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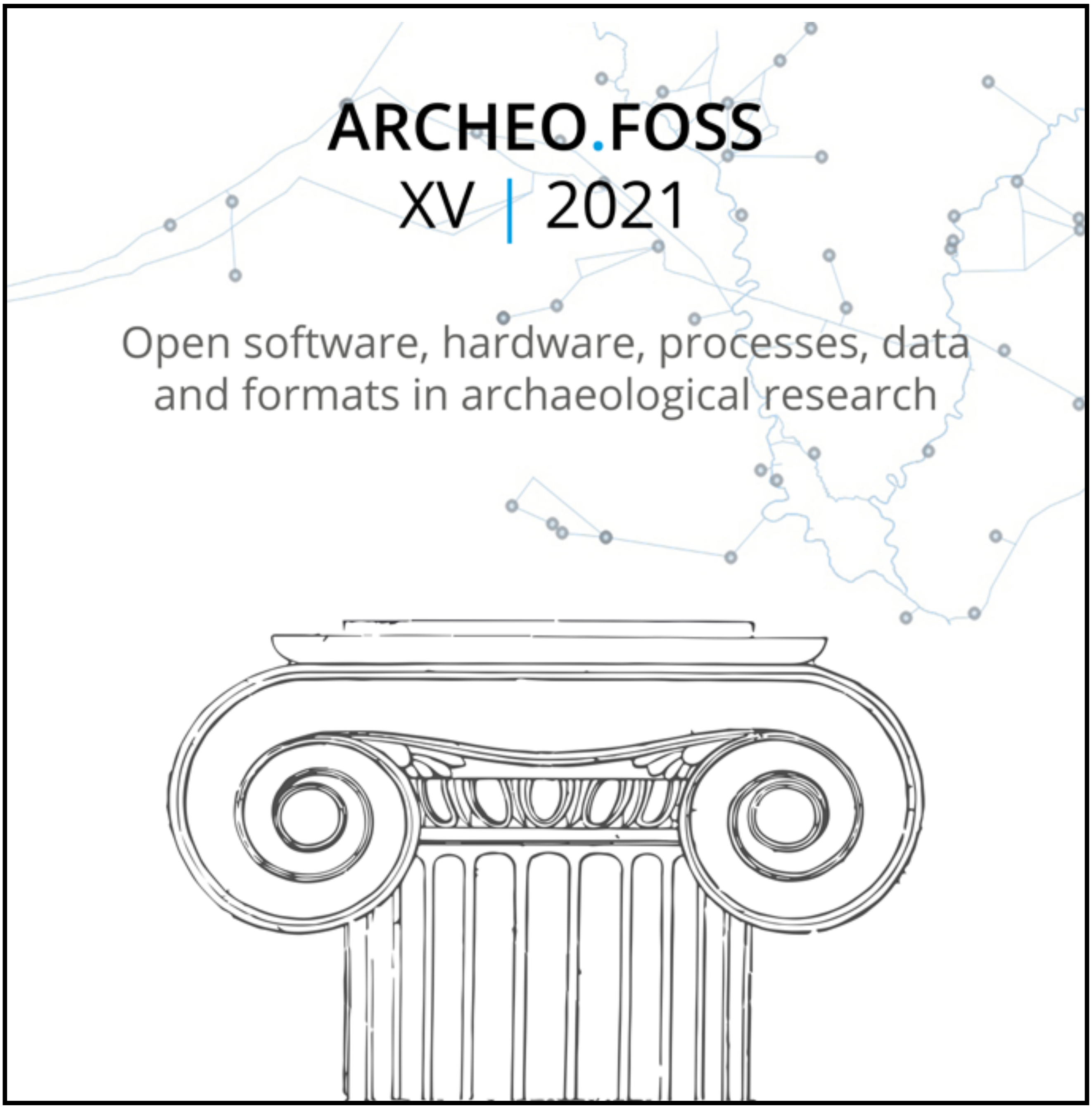

ArcheoFOSS 2021 Conference

GIS, 3D, OPEN DATA

WORKSHOPS

PRE ACTS

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ARCHEOFOSS 2021 PRESENTATION

• ***Introduction: The ArcheoFOSS 2021 Conference***.
The 15th edition of the international conference ArcheoFOSS Open Software, hardware, processes, data, and formats in archaeology is now open.
After the 2020's conference is the second year in which the official conference languages are both English and Italian.
The conference will address a range of important topics and themes relating to data sharing, open tools, processes and formats in the archaeological domain.
The Organizing Committee invited scholars, independent researchers, institutions, freelance archaeologists, and professional companies involved in Cultural Heritage to submit their original researches or case studies by exposing the latest trends, theoretical or practical developments and challenges in the field.
On behalf of the Scientific Committee 2021, the Organising Committee encouraged abstract proposals focused on some thematic areas. Furthermore, for the first time, ArcheoFOSS published the pre-acs volume to facilitate the sharing and the deep understanding of any issues.

• ***The structure of the conference***.
In the conference programme, it is possible to read how the ArcheoFOSS 2021 conference is organised. We have two macro-areas named Talks and Workshops. Compared to the other versions of Archeofoss, the theoretical part was shortened giving more time to practical exposure. The Talks are arranged into the following sessions: two GIS-related groups, one 3D and one Open Data group.

• ***A 'light version' for a 'complex issue'***.
In the present time, organising a congress is more innovative in a fully online way. The Scientific Committee's idea for 2021 was to create a light version of the conference: 10 minutes for each talk and 5 for its questions.
During these months, the Organizing Committee worked on several fronts, including dissemination and the official publication of the pre-acts, available on Archeomatica International (www.archeomatica.it/riviste). The aim is to allow the audience time to delve into the content of the speeches and workshops beforehand while maintaining the high scientific value of the whole ArcheoFOSS experience.
Another stated ambition of this year's conference is to give more space to the practical experiences and to train the ArcheoFOSS community in new tools and methods. The purpose is to improve and increase the awareness of the community in the use of various tools, which are helpful to raise the level of the conferences in the coming years.

• ***The FOSS way to organise ArcheoFOSS***
With this talk, we want to raise the following organising committees to increase the FLOSS solutions to build our annual conference.
Nowadays, there is no complete workflow to organise the ArcheoFOSS congress, a path we will need more and more in the future for credibility issues.
Today we can list the use of openly licensed FLOSS tools such as Jitsi for the periodic organisational meetings, programming Java for the website, Telegram for the daily communications of the organising committee, OpenOffice for document writing and proofreading. However, we are far from achieving our goal because we are too dependent on cloud services from private, closed licence operators, which we have gradually chosen for their convenience and use.
We hope that the replacement of freeware tools will gradually continue until we find a stable manner of organising ArcheoFOSS in a completely FLOSS way.

• ***State of the art***
This year the conference presents an overview of the current use and development of technologies for cultural heritage in the EU and starts to increase its statement in some other parts of the world, especially in the USA and Japan.
It will show a general growth in awareness, authority and natural use of Floss tools.
However,it is not enough, the community is still too small, and the organisation of those above extensive practical sessions increases the audience disseminating good practices and innovative methods for cultural data management.
We very much welcome the news of the recent publication of the 2019 conference proceedings and the imminent publication of the 2020 proceedings. The continued work of publishing these volumes depends on the resumption of the current annual activities of the ArcheoFOSS movement.

• ***Closing***
We hope that this experience can be repeated in the future as proposed, improving the format but confirming the need to strengthen the basis of the people who refer to ArcheoFOSS for their updating and training.

