditional crafts, a neglected domain of Greek culture, becoming a reliable and constant mediator for the preservation and promotion of pre-industrial and industrial heritage. The Museums Network marks PIOP’s significant contribution. It is an excellent

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example for the creation and management of museums in the Greek regions, while also ensuring sustainability and supporting regional development. Seven technological thematic museums have been created, whilst two more are on the way.

These museums specialised on ethnography, traditional crafts and refinement of local products, highlight distinctive productive activities, representative of each region, and, through their outreach activities, become a point of reference for the local population.

Besides the expanded geographical span of the Network, it is also notable that these museums do not belong either to the Foundation or to the Bank, but to the Ministry of Culture and to local government, whilst PIOP has undertaken the commitment of funding and managing the Network for fifty years.

Museum of Industrial Olive Oil Production

Piraeus Bank Group Cultural Foundation (PIOP) which is the trustee of this Museum in Lesvos island, developed a digital multimedia virtual tour that give a complete picture of all the processing stages of olive until the conversion to oil. The equipment of the old olive mill of Agia Paraskevi, is exceptionally highlighted and flanked by this production.

Multimedia productions, virtual tours and collections, as well as edutainment tools for children of different ages have been developed for the Museums of PIOP with the objective of safeguarding traditional crafts which are part of the intangible cultural heritage but also promoting local tourism through ICT.

Goulandris Museum of Natural History

The **Natural History Museum** was founded in 1964 by Angelos and Niki Goulandris, as a private non profit institution devoted to study and protection of natural environment, the first museum of its kind to be established in Greece. In addition The Museum has developed a continuous and eminent scientific activity, relating to field research, collection, identification and recording of species, landscape studies of areas of particular environmental interest, digitization of the museum collections, publications, collaborations with other scientific centres and institutes in Greece and abroad. The Goulandris Natural History Museum was also the first to initiate environmental education in Greece and today plays a pivotal role in this field by the implementation of programs, projects and workshops, addressed to pre-school and school-aged children, but also to the general public.

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Gaia Centre at the GMNH

Gaia Centre is the newest addition to the Goulandris Museum of Natural History and it was designed in cooperation with the London Museum of Natural History. The Gaia (Earth) Center is a center of environmental research and education facility and it uses an impressive array of means to make its point, to emotionally engage the visitors, and to pass along a number of messages concerning our natural environment. The tour begins with a general presentation of the Planet Earth and then proceeds to analyzing particular ecosystems and the human effect on them. The last section deals with the major modern questions concerning the environment, such as energy policies and transportation and their impact on our natural resources. “Geosphere” which is unique in the world, is a hemispherical dome monitor which shows the rotating planet in 225,000 high resolution images. It also presents the geological evolution of the planet from its creation until today. Educational programs are held often for children of various ages.

Ancient Athens 3D

www.ancientathens3d.com

Ancient Athens 3D is a website created as a private initiative of Dimitris Tsalkanis to present the monuments and buildings of Athens from the Mycenaean period (1600 B.C.) to the Early Modern period (~1800 A.D.), through 3D representations. It includes a number of 3D building representations, based on detailed architectural plans and excavations, according to the most up to date studies. Buildings that have left few or no traces at all, like the Mycenaean palace on the Acropolis, were placed in order to give a most complete impression of the city. The trip in Ancient Athens starts by choosing a period, and each period includes a list of monuments where there is a short description of each monument and other information alongside with their 3D representation.

Lepanto1571

www.lepanto1571.gr

This project is an initiative of the Municipality of Nafpaktia (Lepanto in Greek), co-funded by European Union - European Regional Development Fund with the objective to highlight the importance of this area in the Early Modern Period. Under this framework Several digital applications were developed by the private company Diadrasis(www.diadrasis.gr) to designate facts and information about the naval battle of Lepanto, probably the last great

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clash between Catholic Christian West and Islam. Those applications include an interactive map of the area, a historical game, and 3D representations of both the Venetian and the Ottoman gallery.

The Roman Agora & Hadrian's Library

makebelieve design & consulting, in collaboration with minimatik, designed and developed an on-line presentation of the Roman Agora of Athens & Hadrian's Library. The application was created for the Hellenic Ministry of Culture and Tourism and includes a comprehensive selection of text, images, and VR Panoramas of the two important archeological sites, complete with an interactive timeline that allows visitors to view the evolution of the sites in 4 different historical periods.

