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SPECIAL FEATURE

PRESERVING OUR CULTURAL HERITAGE

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“ EDITORIAL
by the editorial team

IS EUROPE'S CULTURAL HERITAGE FADING AWAY?

There is no denying the huge value that cultural heritage holds for Europe's economy and society. But as time flies, political priorities change and budgetary issues increasingly push governments to reduce their expenditure, there is a real risk of seeing the preservation of this heritage pushed onto the back burner — ultimately resulting in invaluable losses.

Stakeholders have been sounding the alarm for a while, peaking with campaigns like Europa Nostra's '7 Most Endangered' programme which identifies the most threatened monuments and sites in Europe and mobilises public and private organisations to save them before it's too late. Among these sites are the Berlin City Hall, threatened by the construction of a new underground station, the historic centres of l'Aquila which were damaged by an Earthquake in 2009, and the Roman and pre-roman galleries at Rosia Montana in Romania.

> **'Around EUR 100 million of research funding was granted under FP7, and an equal budget is foreseen for 2016 and 2017.'**

At the same time, current art restoration practices are increasingly showing their limits and new methods are needed to safeguard works of art without the risk of altering or deteriorating them.

Since the ratification of the Lisbon Treaty, the EU has been expected to ensure that the continent's cultural heritage is safeguarded and enhanced. A number of policies and programmes were developed: Some EUR 3.2 billion and EUR 1.2 billion were invested via the European Regional Development Fund and the European Agricultural Fund for Rural Development, respectively. Around EUR 100 million of research funding was granted under FP7, and an equal budget is foreseen for 2016 and 2017 under the Horizon 2020 programme. As pointed out by the Horizon 2020 Expert Group on Cultural Heritage, 'Not only is [cultural heritage] at the heart of what it means to be European, it is being discovered by both governments and citizens as a means of improving economic performance, people's lives and living environments.'

While New Year celebrations are mostly about hopes for a better future that scientific research personifies to a great extent, they are also an opportunity to reflect on those things that make us who we are and how to preserve them. This is why this first 2016 issue of the *research*EU results magazine* is dedicated to this newly found power of cultural heritage, through the presentation of project results that raise hope of a more in-depth analysis, better conservation and more effective transmission of findings — notably thanks to new information and communication technologies.

This special feature is followed by eight sections providing insights into biology and medicine, social sciences and humanities, energy and transport, the environment, IT and telecommunications, industrial technologies, security and safety, and space, along with a list of upcoming events hosted by or involving EU-funded research projects.

We look forward to receiving your feedback. You can send questions or suggestions to: editorial@cordis.europa.eu ”

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NEXT ISSUE

Focus on
Biomarkers to track down disease

'We did discuss the possibility of commercialising our software, but the academic project partners understood that our end users — archaeologists — work under harsh funding constraints,' says Theoharis. 'So these tools will go live free once the project ends (in January 2016). In addition, we have a great deal of data and research results that we intend to make available online. There were many related cultural heritage issues that we would have liked to tackle, so we hope that by making this information available, the research work will continue.'

Feedback from the archaeological community at various conferences, seminars and demonstrations has been very positive, and Theoharis is confident that the PRESIOUS tools will directly contribute to the preservation of European cultural heritage.

NEW SCANNING TECHNOLOGY REPRODUCES ROCK ART IN 3D

To laypeople, prehistoric art is often pictured in the form of cave paintings. But rock art, another form of visual expression found in the open air, is more ubiquitous and often threatened by the whims of the weather. The 3D-PITOTI team has set out to ensure that this heritage continues to be passed on to future generations. Since 2013, it has been developing technologies able to scan, process, reconstruct and visualise rock art in 3D.

Rock art is generally acknowledged by archaeologists as a valuable record of prehistoric and proto-historic thoughts. People represented the things that mattered to them, and rock art is a unique way of figuring out what they had in mind — be it food security, the threat of interpersonal

"3D-Pitoti's comprehensive digital processing pipeline for recording, storing, analysing and visualising rock art defines the new standard in rock-art research."

violence or gender roles. As pointed out by Giovanna Bellandi, research assistant at the University of Cambridge, 'Rock art can be seen as a type of ancient language or means of communication. It is not a form of art in the modern sense but is, rather, a form of language through which the people of the past communicated certain ideas.'

Rock art is also very different from one region of Europe to another: 'It is strictly related to the place in which it was made,' points out Bellandi. 'It is necessary to consider the geographical context, the particular type of rock and, probably, the social context. There remain many open questions about rock art, and only by continuing research with different and new

approaches can we hope to answer these questions.'

The 3D-PITOTI (3D acquisition, processing and presentation of prehistoric European rock-art) project focuses on Valcamonica in the Lombardy region of Italy — a UNESCO World Heritage site home to at least 100 000 rock art images known as 'Pitoti' and perhaps twice as many more hidden across the region. Most scientific and technical experts with extensive knowledge of Valcamonica joined forces to develop the technology to capture, process and visualise in 3D what is reputed as some of the best rock art in the world. Together they hope to enable a wider audience to experience the Pitoti in an interactive and engaging manner.