• ***Credits***
We express our thanks to Archeomatica editorial staff, who cooperated with us, step by step,to disseminate the news and made itself available to realise these pre acts in the hope of collaboration for years to come.

by Domizia D'erasmo, Cristina Esteban Gonzalez, Paolo Rosati, Matteo Serpetti, Livia Tirabassi

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CULTURAL HERITAGE TECHNOLOGIES
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Open History Map
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OPEN-SOURCE GIS FOR COLOSSEUM STUDY AND MANAGEMENT

by Elisa Cella, Fabio Fumagalli, Pietro Giannini, Silvia Impinna, Francesco Laddaga, Barbara Nazzaro, Federica Rinaldi, Jacopo Russo, Emiliano Tondi, Martina Almonte, Simona Morretta

Both the architectural and fruition complexity of the Flavian Amphitheatrehas become even more evident during the pandemic lockdowns: the past months saw the increase of maintenance and conservation activities, together with the last phase of the restoration works of the hypogea, as the second act of a broader intervention on the entire monument, started in 2011 by SSCol Superintendence.The first phase of works focused on the Northern and Southern Colosseum fronts. It gave a chance to design in 2016 an OSS GIS for the storage of all the conservation mappings and interventions carried out on the facade together with the classification of the monument's architectural and archaeological elements. Mainly intended as an atlas, the system allowed the query of any information from the drawings or documents stored, including images at the deepest detail, as in the case of the brick curtain wall of the southern front, consisting of about 22,000 bricks vectorized in 1:1 scale. In 2018, at the start of the works in the hypogea, PArCo officers decided to expand the GIS system, creating a broader atlas of restoration, architectural and archaeological features of the entire monument. Most of all, the whole dataset was used to enhance and computerize the daily, complex, and multifaceted management of the building's ordinary and extraordinary maintenance activities.It was confirmed the use of OS software, considering the constant updates, the extreme flexibility of the tools designed, and the obligation to comply with the Digital Administration Code. A vast interdisciplinary team developed a programming and monitoring system for structural and ordinary management issues; the range of activities goes from cleaning and electrical systems report management to consolidation interventions, based on a dataset of all the restorations carried out on the walls of the monument from 2017 onwards. The management heart of the OS system architecture is the PostGIS database. It counts hundreds of cross-checking reports and automation, guaranteeing the consistency of the data entered. A sophisticated profiling andauthentication system allows the safe management of different users' needs, with varying authorization levels.

The database currently consists of thousands of geometries, images, or technical relations, accessible both via the QGis platform for the cartographic part and with an application for complex queries.The maintenance management app object of this presentation is currently undergoing an on-field stress test to detect any weakness in the flow of information. It is anyway intended as an integral partof the general system and was created through an OS Webgis laying on the mapping dataset, integrated by an intervention management dashboard.The app generates a location-based alert, like textual and photographic data, defining the urgency and characteristics of the intervention needed. The reporting activity is carried out by "trackers," specific staff figures of the archaeological site (engineers, workers, cleaners, restorers, archaeologists, etc.). All reports flow to a control figure, the "validator,"who accepts, corrects, or rejects the ticket and is in charge of opening new activities, such as assigning priorities, deadlines, setting chronological recurrences for verification, or requesting additional details to the original tracker. He also has itsmanagement dashboard in a desktop environment, connected to the same PostGIS database used by the "tracker."Every report or ticket is connected to a reference system based on the architectural characteristics of the Colosseum and is called "Flavian Coordinates." Instead of latitude, longitude, and altitude, we have adopted three coordinates identifying the fornix, the ring, and the order, dividing the monument into univocal and coded reference units. Opening a ticket starts a procedure designed for adaptive screens and optimized for mobile devices: the system provides a three screens wizard for locating the anomaly by simply tapping the surface of the device in correspondence with the Flavian coordinates in which the element is; compiling of a brief descriptive form, with pre-filled vocabularies and accessible text areas; uploading one or more editable pictures, to mark, by drawing, specific areas to control. Once saved, the report becomes part of the tickets archive. It is visible in a summary map of allthe alerts waiting for check: thanks to this procedure, all the interventions deriving from a report are stored, as well as the evolutions in priorities or intervention planning, tracking the historical memory of the maintenance status of every single element reported.

Thanks to this archive, the Colosseum maintenance app may become a core tool for managing a monument that would provide challenging tasks even if it were not open to the public. The chance to historicize and track any interventions and check over the past years' reports allows one to better understand the anomalies of the moment. It implements the ordinary integrated maintenance of the monument, providing a helpful tool to strengthen long-lasting strategies. The entire OS GIS is, in fact, much broader and more complex than illustrated and obviously allows to interrogate and manage, for documentation and research activities, all the archaeological and archival aspects, through complex queries of historical cartography, drawings, and photographs through the use of metadata; however, the system is designed to interact with future activities, as it is provided for the connection to the BIM system, related to the 3D survey of the entire monument for the new forthcoming seismic monitoring.

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Keywords

Colosseo; ParCo; PostGIS; QGIS; WebGIS

Authors

Elisa Cella[1], Fabio Fumagalli[2], Pietro Giannini[3], Silvia Impinna[3], Francesco Laddaga[3], Barbara Nazzaro[1], Federica, Rinaldi[1] Jacopo Russo[3], Emiliano Tondi[3], Martina Almonte[1], Simona Morretta[4]

Parco archeologico del Colosseo[1], Freelance[2], Poleis scarl[3], Soprintendenza Speciale Archeologia Belle Arti e Paesaggio di Roma[4].

AN OPEN-SOURCE PLATFORM ADDRESSING STRUCTURAL STABILITY RISK ASSESSMENT IN HISTORICAL CENTERS

by Renzo Carlucci, Charilaos Maniatakis, Philip Fayad, Andrea Di Iorio, Nikolaos Schetakis, Constantine Spyrakos, Haris Saroglou, Alessio Di Iorio, Alexandros Paraskeuas, Nikos Papadopoulos, Dimitrios D. Alexakis, Roberta Orsini, Cristina Manzetti

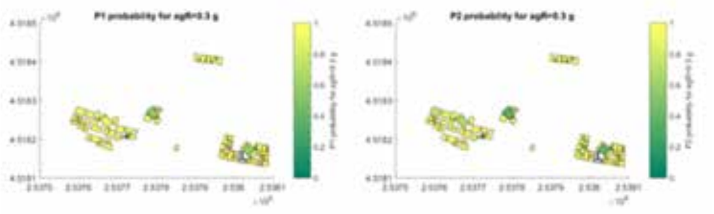

Fig. 1 - The indicative output of the code for the test case in Nafplion (Greece).

Introduction

STABLE (STructural stABiLity risk assEssment, 2018-2022, Horizon2020, MSCA - Marie Sklodowska Curie Actions - RISE - Research and Innovation Staff Exchange - grant agreement n. 823966), has the goal of developing a digital platform to forecast earthquake damage to Historical City Centers in Europe combining different techniques and methodologies: structural stability models, earthquake simulation tools combined with geotechnical data, remote sensing and in situ monitoring technologies.

The goal of the project is the development of a risk modeling system with the integration of different data, from SAR satellite images with geological and geotechnical information, to create deformation soil maps. To achieve those above, we use free and open-source solutions as far as possible.

The risk map generation

The goals of the study are to investigate the vulnerability of the built environment and combine the results with hazard scenarios as the first fundamental step in the seismic risk mitigation process. The two key elements of a vulnerability analysis are a structure's capacity (strength and deformation) and the seismic demand. The results are vulnerability functions expressing the expected damage of the structure as a function of the seismic input. Corresponding fragility curves will be determined, expressing the probability of a structure belonging to a specific class of reaching or exceeding a particular damage grade given a deterministic estimate of the spectral displacement of the expected hazard (e.g., Kappos et al. 2008).

Estimating damage probability will be performed through a simplified mechanical methodology (Lagomarsino and Giovinazzi 2006). This method provides satisfactory accuracy for relatively simple constructions while assessing of structural capacity for more complex constructions, such as monuments requires more elaborated methodologies (Spyrakos, et al. 2015). Initially, the required input parameters will be collected, including:

- *Structural data* (typology, construction period, use of the building, post-earthquake damage data, detection of different construction phases, etc.)
- *Geometrical data* (total height, number of stories, perimeter, footprint area, average bearing wall thickness for masonry structures, Plan view at least of the ground floor, etc.)
- *Satellite data* (coordinates of each building, number of building blocks, number of buildings in each building block)
- *Vulnerability data* (estimation of vulnerability by rapid assessment methods)

The Structural Model processor

This program calculates the risk map of the building stoke of an area for a given seismic hazard by applying a simplified mechanical method. *Risk* is defined as the probability of a certain level of damage being exceeded. Four levels of damage are examined, namely P1, P2, P3, and P4. The level of damage Pi increases with increasing i = 1 to 4. The probability takes values from zero (totally unlikely) to one (certainty).

All the calculation process has initially been realized in MATLAB, a programming platform designed to allow expression of computational mathematics, that for our experimental process is facilitating the use of complex mathematical functions. It has been possible to analyze data, develop algorithms and create models and applications with this. The final aim is to define the capacity curve and the exact displacements related to specific damage states, derived through sophisticated analysis for a selective case-study building.

The code from MATLAB has been translated to an open-source programming language (Python) using the software tool GeoPandas. GeoPandas enables the user to easily do operations in Python that would generally require spatial database software. PostGIS is used for the webGIS representation of the final risk map. By translating the code to Python, we further ensure the open-source capability.