The Hydria Project

www.hydraproject.net

The HYDRIA project had been funded by the UNESCO Participation Programme, the Mediterranean Information Office for Environment, Culture and Sustainable Development (MIO-ECSD) and the Global Water Partnership Mediterranean (GWP-Med). It used water as a “vehicle” to unfold the diverse, yet common, tangible and intangible Mediterranean cultural heritage. The project endorsed several case studies from Mediterranean countries. Within the HYDRIA project minimatik and makebelieve design & consulting designed and developed a number of multimedia applications that have been embedded in the project website. These applications have included texts, photographic material and animations and presented information regarding the collection, storage & distribution of water in the Mediterranean basin in Antiquity.

Archeological Museum of Messenia

www.archmusmes.gr

minimatik designed and developed with makebelieve design & consulting, an interactive application for the new Archeological Museum of Messenia, located in the city of Kalamata in southern Peloponnese, in Greece. The application, titled "The History of a Place", concerns the naming of places in the Messenia prefecture, since antiquity, providing visitors of the museum with information about the place names, the monuments, and the

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archeology projects of areas of interest around Messenia. The application is very rich in content, including scientific research, images, and sketches of over 100 locations on the map. The interactive features of the exhibit allow visitors to participate by including their own commentary about the various names and stories associated with them. The application contains 4 associated interactive games: a names-to-pictures matching game, a pictures-to-sites-on-the-map matching game, a maze game, and a memory game.

MuseumPlus and eMuseumPlus

www.museumplus.org

MuseumPlus is a complete collection management system designed to meet the multi-faceted tasks required for managing museums, collections, galleries and cultural institutions; from scientific documentation to planning exhibitions; conservation to public relations; archiving photographic images to organising events. It is a tested software solution, with more than 600 installations worldwide, compliant with international documentation standards.

MuseumPlus can be complemented by the tool eMuseumPlus. The later web-enables the entire collection database, taking into account the linguistic diversity of its content, automatically publishing it to custom-designed web pages and making it available to a wide audience 24x7 over a secure web server. eMuseumPlus enables visitors to explore the museum collections online, allows them to check out any upcoming events and exhibitions, and to conduct thorough research on the background information of the collections.

Both products are developed by the Swiss company zetcom. The Greek company Postscriptum is contributing to the development and also undertakes all aspects of implementation of MuseumPlus, including requirement analysis, customisation, installation, users training and technical support.

Iceland

Tangible geographical interface

Tangible geographical interface is one of many projects held by the Gagarin Ltd (Iceland-<http://gagarin.is>). A map with a large model of the landscape, showing the Jostedal Glacier National Park in Norway, appears on a screen. Two consoles in front of it wait for users to interact with this landscape. This is the scenario of use of “Tangible Geographical

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Interface”, an application aimed at enabling groups of visitors to explore the glacier park and its surroundings together. They can have information on geological wonders, the flora, fauna, the historical and archaeological sites or the “must-to-see” places, by choosing a tangible “information-pucks” and placing it on one of the console. When a “puck” is on a console, the map dynamically is altered and various location based information on a given subject, is projected in front of the users.

Italy

Museum of the sculptures of the basilica of Saint Silvestro

www.academia.edu

The Museum of the sculptures of the basilica of Saint Silvestro, has been thought and developed using the technology since the beginning. The researchers involved in the project had chosen to maintain the pieces in their original context of the basilica and to improve the accessibility to this monument both physically, through an architectural project, and virtually with a web-application, integrating the visit at the catacombs of Priscilla in Rome. The study of the sarcophagi is a particular field of research in archaeology and not easily accessible everywhere. The numerous fragments do not allow the presentation of much information in the exhibition. By the use of ICT, the user will be able to retrieve detailed information connected to each fragment, using a QR-code (or with a url) in situ connecting to a local server through a WiFi network in the Basilica. Moreover a 3D web application for a virtual visit and a QTVR (QuickTime Virtual Reality) to understand the context of the whole basilica will be available on internet. The archaeological context and the exhibition of the fragments give to the visitors a different experience from the usual museum of classical archaeology.

The project has been thought as a museum-construction site. The visitor can explore the objects, the basilica, the burials, the stratigraphy of the walls and the new structure of the floor from different views. Where the antique and the new met, unless there were fundamental functionality issues, the priority has always been to preserve and enhance the antique. The technological solutions aim at integrating the visit, allowing for each fragment to retrieve further information directly in the museum using smartphones. The Museum of the sculptures of the basilica of Saint Silvestro was a joint project of the University Heidelberg, the Humboldt University, the Dipartimento di Architettura, Disegno, Storia e

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Progetto, and the Musei e Archivi PCAS (Pontificia Commissione di Archeologia Sacra).