'Most prior recording was 2D — photos or tracings of 3D forms carved into the rock surfaces,' says project coordinator Dr Sue Cobb from the University of Nottingham. 'The third dimension adds valuable information, for instance with the superimposition of carvings that can allow us to develop relative chronologies.' Team member Craig Alexander noted that while this is not the first time a 3D recording technique has been used in this field, this is the first time it results in digital recordings: 'Over 40 years ago a series of plaster casts was taken in Valcamonica that could be reproduced and exhibited away from the park. However, digital data is weightless and rapidly transferred from place to place — making our 3D

models accessible to anyone with a decent internet connection. A tangible representation of the rock art in a context away from the real valley can also be produced through modern 3D printing technologies.'
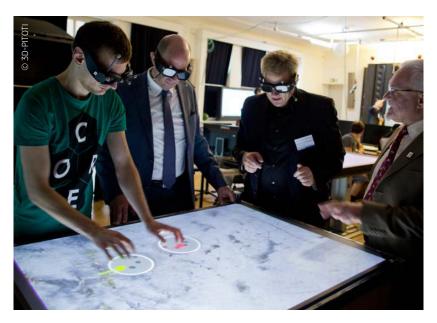
A new set of tools

The team's developments resulted in an entirely new pipeline for multi-scale acquisition, processing and visualisation of rock art. A new rock-art scanning system capturing rock art with sub-millimetre accuracy was developed, and new techniques for flight path planning of 'Unmanned aerial vehicles' (UAVs) allow an efficient and effortless capturing of the terrain surrounding individual Pitoti figures on a centimetre to kilometre scale.

For the processing stage, the project developed techniques to accurately register and combine a large number of these 3D scans into a coherent multi-scale 3D model. Advanced segmentation and classification tools support the semi-automatic identification of different types of Pitoti such as people, buildings and animals and, finally, the visualisation and interaction tools allow the exploration of the Pitoti in their natural surrounding on a wide variety of platforms, from tablets and notebooks to head-mounted displays and the Pitoti Scientists' Lab, a unique high-end 3D visualisation facility at Bauhaus-Universität Weimar.

'The software developed in the project is extremely useful, as it allows for

© 3D-PITOTI

integrating the possibilities of a normal database, organising and storing the data, and also having the Pitoti located in their natural 3D environment and not only on a two-dimensional map,' says Paolo Medici, archaeologist at the Camunian Centre of Prehistoric Studies. 'The database has been created on the basis of the archaeologists' request, so it meets the need for advanced digital rock-art research.'

The benefits of 3D-PITOTI's system are manifold. Whilst state-of-the-art recording of rock art (by tracing on plastic sheets) takes a lot of time and skills and is an analogue technique, the new technology allows archaeologists to scan in high resolution, at multiple scales and in less time — regardless of the number of engravings. The combination of these reconstructions within a single database also enables researchers to concentrate on the big picture. 'Working with an integrated digital pipeline, large numbers of Pitoti can be compared between each other and to rock art at other locations. . This ability to handle large amounts of data also helps us find patterns in the art that might suggest its meaning,' Dr Cobb says. Such a comprehensive digital rock-art library used in combination with Weimar's collaborative 3D visualisation facilities defines the new standard for rock-art research.

Straight to the working field

The consortium hopes to keep developing and testing the project's technologies over the months to come. Graz University of Technology and ArcTron 3D will be working towards the next prototype of the scanner, and several of the archaeologists at the University of Cambridge have already voiced their interest in using the technologies beyond the framework of the project.

Craig Alexander would like to use technologies like image segmentation and classification in the analysis of aerial imagery in order to find new sites such as Neolithic villages in Puglia, while Liliana Janik is hoping to use it as part of her equipment while recording rock art. Frederick Baker, a Pitoti researcher, is interested in filming opportunities: 'I hope the scanner will become the new standard piece of fieldwork equipment. As a film director I will continue to use the scanning technique to create new film in images and a new filmic language,' he concludes.

3D-PITOTI
★ Coordinated by the University of Nottingham in the United Kingdom.
★ Funded under FP7-ICT.
★ http://cordis.europa.eu/project/ rcn/106885
★ Project website: http://3d-pitoti.eu/
★ 📹◀ http://bit.ly/1OP1jfF

JOINT STAKEHOLDER EFFORTS SHAPE TOMORROW'S DIGITAL CULTURE

Already underway, the digitalisation of culture requires a common vision from all stakeholders in order to truly take off. The SMARTCULTURE project brought together 13 partners from eight European regions to shape future developments in the sector.

The digitalisation of cultural heritage is one of the main challenges facing European museums and other cultural institutions. Libraries, museums and heritage sites are increasingly experimenting and embracing new technologies able to turn formerly passive audiences into active practitioners of culture.

This process is key not only to protecting art and architecture from the ravages of time, but also to drawing in a new generation of enthusiasts who have been brought up surrounded by tactile devices and the Web 2.0. There is one thing, however, that hinders the development of this new culture consumption pattern: the lack of cross-fertilisation.

Completed in November 2015, SMARTCULTURE was a three-year project involving cooperation between 13 partners and bringing together eight regional research centres from across Europe. What these partners have in common is their interest in culture, heritage and ICT: Most of the regions involved have a very high population, a very rich cultural heritage with the likes of the Louvre-Lens, Museo Guggenheim and Museo del Prado, as well as dynamic production of contents. Some are European leaders in information & communication and creative & cultural industries, and all have a strong relationship with 'European capitals of culture' (ECoC) whether previous winners or candidates.

'The Digital Cultural Heritage sector necessitates a wide range of competences,' says Anca Draghici, coordinator of the project for French technological hub Euratechnologies. 'Consequently, the cross-fertilisation between ICT enterprises, creative and cultural industries (especially SMEs), research stakeholders, cultural institutions and public