The code requires as input both Structural data and seismic spectral data.

The structural data

The structural data related to the under-examination building are included in a Geopackage file containing information on the geometry, the Average height (Z), and some information about the typology of the building. GeoPackage is an open, standards-based, platform-independent, portable compact format for transferring geospatial information.

The Seismic hazard data

The seismic hazard data are included in a Geopackage file that includes different seismic acceleration spectra at a grid of points within the area of interest. The side of the grid is proposed to be 5.0 m x 5.0 m. At each point corresponds to an acceleration spectrum which has resulted from a seismic hazard analysis taking into account the seismic sources and the local soil effect (e.g., Tselentis et al. 2010).

The final output

The final output depicts with color the value of probability Pi for the given seismic scenario. In Figure 1, indicative results of the code are presented for probabilities P1 and P2.

The GIS platform

All the data derived will be stored in the STABLE GIS platform. More specifically, concerning the processing of the Structural Model processor outputs, automated workflows are used to convert of the Georeferenced Fragility curves to actual classified Structural Vulnerability features in an open format.

Essentially, each building/feature is classified according to its assigned fragility value from the previous Structural Model processor step.

Actual achievements

The project is based on the application of the simplified structural stability model to the whole area of the city center under analysis using open-source software tools. The simulation of different earthquake scenarios, also considering the geological information available and the response of the structures involved in the scenario, will provide detailed damage maps of the area at the building level, enabling preparedness for the seismic events. Public authorities, Urban Planners, and Cultural Heritage responsible will have the capability to address preventive maintenance and consolidation of the structures most damaged by future earthquakes.

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Abstract

The management of stability risk assessment in historical centers is handled in a project that aims to design and develop an open platform where blocks of buildings and large structures may be represented in damage maps before the event occurs, addressing damage forecast for seismic movements impacting the structural stability of the CH. The structural stability is calculated using a Matlab code, translated to an open-source programming language (Python) using the software tool GeoPandas to enable operations that generally require spatial database software (PostGIS). Furthermore, open-source technologies like QGIS desktop software will provide open and free access to view and contribute to in the future.

Keywords

Cultural Heritage; historical center; risk assessment; open platform; GIS; PostGIS; Python;

Authors

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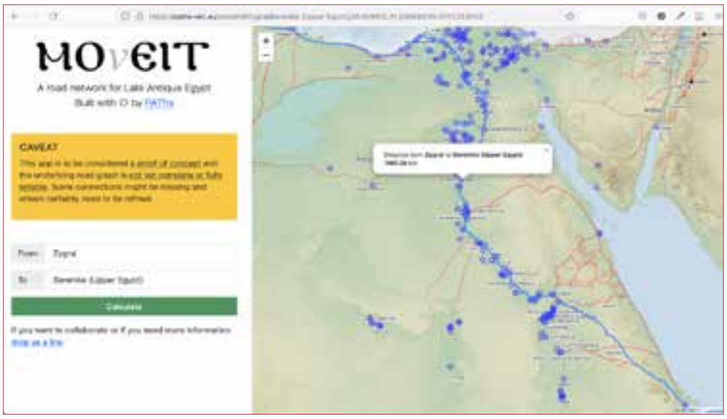
Software and License

QGIS, GPL; PostGIS, PostgreSQL License

MO(v)EIT: PROOF OF CONCEPT OF A ROAD GRAPH FOR LATE ANTIQUE EGYPT

by Julian Bogdani



Screenshot of MOvEIT web application

MOvEIT is a first and rough attempt, a proof of concept, aimed at linking the archaeological sites being catalogued and described in the Archaeological Atlas of Coptic Literature by PAThs, a project directed by Paola Buzi and based at the Sapienza University in Rome (https://atlas.paths-erc.eu/). This contribution is aimed at providing a fast overview of this secondary project, both from the conceptual and the technical point of view. Since it is developed as an open source project (GNU AGPL v3), it is our wish that other people get involved and/or adapt the general idea and the actual framework to their own projects.
For this reason, this paper will be divided in two parts, the first concerning the construction of the road graph, the fundamental basis of any spatial analysis. This part that might be of major interests to scholars trying to understand what the general idea behind the road connection of Late Antique and Medieval Egyptian sites, i.e. PAThs Places is. The second part will be dedicated to the building, updating, and deploying of the Web application where actual directions can be automatically obtained linking two sites. This second part might be of interest to those who want to adapt the application to their own data sets.
The main application is available at https://paths-erc.eu/moveit/, and its source code is hosted on GitHub, at https://github.com/paths-erc/moveit.

The road graph

The road graph of the Late Antique and Medieval Egypt is created and maintained in a GIS environment, as a basically two-layers project. The first being the PAThs places, rendered as a point layer, and providing the nodes of the graph. The second, a polyline layer, connecting these nodes and as such providing the arcs of the graph. As far at the archaeological sites are concerned, many articles have been published explaining the methodology followed to localize and fully describe each place of interest for the Archaeological Atlas of the Coptic Literature. This work is still ongoing and from time-to-time new sites are being added, although the main work consists in providing a thorough description of the already listed sites and in providing geographical coordinates (i.e. positioning) of toponyms still lacking a proper geographical contextualization. This means that the road graph is also being actively updated, since each time a new site is positioned in the map, it must be linked to the main graph.
Different methodologies have been followed to link together sites, i.e. to draw the arcs of the graph. While the precise position of a site can be in most cases clearly defined thanks to a long tradition of archaeological and literary studies, the same cannot be affirmed for the communication network. We do not have, at present, a detailed and affordable model of the road network related to Antique Egypt. It is also far beyond the limits of this experiment to try to build one, based on meagre archaeological evidence in a region where urbanization has radically changed the general landscape.
For these reasons a middle road was followed, by integrating available archaeological information with data deriving from geomorphological analysis and finally by direct (straight lines) connections when no other information was available. The Barrington Atlas of the Greek and Roman World by R. Talbert and R.S. Bagnall provided the main source for the road network. The theme was already available in vector format (Shapefile) thanks to the admirable work of the Ancient World Mapping Center, and released with CC BY-NC 3.0 (metadata: http://awmc.unc.edu/wordpress/map-files/roads-metadata/, files: http://awmc.unc.edu/awmc/map_data/shapefiles/ba_roads/).
A second source of information was provided by the most important highway of Egypt, since very remote times: the Nile and its branches. For this reason the course of the river, the Bhar Yussef channel and the main branches of the Delta where considered navigable and provided a natural backbone for the graph. Since the course of Nile has much changed in the last 100 years due to the constructions of the dams at Aswan and the creation of lake Nasser, the Napoleonic map of Egypt compiled in last years of 1700s was used. Sites by the river were connected with straight lines to the polyline representing the Nile, while farther sites were preferably connected to nearer sites and not directly to the river. This clearly an arbitrary decision is based on the simple assumption that sites were connected to each other, if no natural barrier forbade the direct passage. Furthermore, even if direct connection of farther sites to water might be shorter, it is reasonable and more economic to extend the passage to include nearer sites already connected to the Nile.
Straight lines have been manually adapted in few cases to avoid natural barriers, such as mountains, of difficult to cross ridges. While we are fully aware of the arbitrary nature of this criterion, we have made transparent the source of each line, by adding a description for each arc of the graph recording its source, be it bibliographic, water-course or a straight connection. This makes it easier in the future to gradually fix erroneous connection on the basis of new information.

The Web application

The Web application, available at https://paths-erc.eu/moveit/, is a SPA (Single Page Application) built with HTML and JavaScript. The routing functionality — i.e. the calculation of the shortest path between two nodes —is handled by the GeoJSON Path Finder (https://www.liedman.net/geojson-path-finder/) an open-source (ISC), serverless, offline routing JavaScript library for the browser. Since this library doesn't integrate any UI (user interface) tool, this has been built using Leaflet, the well-known and open source (BSD-2-Clause) web-mapping library (https://leafletjs.com/). The application embeds the road graph and pulls the list

of the PAThs Places from the PAThs web-database based on BraDypUS, by using the available read-only REST API. When a new site is added to the database and the road graph is not promptly updated, an error will be thrown and the path to/from the newly added site will not be calculated. Each time a route is calculated, the URL of the page in the address locator will be updated, easily obtaining sharable URLs containing routes.
GeoJSON Path Finder is a NodeJS (https://nodejs.org/) package and it means that NodeJS is required for further development or update, even when the road-graph is updated. The Web application, nevertheless, integrates few scripts to render plain and fast both developing and building the application.
Further enhancements might regard the use of more complex routing UI libraries, such as Leaflet Routing Machine (http://www.liedman.net/leaflet-routing-machine/), and, most important, by setting a user-defined (custom) cost for each path in the road graph. Actually only the distance is considered, but in the future it will be possible to differently weight desert tracks, water-ways, well-built roads, etc.

