



Digital digs: Technology preserving Europe's cultural heritage

Technological advancements such as 3D scans based on drone images are helping archaeologists document Europe's heritage before sites and artefacts are lost to future generations.

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The common perception is that archaeologists spend their time crawling around a dusty dig on all fours, but Serbian researcher Nenad Jončić could not be more different. He uses drones and digital technology to document archaeological sites at risk of disappearing.

In January 2016, Jončić, then a postgraduate archaeology student at the University of Belgrade, was seconded to a technology company operating in Slovakia that specialised in documenting archaeological sites and artefacts.

Digital reconstruction

His work was part of an EU-funded collaboration aimed at safeguarding cultural history in Eastern Europe. Called CONPRA, the research initiative ran from 2013 to December 2016.

It brought together university researchers and small businesses working on archaeological sites in Slovakia, Czechia, Slovenia and Serbia. The idea was to exchange know-how in the use of digital imagery for creating 3D reconstructions of sites.

For Jončić, it was a life-defining experience. "It helped me to understand what I wanted to do in my life," he said.

It inspired him to start one of the first private archaeology companies in Serbia, ArheoData, so that he could continue to help protect Serbian cultural heritage. He also became the "digital heritage specialist" for Belgrade's National Museum.

During the EU-funded collaboration, and with his company, Jončić perfected the use of drone technology, thermal imaging and other cutting-edge archaeological techniques to create stunning 3D visuals of archaeological digs.

Speed is of the essence

He is acutely aware of the time constraints archaeologists face, an issue where digital technology comes to their aid.

“In scientific archaeology, you have all the time in the world, it’s a very slow process for analysing and documenting everything,” he said.

“In protective archaeology, it’s like you’re running out of time from the start. We’re really running in front of bulldozers. We have to be very fast, very accurate, to do everything on time because if you’re too slow, it’s going to disappear.”

Digital technology rapidly captures historical remains in minute detail to create a permanent digital record before archaeological sites are lost to urbanisation and infrastructure development.

This approach is rooted in the principles of protective archaeology, set out in the 1992 European convention on the protection of archaeological heritage.

While most ongoing archaeological activity follows this approach, navigating the world of property development – where financial pressures often take priority – remains hard work for archaeologists, explained Professor Predrag Novakovič, an archaeologist from the University of Ljubljana, Slovenia.

“Preventive archaeology is very important,” said Novakovič, who co-led the EU-funded collaborative effort. “It’s also the most demanding and challenging situation because you have to negotiate with developers and planners. The pressures on archaeologists are very real.”

Novakovič and colleagues shared the advanced techniques they were already using in university labs to grow the number of small businesses working in preventive archaeology. The goal was to help Eastern Europe catch up with advancements in archaeology in other European countries.

Recreating prehistoric sites

One of the sites they worked on was Vinča in Serbia, one of Europe’s most important prehistoric sites, located just 14 kilometres from the University of Belgrade. The team used digital techniques to recreate the development of early human settlements and their daily routines.

At the neolithic site, Jončić and others used photogrammetry, a non-invasive technique that captures multiple photographs from different angles. This method uses handheld cameras or aerial shots taken by drones to create highly detailed, vivid 3D models.

“It was really the beginning of digital archaeology and the implementation of the gadgets that we’re using now,” said Jončić.

His company is now documenting fortresses lined up along the Danube. Known as the Limes, they were once part of the Roman Empire’s defence system.

One of their projects is an educational film – entirely based on their 3D reconstruction – about two large burial mounds from 500 BC in Atenica, central Serbia.

The researchers created a digital simulation of how the mounds were built, from the tomb itself, decorated with precious amber beads and iron parts of a wagon wheel, to the carefully arranged circular mound of rocks covered with earth.

Other challenges lurk

The pressures of property development are not the only threat to archaeological sites. In recent decades, climate change and its impact on soil have also been factors to reckon with.

Dr Fabiana Battistin, a postdoctoral researcher in classical archaeology at the University of Tuscia in Viterbo, Italy, has been investigating the impact of environmental changes on historic sites.

Alone or in combination, soil erosion and changes in land use can cause physical damage to archaeological sites, both above and below the surface.

“Soil erosion can mean we lose very important archaeological information. By exposing and destabilising buried remains, it can literally destroy layers of information about the past,” said Battistin.

From 2018 to 2023, Battistin was part of an EU-funded initiative called RESEARCH. Researchers from Italy, Greece, Cyprus and Poland explored how new remote sensing techniques could help preserve valuable archaeological information under threat.

Stefano De Angeli, an associate professor of classical archaeology at the University of Tuscia who coordinated the project, highlighted the value of international cooperation.

“The opportunity for transnational cooperation provided by EU funding has allowed us to test the methodology developed in very different environmental conditions and types of archaeological contexts. This made the methodology adaptable, and, therefore, replicable in other archaeological sites in Europe.”

The researchers tested different aerial, satellite and ground-based remote sensing technologies to assess the impact of soil changes and the vulnerability of archaeological heritage sites.

Their results led them to create a prototype of a new geographic information system that will help local authorities better understand the risks to heritage sites in their region and put in place plans for their protection.

“We were able to map the vulnerability of a site and the environmental threats it faced, assess the risk level and provide data-driven information on how best to protect it,” said Battistin.

For Jončić, the insight into how early European cultures lived that was gained at the Vinča site sums up the essence of why preserving archaeological heritage through digital records is so important.

“It’s heritage for all of us because archaeology isn’t connected with national identities. It speaks to all of us. And if we really want to know how we came to live like we do today, we need to know how these people lived before us.”

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- [RESEARCH project website](#)
- [Cultural heritage in EU policies](#)
- [European Convention on the Protection of the Archaeological Heritage](#)