Museo Civico d’Arte Antica in Turin

www.palazzomadamatorino.it

Museo Civico d’Arte Antica is located on the four floors of the building of Palazzo Madama is a UNESCO-listed historic building renowned for its 18th century baroque architecture and its cultural value is further enriched by the sculptures, paintings and decorative arts collections, dating back to the Middle Ages and the Roman period. “Step by Step”, a mobile AR application for a cultural heritage context, was thus intended to suit and communicate the composite identity of Palazzo Madama, fostering engagement and a positive visitor experience.

Visitors were given the choice to explore the museum and the architecture on-demand - accessing information when desired- or to follow one of the three thematic trails that were developed. In this occurrence, visitors were guided from stop to stop by the innovative ARRU navigation system: thanks to its algorithm, the system is in fact able to locate the position of the visitor inside the building, indicating the direction to be taken in order to reach the following stop.

The museum developed also a game addressed to children aged 7-13 years, visiting the museum with their families. This game is coherent with an audience-centred approach and intrigues visitors participation in the museum. The goal of the game was to uncover a hidden thief among a set of characters, solving a variety of mini-games (quizzes, riddles...) in order to find the clues.

With the aim of investigating to what extent the application met the pre-set objectives and identifying patterns of use as well as areas of future improvement, evaluation was conducted, combining quantitative and qualitative methods.

The Catacombs of San Giovanni in Syracuse

http://link.springer.com/chapter/10.1007%2F978-3-642-34234-9_40

This study is a cross-disciplinary research carried out by archaeologists, engineers and architects from the Department of Humanities and the Department of Architecture in Catania, Italy, 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

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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.

Excavate and Learn

ettsolutions.com/Homepage.aspx

Excavate and Learn is a project held by ETT solutions, with the involvement of University of Genoa, Municipality of Sestri Levante, Museum of Sestri Levante (Genoa) – Archeological Museum of the City and Masso Archeo-mineral site – Castiglione Chiavarese (Genoa). The project consists of an innovative museum installation that integrates different technologies (touch and NFC- Near Field Communication) and allows the visitor to simulate what happens in an excavation and learn both about part of the archaeologist's work and the archaeological objects. In this kind of installation, museum visitors can choose copies of archaeological objects that are placed on mock-ups reproducing archaeological excavations (prehistoric and medieval, called respectively A and B in the following), pick them up and experience the traditional activities performed by the archaeologists, such as observation, analysis and deduction; by doing so, museum visitors can study the objects and try to understand their usage, their material, why they are located in that specific point, in which age they were used, etc.

Siracusa 3D

www.archeotour.eu

This virtual archaeology project, undertaken by a team of scholars of the IBAM-CNR and The Arcadia University – TCGS, is aimed to the digital reconstruction of Ortigia, the core district of the Greek Syracuse, and to produce a 3D documentary, 'Siracusa 3D Reborn', that represents an original advance in the knowledge of the Greek background of the city. In this perspective, the designers have chosen to produce 'passive' tools embedded with communicational and emotional components that did not affected the scientific accuracy with which the reconstructive process has been carried out. Therefore, the visitor can learn about peculiar architectural and urban features of the Greek city, without disregarding those historical characters who played 'key roles' in the diffusion of Greek culture in the Mediterranean. Main monuments of Ortigia are described and analyzed in the context of a full 3D stereoscopic representation employing techniques of modern cinema industry for explaining its historical and archaeological characteristics.

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Fondazione Aquileia

www.fondazioneaquileia.it

Aquileia Virtuale is an Augmented Reality Real Time 3D app for Android and iOS tablets and smartphones, produced by Ikon and NuDesign for Fondazione Aquileia, institution in charge of most archaeological areas in the town of Aquileia.

Aquileia was one of the largest and wealthiest cities of the Early Roman Empire until Attila destroyed it in the mid-5th century. Inscribed in UNESCO’s World Heritage List in 1998, it is currently a small town and the ancient Roman buildings, except for the majestic Basilica, are mostly unexcavated or buried under more recent buildings. The only way for people to understand what the ancient city looked like is through 3D reconstruction. Funded by Fondazione Aquileia, the companies Ikon and NuDesign, specialized in 3D modelling and mobile apps, have created 3D reconstructions and videos of most of the ancient buildings. The app Aquileia Virtuale, combining 3D images, videos and Real Time 3D models, allows visitors to tour Aquileia using their mobile device as a “time window” and as a multimedia videoguide. Walking around town, the visitor receives information on the ancient buildings nearby and, where there is a 3D model available, can virtually “enter” the building to explore it. The Real Time 3D models can be explored both on site (Augmented Reality) and off site (Virtual Tour): the visitor can move the mobile device around him to explore on site or use the virtual joypads on the side of the screen when off site. This app does not present a 3D walk-through but allows an exploration of the 3D Real Time reconstructed buildings using the GPS and the accelerator built in the devices, in an Augmented Reality mode, on the very spot where the original building was. Inside the 3D models are also various hotspots with information on buildings and objects. This App is the result of a strong scientific and technological partnership and of the innovative approach of Fondazione Aquileia in promoting heritage. It combines research by the scientific team of the Fondazione with Ikon and NuDesign’s technological skills and creativity, to offer a unique experience that fully engages the visitor. A live working demo of the App is available to the visitors of Digital Heritage in an installation with iPads mini to show at their best the high quality 3D models.