Abstract
In the context of PAThs project, an experimental attempt to link places being described in the Archaeological Atlas of Coptic Literature, developed into a road graph for Late Antique Egypt. Desktop GIS is used to build the graph following different methodologies and resulting data have been published online. A single page application was built and is available to calculate directions from one place to another. The graph is continuously updated, following the implementation of the Atlas.
Keywords
Digital archaeology; communication graph; late antique Egypt; landscape archaeology; web technologies

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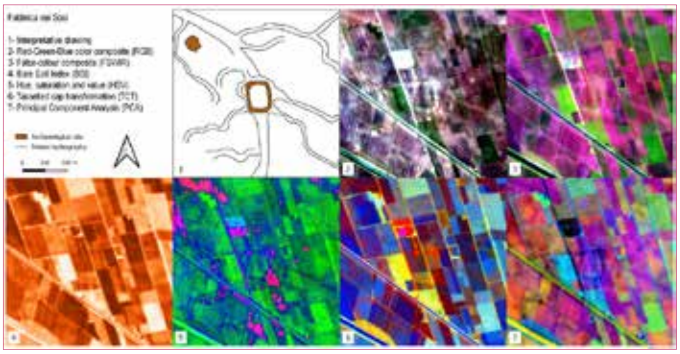
List of FLOSS software used/ data repository and licence:
Software: Node.js, QGIS, BraDypUS
Libraries: Leaflet, GeoJSON Path Finder
Repository: https://github.com/paths-erc/moveit; https://paths-erc.eu/moveit/
License: GNU AGPL

PALAEO-LANDSCAPE FEATURE IDENTIFICATION: A FOSS CLOUD-BASED PYTHON APPROACH THROUGH GOOGLE EARTH ENGINE (GEE)

by Guillem Domingo-Ribas, Filippo Brandolini



Contemporary landscapes materialise from the complex long-term interactions between natural and cultural forces. Human populations reorganise the land, adapt its use and its spatial structure to meet their needs. Their use of the land has altered the natural environment at least since the late Pleistocene, and, over recent millennia, these processes have accelerated. Therefore, given the thread of human activities as active geomorphological agents that modify the physical landscape, it becomes paramount to develop techniques that enhance past landscape reconstruction while aiding future landscape planning and sustainable development perspectives.

In this line, interdisciplinary GIS and remote sensing techniques have provided significant enhancements in landscape research. These tools have improved the analysis of landscape dynamics over different spatial and temporal scales, enabling the identification of land-use change, inferring population dynamics, economic development and, in turn, providing examples of human resilience through past sustainable development practices. Thus, GIS and remote sensing tools also permit the assessment of the human impact on natural environments, hence requiring an approach in which the natural and cultural heritage domains are perceived together (Harrison 2015: 36).

However, considering that archaeological research or commercial archaeological companies do not normally receive a high investment, software companies' licenses can hinder the usage of GIS. Instead, free and open-source software (FOSS) constitute an alternative that does not only imply saving money but also benefits from a vast active online community as well as installing, modifying and sharing the software when necessary (Ducke 2012). At the same time, in order to move towards good scientific practice, it is necessary to publish the data, the source code and the software environment that generated the results, which is a growing tendency amongst open-source projects and enables other users to reproduce the same process (Donoho et al. 2009).

Therefore, the advent of free-ware cloud computing services, such as Google Earth Engine (GEE), represent a step forward towards sustainable and cost-effective landscape monitoring through the processing of more than 40 years of free and open satellite imagery and earth observation tools. Moreover, the possibility of employing GEE through its Python API in Google Colaboratory (commonly known as Colab) allows the use of a Python development environment that runs in the browser using Google Cloud, facilitating the creation of extensions, packages and scripts that broaden the applications of FOSS, particularly for processing more than 40 years of free and open satellite data, whose integration within archaeological projects is expected to continue increasing (Orengo 2015). In this line, while the capabilities of Python in modelling landscape dynamics are widely known, a low amount of research revolves around the potential of the GEE Python API (Vos et al. 2019). Thus, our paper proposes a complete FOSS-cloud approach to identify palaeolandscape features through the use of GEE Python API in Google Colab (Brandolini et al. 2021).

Test case area

In order to test the potential of our FOSS approach, riverine landscapes have been selected for assessing the applicability and effectiveness of the methodology that we propose. Fluvial/alluvial environments have played a key role since prehistory, and archaeological research has shown that human agency has altered the spatial configuration and rate of fluvial processes deeply. Therefore, riverine landscapes are the result of complex relationships between human activities and environmental factors (Fryirs & Brierley 2012). Moreover, the large scale of palaeo-riverscape features has triggered their identification through remote sensing and satellite imagery, hence becoming a solid example for testing this type of approach.

In this line, the Po Plain (Northern Italy), which is the largest floodplain in Italy, is rich in field and remotely sensed geomorphological data. Thanks to its complex settlement and land-management history, this test case area represents an ideal space in which to test the possibilities of our FOSS-cloud approach to detect riverscapes' palaeo-features. Thus, in this contribution, we will introduce the first Python application of Sentinel-2 data for heritage research in a European riverscape while illustrating the possibility of detecting and interpreting buried anthropogenic landscape features originating in different periods.

Materials and methods

Several applications of remote sensing techniques and GIS to record past landscape settings have been applied in the Po Plain over the last decades. Nevertheless, the current state-of-the-art in FOSS software and the availability of open-source satellite data enable the development of protocols that require less computational power and are more user-friendly for non-experienced researchers.

Our approach tests the potentiality of Sentinel-2 (S2) satellite constellation, which was developed by the European Space Agency (ESA) and provides data in 13 separate bands with a spatial resolution of up to 10 meters.

In this line, it is worth mentioning that buried features can sometimes be visible through crop marks and soil marks on the surface, given the difference in moisture that they retain in comparison to their surrounding area. However, even with high-resolution satellite sensors, crop marks are often dependent on various aspects, amongst which the phenological stage of the crops stands out. Therefore, in order to overcome the problematic nature of crop mark identification, a multi-temporal approach has been taken by calculating the mean values of bands in the most significant periods, depending on drought and ploughing episodes, for the identification of crop/soil marks between the years 2015 – 2020.

The S2 satellite data were accessed through the Python module geemap in Colab, a serverless Jupyter notebook computational environment for interactive development. The native GEE Python API has relatively limited functionality for visualising the results, and the geemap Python module was created specifically to fill this gap. The Python code developed enables the analysis of the S2 filtered image collection through spectral index (compositions RGB (bands 4-3-2), false short wave infrared colour (FSWIR, bands 12-8-4) and Bare Soil Index (BSI)), as well as spectral decomposition techniques (hue, saturation and value (HSV), tasselled cap transformation (TCT) and principal component analysis (PCA)). The Python module rasterio was also used to create individual plots for each raster band. Additionally, the Python packages rioxarray and matplotlib were employed, respectively, to access each raster band and create customisable histograms of their values.

Final remarks

While the choice of timespan is the only part of the protocol that needs to be customised by the final user according to the environmental conditions of each study area, the FOSS-cloud protocol presented here offers significant advantages regarding the mitigation of specialist software, data licensing and computational power. Overall, the outputs generated for the test locations of the Po Plain show some of the potentialities and limits of the GEE Python API in Colab as an alternative remote sensing tool to identify buried natural and anthropogenic palaeo-riverscape features.

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Abstract

Landscapes are the result of the complex long-term interactions between natural and cultural forces, hence requiring techniques that enhance past landscape mapping and sustainable development perspectives. This paper presents a FOSS cloud-based protocol that employs Sentinel-2 imagery in GEE to identify palaeo-landscape features. Developed in Google Colab, the procedure is tested in the Po Plain riverscape (Italy), and it can be easily adapted and replicated for any area of the world.

Keywords

Multispectral analysis; Sentinel-[2]; Google Earth Engine; Riverscape; FOSS

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List of FLOSS software used/ data repository and licence

1. Google Earth Engine, Google Earth Engine License Agreement; 2. Python Programming Language, PSF License Agreement; 3. QGIS, GNU Public License (GPL) Version 2; 4. Google Colab, Modified BSD License

Link to the Python script (DOI: 10.5281/zenodo.5235030): https://doi.org/10.5281/zenodo.5235030#.YUJu13AIslk.link

QFIELD, PYARCHINIT AND BRADYPUS , INTERCHANGE OF PROTOCOLS AND WORKFLOWS FOR ACADEMIC RESEARCH

by Giuseppe Guarino, Paolo Rosati

Fig. 1 - Using the integrated systems on the field-work.

In the past, documenting archaeological research was based mainly on subjective experience due to the lack of digital platforms that would standardise documenting a context. Although it is in the last two decades that practice has been digitally standardised.
Some user-friendly systems help collect and organise data.. Sometimes, they seem non-interoperable. Then it is to study a unique method capable of making different software communicate with each other.
The aim of this study is the integration of state-of-the-art software to aid in developing a criterion for the creation of an archaeological data interchange protocol. FLOSS was chosen as it offers the highest level of interoperability.
One premise, it is assumed that you already have pyArchInit 2.6.2 on your computer, a server with BraDypUS 4.0 installed and a PostgreSQL database.

The systems used
The article focuses on finding a single workflow between Qfield, PyArchInit and BraDypUS to find if it is possible to make the different software communicate. Qfield is a handy Android app developed by OPENGIS.ch, also known as "QGIS for mobile", is a necessary open-source tool for fieldwork research. PyArchInit is the QGIS plugin for archaeology, developed by Luca Mandolesi implemented by Enzo Cocca and Ad Arte s.r.l. (Cocca and Mandolesi 2013) with the continuous support of Una Quantum inc. organization (Montagnetti and Rosati 2018). PyArchInit is highly suitable for a desktop GIS-managing of the stratigraphical archaeological excavations. BraDypUS is a broad CMS for archaeology developed by Julian Bogdani; BraDypUS enables users to freely build and implement a relational database and publish data online with customisable interfaces (Bogdani 2021).
According to the philosophy of GNU's movement with the "Free software", "... the user have the freedom to run, copy, distribute, study, modify and improve the software." (Bogdani 2019 p. 124 and ss.)[1]. Thus, FLOSS allows using some open formats and databases for their easy exchange between systems, otherwise hardly possible with licensed solutions. Using the proposed method, we can create synergistic relationships between various research groups and projects without passing different data from one programme to another, thus avoiding the risk of format incompatibility.

From PyArchInit to BraDypUS and vice versa
This is the central issue of this study. In the archaeological world, it is customary to use software developed for different purposes, while either pyArchInit and BraDypUS are customised for archaeology. PyArchInit is almost entirely developed in Python, and it is based on a fixed database schema, consisting of mandatory fields that are fundamental for the plugin like 'Site' and 'Stratigraphic Unit' tables. PyArchInit is available as a plugin for QGIS, whose main purpose is to work with spatial data. BraDypUS uses different web languages like JavaScript, PHP, Twig and Css. The program is totally versatile and allows full customisation for relational databases. BraDypUS needs to be installed on its own computer or server, and it is to set up a php environment on its own OS.
The two systems have been connected by using a Spatial RDBMS to solve the problem due to the different structures. Both programs are able to connect with PostgreSQL and PostGIS as a solution to allow several people to work together on the same project.
As mentioned above, due to the fixed database schema of PyArchInit, we need to build the database using pyArchInit's

#	Name	Type	Null
0	id_sito	INTEGER	N
1	sito	TEXT	Y
2	nazione	VARCHAR(100)	Y
3	regione	VARCHAR(100)	Y
4	comune	VARCHAR(100)	Y
5	descrizione	TEXT	Y
6	provincia	TEXT	Y
7	definizione_sito	VARCHAR	Y
8	find_check	INTEGER	Y
9	sito_path	VARCHAR	Y

Tab 1. PyArchInit "Scheda Sito" - Site table, (credits Enzo Cocca 2021)

tool, then connect the database to BraDypUS. Then is to create the necessary tables and relationships to use the database in BraDypUS as the below example. The pyArchInit mandatory protocol is the "Tabella di sito" - Site tabl
The Site Table is easy and simple to reply to and rebuild. On the contrary, the" US_table" in PyArchInit has 95 fields mandatory for the Italian '*Soprintendenza*' standards. What is in the "US_table" is the Italian Heritage Ministry standard for the SU. In PyArchInit, every other table, layer, view and tool is dependent on these two tables in a tree scheme.
The simplest way will be to connect PyArchInit and BraDypUS through the same Postgres Database.
It is to replicate this scheme by adding in PyArchInit two new fields ("id" and "creator") that are mandatory in the BraDypUS DB scheme and during the conference will explain the full exchange protocol between the two systems.
The aim is to maintain the PyArchInit and BraDypUS aligned. PyArchInit is a desktop tool, BraDypUS is a web device. To connect them, to switch between could be essential for empowering the researcher's possibilities and enlarging their future capabilities.

The workflow, however, still needs to be tested further to understand if these two systems can be used within a research team on the field.

From GIS archaeological platform to QField

That part of the workflow is explained in the recent work to be published in the ArcheoFOSS 2019 Acts (see Guarino and Montagnetti 2021). The main benefits of using the QField app concern acquiring the data directly on the field on our QGIS project. Working with both QField and QGIS (using PyArchInit as a spatial database tool for archaeological data storage) allows archaeologists working in the field to reduce the work of entering data into the database system by eliminating the related paperwork (Guarino and Montagnetti 2021). QField allows users to view and manage a GIS project on a smartphone or tablet, allowing the user to retain all the themes, labels and styles set up that are in the original project. In addition, the power of the smartphone's built-in geographic positioning system can be exploited. If more precision is required, geodetic positioning methods can be used via GNSS in NRTK mode.
This tool seems to be one of the best ways to record archaeological features on the field, especially when it is to record data and collect pictures directly on our QGIS project, thus allowing to keep the photos linked at the features.

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Abstract

The last years of research led the authors to develop and study methods and protocols to interchange data and workflows between Qfield (QGIS mobile), pyArchInit (the first plugin for archaeology in QGIS) and the archaeological CMS BraDypUS. The present work aims to present the rationalisation of the workflows achieved during the last years of research to spread the cross-use of these powerful tools. Indeed, each of these three software systems has its unique field of application and potential. However, it is their complementary use in pairs or together that reveals their greatest potential. This work summarises and reports on the current methods (2021) that make it feasible to work simultaneously on the mobile, desktop and web fronts, according to each need, by sublimating the scientific potential of these used systems.

Keywords

Archaeology; GIS; Foss archaeological documentation; Archaeological protocol documentation; QField; PyArchInit; BraDypUS

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List of FLOSS software used/data repository and licence

1 QFIELD, GNU Public License (GPL) Version 2; 2 BraDypUS , MIT license; PyArchInit GNU Public License (GPL) Version 2.

End notes

[1]https://www.gnu.org/philosophy/free-sw.en.html
[2] https://docs.bdus.cloud/environment/setup-windows (accessed 15/09/2021)

USING QGIS, QFIELD AND PYARCHINIT IN THE MAASSER EL-SHOUF ARCHAEOLOGICAL PROJECT (MESAP)

by Silvia Festuccia, Roberto Montagnetti, Giovanna Verde

Fig. 1 - Using the integrated systems on the field-work.

The village of Maasser el-Shouf is located in the Shouf territory in the *Shouf Biosphere Reserve;* this area is very important from a cultural, environmental, and touristic point of view. This area can be further developed to promote a sustainable tourism economy through the protection of the archaeological and ecological heritage.
One of the short-term goals pursued by the Multidisciplinary Archaeological Mission in Maasser el-Shouf is to establish a bond of protection on the archaeological site of Qalaat el-Hosn by the General Directorate of Lebanese Antiquities (DGA).
Accurate positioning of the archaeological features with a QGIS platform is very important in order to better safeguard the area.
The archaeological survey carried out in Qalaat el-Hosn is allowing to discover structures, including monumental ones such as a Roman temple dated to the second century A.D., underground tombs, quarries for the extraction of limestone blocks, working areas, cisterns, wine presses and many archaeological artifacts (Festuccia-Ziadé *et alii,* in press).
The research activities will be further expanded in 2022 by moving forward with the systematic identification of the settlement and paying attention to the exploitation systems of natural resources (flora and fauna) and to paleoenvironmental data for the reconstruction of the ancient landscape.
We are trying to reach these aims by putting in the field traditional methodology and cutting-edge technologies.
Archaeological survey, geological and geophysical prospections, geospatial analysis, remote sensing, 3D modeling, restoration activities (Festuccia-Brunori *et alii,* in press), and a continuous update of the QGIS platform will be carried out during the project.
Another priority is the extensive excavation of the area of the Roman temple, a monumental structure probably dating back to the second century. A.D. with the relative digital survey and paperwork.