Apa Game

hpc-forge.cineca.it/files/visit_Dissemination/public/ApaGame

Apa Game was a project by CINECA (Italy- www.cineca.it), CNR-ITABC (www.itabc.cnr.it),

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Fraunhofer Institute (www.fraunhofer.de) and University of Ferrara (www.unife.it). Apa Game is a third-person quest for on-line PC platforms. It uses the open source Blender game engine to thrust players into the role of a merchant’s apprentice in 13th century Bologna. Guido, the main character, falls into a time vortex and finds himself in Roman Bologna, where, through the accomplishment of some quests and the solution of funny educational riddles, he must figure out a way to get back home, to the 13th century.

The game, actually, uses several already available assets from the “Apa the Etruscan” movie; the production pipeline is grounded on a complete open-source one, using tools such as Blender for modelling, OwnCloud for storage and sharing, Blender Game Engine and Burster for on-line gaming. The assets are based on precise archaeological references and realised under scientific supervision.

Slovenia

Ljubljanski grad / Ljubljana Castle

www.ljubljanskigrad.si

In late December of 2010, the City Municipality of Ljubljana established the independent public institute Ljubljana Castle. The institute organizes and conducts cultural, artistic, touristic and other events with the purpose of developing a comprehensive cultural and tourist offer. In this context, the treasures of cultural heritage preservation intertwine with eclectic contemporary art by Slovenian and foreign artists. The Ljubljana Castle institute preserves and promotes the castle's material and intangible heritage. The Virtual Castle and the Permanent Exhibition of Slovenian History stand as its two permanent museum exhibitions.

The Virtual Castle is a technical, spatial and content renovation of the past Virtual Museum diversified the offer at the Castle, taking visitors for an interesting virtual walk along the Castle’s history. The Ljubljana Castle developed the Virtual Castle project in cooperation with Art Rebel 9 from Ljubljana.

Furthermore, QR codes are used within the context of the permanent exhibition. Also, the museum has an online presence through the official website and profiles in social networks, such as Facebook and Twitter.

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Pokrajinski muzej Celje / The Celje Regional Museum

www.pokmuz-ce.si

The Celje Regional Museum has been collecting, housing and displaying the cultural heritage of Celje and its wider area since 1882. The exhibited permanent collections offer the unique opportunity to experience the "walk through time", from prehistoric times to World War I. In the official site, a web-based, virtual reality 3D museum has been developed, which allows users to enter into an artificial environment, based on computer software.

Apart from the website, the museum has created profiles in social networks in order to communicate events and activities and establish a contact with the potential visitors.

KSEVT- The Cultural Centre of European Space Technologies

www.ksevt.eu

KSEVT is an institute with the purpose to initiate and facilitate space culturalization research and development activities. It aims at creating an immersive environment for contemporary and historical intercultural scientific investigation. Having the main goal of disseminating knowledge dedicated to space culturalization to the larger public looks for innovative ways for establishing a regular contact with various audiences and engaging in the production of exhibitions and events. One of those communication channels for reaching the public is using social media for building the audience, as being one very young (1 year) institution. In addition, one of the main activities of KSEVT is the multimedia educational programmes for primary (elementary) and secondary (high) schools. KSEVT makes a good example of a contemporary museum, where the idea of using ICT solutions, from enhancing the experience, to educational programs and promoting the institution were born from day one of the museum's opening.

National Museum Slovenia

www.nms.si

The National Museum Slovenia has introduced various ICT solutions ranging from virtual exhibitions, digital reconstructions and online digitalized artefacts, to interactive games as part of exhibitions. For getting in contact with visitors and promoting their exhibitions, the museum uses QR codes, social media and of course mailing lists and web-site announcements.