Construction, processing, and development of the Geographic Information System (MeSAP QGIS)
The management of the collected data is carried out, from a methodological point of view, by means of a GIS platform of the Project elaborated with the QGIS software. The reference system utilized is EPSG: 23036 ED50/UTM zone 36N.
The GIS platform of the project is deployed by two different geodatabases: a "Territorial" one where we collect the archaeological survey data and the "Archaeological Investigation" one for the registration of the archaeological features identified during the investigation.

The "Territorial" database is a geo package one and it contains these layers:

- Archaeological Features POINT: used for the registration of all the archaeological features that are suitable to be represented by a punctual geometry (small finds, coins, tombs position, etc.);
- Archaeological Features POLYGON: used for the registration of all the archaeological features that are suitable to be represented by a polygonal geometry (pottery sherds area, archaeological site with clearly identifiable limits, etc.);
- Archaeological Features LINE: used for the registration of all the archaeological features that are suitable to be represented by a linear geometry (tracks of an ancient road, aqueducts, etc.);
- Area Survey: used for the digitization of the areas surveyed.

Thanks to the combined use of QGIS and Qfield, the territorial database is continuously implemented (Fig. 1).
In fact, the entire GIS project has been exported through the plugin "QFieldSync" on the Android devices of each surveyor who, at the end of each day of the survey, synchronize the collected data with the master of the project kept inside the project laptop (www.qfield.org).
Also, in this case, the synchronization work is carried out with the plugin "Qfieldsync" (Montagnetti, Guarino, 2020, in press).

We provide below a summary of the steps performed:
- Creation into the project laptop of a "Qfield Dataset" where we save the GIS project as in .qgis format. In the same dataset, we create an "Export" folder where we export the package for QField after configuring the various layers as "offline editing" mode;
- Copy of the "Export" folder to the surveyors Android devices;
- Once the survey in the fields has been carried out and all the archaeological features and related photos have been recorded, we create into the laptop a subfolder for each of the surveyors within the "Qfield Dataset", in which the "Export" folder can be copied from the various devices;
- Synchronization of the master project with the data collected by each surveyor. Regarding the survey pictures, Qfield automatically creates a DCIM folder within the Qfield dataset where it exports all the pictures taken on the field by each surveyor and stored into the "Export/DCIM" folder of each of them;
- Saving the master project;
- Creation of a new package for QField, which will be saved back to each of the surveyors' devices. At this point, everyone will have the complete and updated work on their devices at the last synchronization per-

formed. In this way, each surveyor will be able to resume the survey work and repeat the steps listed above, having the complete data of the entire workgroup available.

Concerning the archaeological investigation interventions, PyArchinit is used for the management of the collected data (Mandolesi 2009).
More in-depth, we decided to use PyArchinit through a "SpatiaLite" database that allows us to work on the system even in the absence of an internet network. On the site, for the survey of the archaeological features identified during the investigation, when it is impossible to carry out a photogrammetric survey, we use a "Plan of the archaeological investigation beginning" of each intervention sector. On this plan a geographical grid with a 2-second degree wide grid is imprinted as a cross symbol, capable of marking a 2 x 2 m space.
Such plans are printed in 1:20 scale on plexiglass sheets. We proceed to the manual drawing of the archaeological features performed on permatrace sheets through trilateration from points positioned throughout the investigation area. This system needs the tracing from the "Plan of the archaeological investigation beginning" of at least four topographical markers together with the corresponding coordinates of longitude and latitude. In the laboratory, the various drawings are then scanned and georeferenced into QGIS. After this, we digitalize the archaeological features with the " Stratigraphic Units Drawings" layer provided by PyArchinit (Montagnetti, Rosati 2019).
About the registration of SU sheets, we use Qfield on the site, as in the case of the archaeological survey. The fill-in of the SU sheets is performed directly on the site through Qfield and then synchronized with the project master stored in the project laptop. In this way, we automatically update the Archaeological Investigation database.
All the artifacts are also filed within Pyarchinit and managed centrally by the system.

Conclusions

This setting of the work allows the team of the multidisciplinary archaeological project in Lebanon to optimize the time available for the archaeological survey and investigation and to perform a large part of the data recording work directly in the field.

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Montagnetti R., Guarino G., *From Qgis to Qfield: how the new Android application is facilitating the work of the field archaeologist,* in Archeomatica (1) 2020, in press
Festuccia S., Ziadè M. *et alii* in print, *The Maasser el-Shouf Archaeological Project: First Preliminary Report on the 2018 and 2019 Seasons in Qalaat el-Hosn (Lebanon)*, Bulletin d'Archéologie et d'Architecture Libanaises (BAAL)
Festuccia S., Ziadè M. *et alii* in print, *'Maasser el-Shouf Archaeological Project: Pre-conservation and Holistic Landscape/Heritage Preservation Strategies'*, Bulletin d'Archéologie et d'Architecture Libanaises (BAAL)

Abstract

The Maasser el-Shouf Archaeological Project (MeSAP) is aimed to study climate, landscape, and settlement changes of the area between the Beqaa valley and the Mediterranean coast, from the Bronze age to the Ottoman period. The project pursues such goals through interdisciplinary research.
The paper sheds light on the open-source cutting edge technologies put in the field by the project carried out since 2018 by Silvia Festuccia (University 'Suor Orsola Benincasa', Naples) with Myriam Ziadé (Directorate General of Antiquities of Lebanon) in collaboration with a multidisciplinary team.
In particular, this paper explains how the GIS platform of the project has been created, tested, and customized according to the typology of the data, supported by the use of Qfield and PyArchinit for the centralized management of the data collected from archaeological and geophysical surveys, remote sensing, geoprocessing and conservation and study of the archaeological material found out.
All these data will improve knowledge and interpretation of the historical-environmental processes of the territory.

Keywords

QGIS; Qfield; PyArchinit; Qalaat el-Hosn Lebanon; Archaeological survey

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List of FLOSS software used/ data repository and licence

QGIS; Pyarchint; Qfield (GNU General Public License - GPL)

FROM MICRO-REGIONAL TO INTRA-SITE ANALYSIS: THE GIS OF THE ITALIAN ARCHAEOLOGICAL EXPEDITION IN THE ERBIL PLAIN (KURDISTAN REGION OF IRAQ)

by Valentina Oselini, Michael Campeggi, Luca Forti, Elisa Ginoli, Andrea Pezzotta, Luca Peyronel

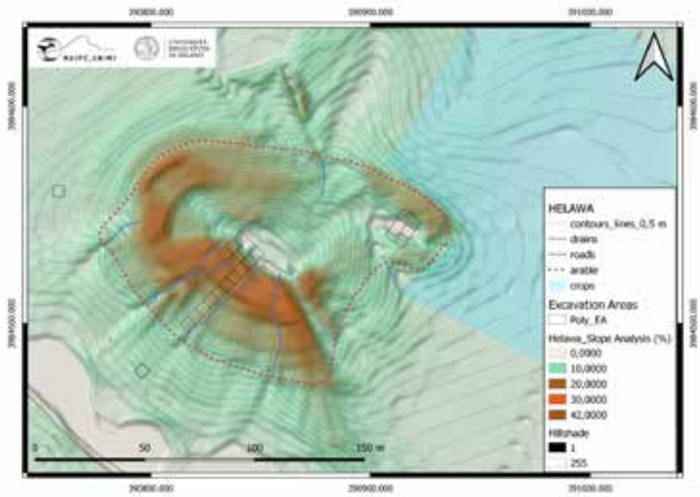

Fig.1 - Slope Analysis of Helawa with the indication of excavation areas and the characterisation of the anthropic environment around the mound and the natural gullies. The colour shades indicate steepness in percentage. The MAIPE team has realised the Slope Analysis of Helawa with QGIS on the basis of the Digital Elevation Model developed in 2013 (©MAIPE).