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Technical Museum of Slovenia

www.tms.si

The Technical Museum of Slovenia makes use of digital archives and displays the artefacts online; the website contains all relevant information about the institution and the exhibitions, and also digital reproductions of exhibitions and virtual tours. The most important motivation behind the use of ICT is to make collections as accessible as possible and also increasing the recognizability of the museum. This is successfully addressed; it results in an increase of visitors to official website and in the amount of given feedback.

Museum of Architecture and Design

www.mao.si

The MAO is a small and flexible public institution. It uses ICT to some extent (website, social media, YouTube channel, digital inventories, some artefacts accessible online) and is trying to expand ICT knowledge and extent of use. The main reservation that personnel had when implementing ICT was fear of abuse from private partners who offer ICT solutions.

National Gallery of Slovenia

www.ng-slo.si/en

The National Gallery of Slovenia (ng-slo) makes a good example of an institution which uses ICT for several purposes, and also has a dedicated museum information specialist who is responsible for dealing and organizing ICT projects. The implementation of ICT solutions within the gallery, vary from creating digital inventories and making artefacts available online, to digital publications, virtual galleries, and usage of QR codes and eduroam. In addition, a wide range of ICT is used for PR programs, and promoting the gallery. As an institution, the National Gallery of Slovenia is continuously seeking for new ICT solutions trying to overcome the low founding limitations.

Slovene Ethnographic Museum

www.etno-muzej.si

This institution seems to be one of the most advanced in the ICT integration. The museum uses a wide array of technologies: digital archives (both a commercial system and an application of their own to have more freedom), website, eduroam, online galleries

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(containing more than 24000 digitalized artifacts with descriptions), free access digital magazines, a geolocation system (it enables the user to see from where a certain artefact came and also all artefacts connected to a specific site.); the exhibitions often include interactive multimedia components and QR codes; in PR programs museum uses traditional media, the website, mailing lists, outside websites and many social networks. ICT is used both for informing the public of museum’s activities and attracting audiences and for making the collection more accessible. The number of digitalized artifacts is constantly expanding.

The City Museum of Ljubljana

www.mgml.si

The City Museum of Ljubljana seems to be quite open towards accepting ICT and have done so to a large degree. In this context, Kronos system has been co-developed for digital archiving and the automatization of museum processes. This database is not yet accessible online, because there is a worry about potential use of these artefacts for commercial purposes by outside parties.

Semantika

www.semantika.si

Semantika is one of the leading Museum Applications providers in Central Europe. It has over 10 years of experience in Collection Management Systems, and their client list includes museums and galleries of all types and sizes, including national, regional, municipal and private institutions. Semantika is developing desktop, web, mobile and cloud solutions for a wide variety of platforms and devices and is awarded with Microsoft Gold Partner status.

Videofon

videofon.si

Videophone d.o.o. is a communications studio specializing in modern digital media. Their services range from video production and multimedia projects, to 2D and 3D computer animation, web presentations and mobile media applications. Videofon services cover the entire conceptual preparation and implementation of projects. The following link includes

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some examples related to culture and history: http://videofon.si/?page_id=2197

Logon informacijske tehnologije

www.logon.si

Logon unites experts from various disciplines of information technology. The core business is development of advanced software solutions adapted to the specific requirements of customers. Logon provides an extensive range of services and complete information support in various business processes. The principal services of Logon are: customized software, mobile apps, web development, marketing solutions, visualizations, Virtual Reality, training simulators, Research and Development.

Dimenzija (company)

www.dimenzija.com/

Dimenzija has developed in collaboration with the City Museum of Ljubljana the KRONOS System, that is a museum collections information system. KRONOS has been developed in accordance with the recommendations of the Ministry of Culture and already contains the inventory book, submission of reports and print standardized forms; it enables the standardization of museum concepts and processes. The system itself provides users with a friendly and intuitive environment where there no computer skills are needed; the entire application is carried out through a web interface. The main advantages of KRONOS include the user-friendly environment, the covering all the museums processes from registration to exhibition management, the simultaneous access to increasing number of users, the easy integration into existing computer network, the safe and fast controlled storage and documentation of material through the system. Moreover, different modules allow direct publishing of material on the internet creating web galleries.

Spain

Mochica

www.asehs.com

Mochica is a film about a Mochica's sacrifice's ceremony realised by the Spanish company asehs studio for the Royal Museums of Art and History of Brussels. The idea of the film is based on the iconography's Mochica's vases, recreate a ceremonial sacrifice of this

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prehispanic culture. The story starts from two typicals Mochica’s vases which contain two groups of warriors with different attributes (example: the shields are circulars for a group and square for the other).