Since 2013, the Italian Archaeological Expedition in the Erbil Plain (MAIPE, University of Milan) has carried out archaeological investigations at Helawa and Aliawa, ca. 27 km SW of the modern city of Erbil, in the Kurdistan Region of Iraq. The investigated area (ca. 20 Sq.km) lies in a strategic position of the plain, just north of the Awena Dagh, a range of low hills running parallel to the Qara Chuq mountains, which represent the border with the Makhmour Plain, and on the course of two tributaries of the Kordara River, which forms the Erbil drainage system together with the Siwasor and the Bastora Chai, south of the Greater Zab (Peyronel *et al.* 2019).
During six years of actual fieldwork activities (2013, 2015-2019), MAIPE collected a large amount of data through archaeological and geomorphological surveys and excavations, documenting the long-standing occupation of the area in a time span ranging from the Late Neolithic to the Islamic period. All data are being stored and continuously updated within a GIS project, namely the MAIPE GIS, initially developed as early as 2013, based on the open-source QGIS system (Peyronel, Bursich, Di Giacomo 2016)[1]. In fact, as well as being a repository tool for databases, this is an effective medium for managing the archaeological and paleoenvironmental data (D'Andrea, 2003). In addition, it enables predictive analyses regarding the chronological sequence of the mounds of Helawa and Aliawa, the possible areas covered during the different occupational phases at the sites, and the identification of production zones. This contribution aims to show how different information from an ongoing research project is processed using a QGIS system and to illustrate how this tool is helpful in combining data and carrying out cross-correlated analyses (Orengo 2015).

The geomorphological approach for the reconstruction of the archaeological landscape between Helawa and Aliawa

The geomorphological approach was based on data collected on the field and on the analyses of satellite imagery; this data enabled us to elaborate with QGIS a preliminary geomorphological and geoarchaeological map of the natural and cultural landscapes between Helawa and Aliawa. We reconstructed the evolution of the landscape during the Holocene in order to understand how variations of the local fluvial network influenced settlement dynamics and land use around the two sites. In detail, QGIS was used to map the different landforms with several linear and polygonal shapefiles. Furthermore, an ALOS World 3D - 30m (AW3D30) Digital Surface Model (DSM) with 1° horizontal resolution (~30 m resolution at the equator), available on the Japan Aerospace Exploration Agency platform, was used for different analyses such as the hillshade, slope aspect and asperity in order to observe specific landforms (wadi valleys, paleo valleys and other features)[2].

The archaeological survey collection data management

The archaeological survey investigations at Helawa and Aliawa were carried out by MAIPE in 2013 and 2015[3]. The two sites have a similar morphological configuration, including a higher mound and a series of lower reliefs in the immediate surroundings.
On the one hand, Helawa was surveyed by applying two different approaches: an intensive survey on the mound, through the collection of a large number of materials located in a geo-referenced grid system (Collection Areas and Collection Units), and an extensive survey on the lower sides, in which diagnostic materials were collected and localised via differential GPS. On the other hand, Aliawa was subdivided into different CAs by following the natural morphology of the site, and their position was recorded via GPS. The CAs established during the survey around the mounds of Helawa and Aliawa, and the materials collected in the field (pottery sherds, lithics, slags *etc.*) have been digitised in QGIS as shapefiles and linked to attribute tables. Through the analysis of the spatial distribution of sherds and the use of the Kernel Density Estimation tool in QGIS, among others, we visualised density clusters both at a general scale and concerning each period of occupation on the mounds.
If combined through the interpolation function in QGIS, this data allows us to hypothesise regarding the transformation in area use at the sites during the various phases of occupation.
Moreover, it enables us to associate the changes in the mounds' morphology detected through the Slope Analysis and the DEM to anthropic and/or natural events.
Concerning Helawa, the distribution patterns of the lithic finds, slags and pottery manufacturing by-products have been analysed by categorising the CUs per number of finds. This visualisation method enables us to obtain clues on likely production areas dedicated to knapping and ceramic crafting. This evidence was then tested and ultimately confirmed through excavations (Vacca, Moscone, Rosati, 2020).
At Aliawa, a similar collection and digitisation methodology was applied, allowing us to gain information on its occupational sequence, the distribution patterns of its surface finds and elaborate a comparative model for the results from Helawa and other sites in the Erbil Plain. During the 2021 campaign, the use of GIS and, especially QField, has been fundamental for gaining insight into the settlement's spatial development and its geomorphological setting in the different phases of occupation.

QGIS for the archaeological excavation

The data from the excavations, which are ongoing, are being stored and continuously updated within the MAIPE GIS. After elaborating on the orthophotos produced in the field, these are imported, digitised, and further characterised in QGIS based on the typology of the architectural elements (wall, bench, floor, *etc*.). The aim is to link each layer to an attribute table containing the chronology, stratigraphic relation to other layers, dimensions, elevation, and associated materials.

Such a database, which has been ultimately unified into a geopackage, is allowing users to rapidly filter and perform queries for the excavated sequence, carry out distribution analyses of the materials found in the archaeological context and examine the associations between the different types of artefacts discovered. During the 2021 fieldwork, the team is also experimenting with the use of FOSS by integrating QField and tablets during excavations to manage the data acquisition process more effectively in the field.

Conclusions

Using QGIS for fieldwork provides solutions to both practical and research issues.

The combination of geomorphological data and the analyses on the distribution of the archaeological material with QGIS, in addition to the use of various plug-ins, made it possible to identify specific points of interest and create new insights for further investigation.

Finally, QGIS has also proved to be a suitable tool for processing data available on different platforms and generated by other applications. The possibility to directly access files created with licensed software and to integrate data made available by other organisations makes the collaboration with other teams working in the field efficiently. Moreover, it enables interaction with other research projects that are being carried out on the same territory.

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Abstract

The Italian Archaeological Expedition in the Erbil Plain (MAIPE) of the University of Milan is experimenting with a GIS project based on the QGIS system. It aims at combining data from survey, excavation, and geomorphological investigation carried out in the two sites of Helawa and Aliawa and the surrounding landscape. The MAIPE GIS is intended as a valuable tool for predictive, distributive, and cross-data analyses considering the complex diachronic development of the area and the results of paleoenvironmental studies at a micro-regional and intra-site scale.

Keywords

QGIS; cross-data analyses; fieldwork; archaeology; geomorphology

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UN ECOSISTEMA DIGITALE PER LA CONOSCENZA, LA CONSERVAZIONE E LA VALORIZZAZIONE DEL SITO ARCHEOLOGICO MEDIEVALE DI *SATRIANUM* (TITO, PZ). STRUMENTI FOSS

by Giorgia Dato, Eugenio Saccà, Alessandro Spadaro, Francesca Sogliani

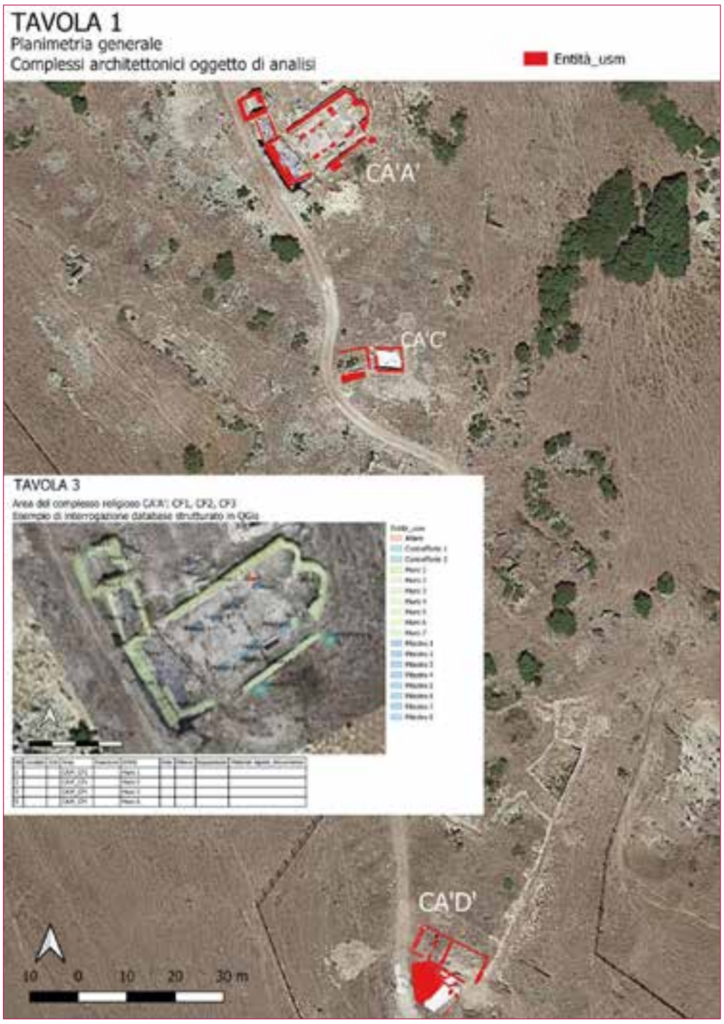

Fig. 1 - Panoramica del sito archeologico di *Satrianum* in GIS e focus sul *database* pertinente alle strutture della cattedrale.