Asehs studio is using 3D Technology for the reconstruction and valorisation of natural and cultural Heritage World Wide. The company is specialising in the reconstruction of virtual objects, archaeological elements and historical buildings, and works using all types of media support: Fixed images, animations, video, interactive DVD, or CD Rom.

Marq – the Provincial Archaeology Museum of Alicante

www.marqalicante.com

Together with the Fundación de la C.V. MARQ and various local archaeological museums, have spent a number of years developing a project to create virtual reconstructions to highlight and enhance some of the most emblematic archaeological sites in the province. This project is funded by the Fundación de la C.V. MARQ, as part of its annual programme of temporary exhibitions – Local Museums in MARQ. It has enabled the swift and adaptable creation of a series of audiovisual displays, which can be used by each of the participating museums to showcase their sites, in a cost effective way which would have been otherwise impossible. The institutions involved in MARQ project are also Museu d’Historia de Calp Museo Arqueologico Municipal, Vilamuseu. Museo Arqueologico de La Vila Joiosa and Museo del Mar.

UK

Panoply

www.panoply.org.uk

Panoply is a private initiative run by Steve K. Simons and Sonya Nevin, combining animation skills with expertise in ancient Greek culture. Panoply animations are created from the actual scenes which decorate ancient Greek vases. The creators keep as close as they can to the original artwork, adapting it to create the animations. As claiming in their website, the animations as well as being lovely to watch, also make great teaching resources. Some of the animations are in use in museums, while others feature in online learning modules or in classrooms. The next phase of the project targets the building of educational resources to go with the animations.

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5 Conclusions

In this deliverable we presented the main European efforts concerning ICT for CH, as well as smaller individual, private and national initiatives. The aim of this presentation was not to produce an exhaustive list of all the tools, companies or projects available at this moment throughout Europe, neither to analyse the champions of the field such as Victoria & Albert or the British Museum, which are already well-known to the wide public. Our aim was to provide a commented overview of existing efforts and not to extract statistical facts based on a broad sample. Still the following safe conclusions can be derived:

- a) European projects play a major role in supporting innovation and promote research and development in CH. The importance and impact of this support is even more valuable for smaller countries, which are poor in national funding but rich in Cultural Heritage.
- b) It is of no question that the efforts supported by European projects are, in most of the cases, of bigger duration, higher goals, deeper and wider impact. This fact could be attributed not only to the financial support, but also to the collaborative character of these projects. Designing and developing ICT solutions for CH especially for adding value to museums, collections, monuments etc, and creating meaningful artefacts for CH demands the collaboration of both IT and CH experts. It is not of surprise that even some of the successful aforementioned small companies, and also individual's initiatives are either spin-offs stemming from publicly funded efforts or follow the example of this collaborative, interdisciplinary model.
- c) In the above examples of efforts a variety of technologies and purposes were mentioned: Multimedia, sensor technologies, 3D reconstructions, digital storytelling, web-based applications, Augmented Reality, Virtual Reality, visitor's guides, virtual tours and interactive applications & games. The diversity of those technologies, successfully applied so far, shows the great potential of ICT in CH and also highlights the importance of choosing the correct tools for the correct purpose (Edutainment, Multivision, Visitor's engagement, User Experience, etc).
- d) Directly related to the two points above, is the fact that in the majority of the aforementioned efforts regardless of their size and funding resource, the development and implementation of the tools were created for a specific institution

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and for a specific purpose. This fact of course, is not necessarily against the idea of reusability and do not stand for only custom made applications, which usually are not affordable by smaller institutions, but highlights the importance of identifying the needs and clarifying objectives before going into the implementation. For the same reason, companies specialised in ICT for CH, at the least the ones mentioned above, provide consulting services, customisation and support.

- e) Despite the successful individual efforts, the question of bringing them together still remains. Sustainability, openness, and networking seem to be the promising missing link to bring more efforts together eliminating the limitations of small funding and exploit sporadic initiatives and know-how to upper levels.

6 Appendix: Table of Companies

Affiliation	e-mail	Country	Website	Focus
Greentube	stefanie.jenner@greentube.com	Austria	http://www.greentube.com/	3D games
Checkpointmedia	m.krottenhammer@checkpointmedia.com	Austria	www.checkpointmedia.com	multimedia, websites for museums
Arcicom	a.remy@arcicom.com	Belgium	http://www.arcicom.com/	audioguides
Visual Dimension	daniel.pletinckx@visualdimension.be	Belgium	http://visualdimension.be/	3D
Kascen	julie@kascen.com	Belgium	http://ka-scenographes.com/	scenography
Larian Studios	info@larian.com	Belgium	http://www.larian.com/	Video Games
Arkaos	contact@arkaos.net	Belgium	http://www.arkaos.net/	video mixing technologies



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Novena Digital Media Studio	novena@novena.hr	Croatia	www.novena.hr	Digital Media Services, 3D
Emagison	info@emagison.com	France	http://www.emagison.com/	audiovisual communication
Cibul	romain.lange@cibul.net	France	http://cibul.net/	Online cultural agenda
Buzzeum	diane.drubay@gmail.com	France	http://www.buzzeum.com/	Cultural Communication and Marketing
Mediaspheres	contact@mediaspheres.fr	France	http://www.mediaspheres.fr/	Digital Business model, communication, webmarketing for CH
Métapragis (Museographie and Museologie)	ds@metapragis.fr	France	http://www.metapragis.fr/	interactive scenography, museology
Anamnesia	m.meyer@anamnesia.com	France	http://www.anamnesia.com/	Innovative design for museum and exhibition
Mazedia Culture	http://www.museographie.mazedia.fr/refere#contact	France	http://www.museographie.mazedia.fr/	Interactive technologies, multitouch and Museography
Umaps	nicolas.loubet@umaps.fr	France	http://www.umaps.fr/	Internet publishers, communication and mediation about innovation
Aldea	info@aldea.fr	France	http://www.aldea.fr/	lead businesses and non-profit organizations in their effort to align IT with their strategic objectives.

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Ducaroy Grange	info@ducaroy-grange.com	France	http://www.fabrication-maquette-dg.com/	models designers
Reciproque	contact@reciproque.com	France	http://www.reciproque.com/	Multimedia design and engineering for museums and cultural centers
Lumento	olivier@lumento.fr	France	http://www.lumento.fr/	film creation
Signes de Sens	s.houriez@signesdesens.org	France	http://www.signesdesens.org/	museum technologies for disables people
Tech2Market	brivollet@tech2market.fr	France	http://www.tech2market.fr/	support for technology commercialization and market study
seppia	c.bonin@seppia.eu	France	http://www.seppia.eu/	Transmedia experience, 3D, augmented reality
Enigmapp	contact@enigmapp.fr	France	http://www.enigmapp.fr/	treasure hunt and visit route on mobile app
Geoffrey Dorne / Graphism.fr	GeoffreyDorne@gmail.com	France	http://www.geoffreydorne.com/	Young independant graphist/designer and researcher. EN and FR
IRI Laboratoire Centre Pompidou	contact@iri.centrepompidou.fr	France	http://www.iri.centrepompidou.fr/	R&D laboratory
Latitude Communication	yolande.geyer@latitude.fr	France	www.latitude.fr	media and communication agency

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Photograph / Virtual Visit	jmdebalthasar@gmail.com	France	www.alsace-visite-virtuelle.com	virtual visit
Urban Expé / QRiosity	nathalie.paquet@urbanexpe.com	France	http://www.urbanexpe.com/	QR Codes, Transmedia games
Virtual Experience	info@virtual-experience.de	Germany	http://virtual-experience.de/	3D videos and films
Soudgarden	info@audioguide.de	Germany	http://www.audioguide.de/de/	audioguides
Tonwelt	info@tonwelt.com	Germany	http://www.tonwelt.com/	audioguides
www.ikono.org	markevitch@ikono.org	Germany	www.ikono.org	design and strategic communication agency, video/films (IPTV)
Archimedes	wr@archimedes-exhibitions.de	Germany	www.archimedes-exhibitions.de	design and scenography
Archimedix	pm@archimedix.com	Germany	www.archimedix.com	Multi-medi exhibits, videos
Architectura Virtualis GmbH	grellert@architectura-virtualis.de	Germany	www.architectura-virtualis.de	3D reconstruction
DomeProjection.com / Projet Syntropy	michel@project-syntropy.de	Germany	http://domeprojection.com	interactive & immersive attractions, multimedia experiences

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Eye Factive	ybernhardt@eyefactive.com	Germany	www.eyefactive.com	Multitouch tables
Link 3D	info@digitale-archaeologie.de	Germany	www.digitale-archaeologie.de	virtual/augmented reality
Cluetec	annette.henkel@vaub-el.de	Germany	http://www.cluetec.eu/start-page/	Mobile Apps
KM-Apps	ds@kulturmanagement.net	Germany	http://www.km-apps.net/	mobile apps
Core Competence	cmueller@core-competence.com	Germany	http://www.core-competence.com/	Serious Games for learning
Cultimotion	sebastian.fritsch@cultimotion.de	Germany	http://www.cultimotion.de/	museums app
Janus Media	christian.gries@janus-media.de	Germany	http://www.janus-media.de/	digital communication agency
LiveQR	laura.geissler@liveqr.de	Germany	http://www.liveqr.de/	QR Codes
Textbau	info@textbau.com	Germany	http://textbau.com/	media and communication agency
Xenagos	info@prisma.gr	Greece	http://www.virtualguide.gr/	interactive exhibition guides

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makebelieve design & consulting	info@makebelieve.gr	Greece	www.makebelieve.gr	interactive, multimedia design and evaluation
Postscriptum	info@postscriptum.gr	Greece	http://www.postscriptum.gr	museum information systems, digitization
Museotechniki Ltd	info@museotechniki.com	Greece	www.museotechniki.com	consulting, R&D, products & solutions
minimatik	info@minimatik.net	Greece	http://www.minimatik.net	visual interaction & communication technologies
Easyling.com	bbenedek@easyling.com	Hungary	www.easyling.com	automatic translation for websites, interested in having CH clients
Gagarin Ltd	gagarin@gagarin.is	Iceland	http://gagarin.is/	interactive media solutions
Martello Media	markl@martellomedia.com	Ireland	www.martellomedia.com	scenography, narrative architecture, interactive experiences
Asteria	stefania.parrello@allesiementomuseale.it	Italy	http://www.asteria.it/	communication and design agency
CENTRICA	m.cappellini@centrica.it	Italy	http://www.centrica.it	digital imaging
Software developer	me@luca.simeone.name	Italy	http://luca.simeone.name/	Design Management, Interaction Design, Design Anthropology

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Syduio28 TV & PERYPEZYE URBANE EUROKLEIS	giovanni@perypezeyeurbane.org	Italy	http://www.perypezeyeurbane.org/	Cross-media cultural approach, cluster
	francesco.bellini@eurokleis.com	Italy	http://www.eurokleis.com/en/	design and production of integrated software solutions (MAXICULTURE)
ETT solutions	info@ettsolutions.com	Italy	http://ettsolutions.com	interactivity and visitor-actor immersion
TONICMINDS	http://www.tonicminds.com/wp/?page_id=242&lang=en	Italy	http://www.tonicminds.com/wp/?lang=en/	mobile environment, artificial vision and computer graphics, augmented reality
Holo Guide	c.dacosta@holo-guide.com	Luxembourg	www.HoLo-Guide.com	smart guides for smartphones
Take the Wind	pedropinto@takethewind.com	Portugal	http://www.takethewind.com/	Digital Media Services
Famasete (Wingsy)	olga@famasete.pt	Portugal	http://wingsys.pt/index.php/en/	Multitouch interactive table
Semantika	info@semantika.si	Slovenia	http://www.semantika.si/	multiple museum solutions and services
Zaslon - Telecom	http://www.zaslon-telecom.si	Slovenia	www.zaslon-telecom.si	voice systems, telecommunication
TSmedia	info@tsmedia.si	Slovenia	www.tsmedia.si	advertising services, communication strategy

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Videofon	info@videofon.si	Slovenia	http://videofon.si	digital media, animation, 3D
Logon informacijske tehnologije	http://www.logon.si/find.html	Slovenia	www.logon.si	Mobile apps, Virtual Reality, Visualisations, R&D
Dimenzija	www.dimenzija.com	Slovenia	www.dimenzija.com	musuem information systems
Fleiguia	http://www.flexiguia.com/Flexiguia_contactanos.html	Spain	http://www.flexiguia.com/Home.html	audioguides
Bilbomatica	it@bilbomatica.es	Spain	http://www.bilbomatica.es/	augmented realities
Vicomtech	mtlinaza@vicomtech.org	Spain	http://www.vicomtech.org/en	visual interaction & communication technologies
GCAM	info@gvam.es	Spain	http://www.gvam.es/en/	mobile guide for museums
Stendhal	info@stendhal.com	Spain	http://www.stendhal.com/en/	multiple museums solution
Virtualware	info@virtualwaregroup.com	Spain	http://www.virtualwaregroup.com	virtual/augmented reality
Imaste	info@imaste-ips.com	Spain	http://www.imaste-ips.com/	Webcasts, Virtual Environment

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asehs studio	contact@asehs.com	Spain	http://www.asehs.com/	reconstruction of virtual objects, archaeological elements and historical buildings, media
Brennan Design LLP	dennis@brennanwhalley.co.uk	UK	www.brennanwhalley.co.uk	interior design for museums, galleries, etc...
Pixelearning	helen.axe@pixelearning.com	UK	http://www.pixelearning.com/	Serious Games