Il territorio in cui è ubicato il sito archeologico di *Satrianum*, un insediamento fortificato medievale distribuito su una collina a dominio dell'areale circostante, è compreso tra gli attuali comuni di Tito e di Satriano di Lucania (PZ), in Basilicata.
Particolarmente importante per la sua posizione strategica lungo assi di collegamento territoriale e per la ricchezza di risorse, l'intero comprensorio è stato occupato in maniera capillare fin dall'VIII secolo a.C.
Negli ultimi decenni dell'XI secolo, l'altura venne scelta dai Normanni per costruire una torre, una cattedrale con relativo episcopio e un villaggio racchiuso da mura: un insediamento, con continuità di vita fino all'età angioina, che costituisce un caso di studio di particolare importanza poiché rappresenta l'esito di un processo di gerarchizzazione e di ristrutturazione di spazi e strutture voluti dall'iniziativa signorile per controllare i territori e le modalità di sfruttamento delle campagne.
L'insediamento medievale di *Satrianum* è da circa vent'anni oggetto di ricerche da parte della Scuola di Specializzazione in Beni Archeologici di Matera dell'Università della Basilicata.[1] Attualmente è inserito in un progetto di valorizzazione finalizzato a definirne la fisionomia di *Open Museum*, attraverso percorsi di Archeologia pubblica (Format "*Festivalia*. L'Archeologia si racconta"), di *storytelling* digitale e di ricostruzione virtuale; è inoltre uno degli *SmartLab* inseriti nel Progetto Basilicata *Heritage Smart Lab* coordinato dal *Cluster* Basilicata Creativa.
Il percorso di ricerca e di studio ha previsto l'analisi dello stato di conservazione delle strutture murarie dell'insediamento fortificato di *Satrianum*,[2] e la realizzazione di un progetto di fattibilità per il restauro degli ambienti, attraverso la programmazione di un sistema dedicato di archiviazione digitale.
Pertanto, si è ritenuto opportuno realizzare un *database* strutturato con il software *open source* QGIS che permettesse di organizzare, analizzare, gestire e rappresentare dati spaziali.
Lo sviluppo del suddetto *database* nasce dall'esigenza di documentare, catalogare e sistematizzare i dati raccolti, localizzandoli nello spazio attraverso la geolocalizzazione. Inoltre, lo sviluppo del progetto in ambiente GIS rende possibile incrociare i dati attraverso l'interrogazione del *dataset* pertinente alle strutture murarie medievali oggetto di studio.
È stato utilizzato il plugin *Quick Map Service* e, nello specifico, Google Satellite, per l'acquisizione delle immagini satellitari relative al contesto di studio (EPSG: 3004 Monte Mario).
La prima operazione pratica è consistita nel georiferimento delle ortofoto[3] di maggior dettaglio relative alle tre aree principali del sito: la cattedrale (CF1; CF2; CF3); l'area del primo villaggio (CF 23; CF 104); l'area del secondo villaggio (CF 59; CF 75; CF 79). Durante questo processo ci si è avvalsi di un georiferimento autoptico adottando, tra i vari parametri, la trasformazione di Helmert.
È stato poi realizzato il database tramite l'uso di un *geopackage* con la creazione di un *layer* geometrico poligonale al suo interno (EPSG: 3004/ Monte Mario Italy 2).
La tabella attributi di questo *file* presenta una serie di campi divisi in schede e menù a tendina, organizzati e gestiti tramite il *widget* "mappa valori" per facilitare la compilazione.
Si è proceduto poi con la vettorializzazione delle opere murarie, una categorizzazione per tipologia e una stampa composita e in serie per complesso. Infine, il *file* è stato duplicato in formato *shapefile*.
Poiché solo un approccio progettuale pluridisciplinare può costituire l'imprescindibile, primo anello di un sistema integrato di valorizzazione, si è tentato di fornire una base per un'analisi complessa e strutturata di tipo urbanistico, funzionale e geomorfologico, mettendo in relazione le strutture esistenti e le vie di percorrenza con le curve di livello, al fine di individuare e prevenire il comportamento del sito, ad esempio, in occasione di eventi meteorologici, tanto di intensità moderata e frequenza quotidiana, quanto di particolare violenza. A tal fine, è stata scaricata dal *dataset* on-

line TINITALY DEM dell'Istituto Nazionale di Geofisica e Vulcanologia (INGV)[4] la sezione dei Modelli Digitali del Terreno (DTM) in formato *raster* in cui ricade il sito preso in analisi. Dopo averla caricata nel progetto GIS in EPSG:WGS84/ UTM 32 N, ri-proiettata, e opportunamente ritagliata, ne sono state estratte le curve di livello con un intervallo di 1 metro e sono state salvate in formato *shapefile*. Successivamente è stata effettuata l'acquisizione geometrica del sito archeologico, nel suo attuale stato di conservazione, basata su misurazioni da rilievo 3D con lo scopo di creare un modello digitale del sito stesso. Si è proceduto con un rilievo fotogrammetrico delle aree analizzate tramite l'utilizzo di un Veicolo a Pilotaggio Remoto modello *DJI Mavic Pro*.

Le immagini sono state processate con *WebODM*[5], un *software open source* per elaborazioni *Structure From Motion* che ha permesso di ottenere una *mesh* texturizzata, l'ortofoto zenitale del modello per la rappresentazione planimetrica del sito e il suo *Digital Elevation Model*.

Quest'ultimo è stato importato a sua volta in QGIS per l'elaborazione delle curve di livello del sito, salvate poi in formato *shapefile*.

I *dataset* ottenuti sono stati quindi importati su *Blender*. Attraverso l'*add-on Blender GIS* sono stati importati i due *shapefile* relativi alle curve di livello a cui è stata assegnata l'elevazione originaria; di queste, le prime sono state interpolate per ottenere la *mesh* con metodo di Delaunay. Successivamente, sono stati importati gli *shapefile* relativi ai poligoni risultanti dalla vettorializzazione delle opere murarie; i vari *layers* sono stati poi organizzati all'interno dell'*outliner* in diverse "*collection*" secondo un principio cronologico per una consultazione delle UUSSMM più agevole. Infine, sono state importate le *mesh* texturizzate dei complessi architettonici, georiferite manualmente collimandole con le relative curve di livello.

In conclusione, la visualizzazione degli elementi architettonici nel loro contesto geomorfologico e altimetrico in ambiente 3D ha permesso di avere un quadro più chiaro ed esplicito del contesto in esame, consultabile secondo criteri cronologici per l'analisi storico-archeologica e topografica delle strutture del sito.

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Abstract

Il caso studio presentato riguarda il sito medievale fortificato di *Satrianum* in Basilicata. L'analisi topografico-architettonica ha condotto alla strutturazione del *database* spaziale attraverso l'utilizzo di un Sistema Informativo Geografico (GIS), mentre, ulteriori sviluppi comprendono la realizzazione di nuvole di punti e l'elaborazione di modelli 3D delle strutture georiferiti nello spazio. Il *data set* completo così ottenuto per la conoscenza del sito, permette la progettazione di interventi volti alla conservazione, la valorizzazione e la fruizione di *Satrianum*.

Keywords

GIS; 3D; archeologia medievale; archeologia dell'architettura; *Satrianum*;

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List of FLOSS software used/ data repository and licence

1 QGIS, GNU Public License (GPL) Version 2; WebODM, GNU Affero General Public License v3.0; 3 Blender, GNU General Public License v3.0

End notes

[1]Lo studio archeologico del sito, su concessione della SABAP - MIC, è iniziato nel 2000 sotto la direzione di Massimo Osanna in collaborazione con la Soprintendenza per i Beni Archeologici della Basilicata. L'indagine dell'insediamento medievale è poi diventato il focus della ricerca a partire dal 2005, sotto la direzione scientifica di Francesca Sogliani.

[2] La proposta di progetto ha rappresentato il lavoro di tesi di specializzazione in archeologia medievale di Giorgia Dato dal titolo "Archeologia e restauro dei monumenti. Prospettive di ricerca nel sito fortificato medievale di Satrianum in Basilicata" (Relatore: Francesca Sogliani; correlatore: Filiberto Lembo). Inoltre, si sottolinea che il progetto è stato presentato alla Soprintendenza Archeologia Belle Arti e Paesaggio della Basilicata.

[3] Il materiale è stato fornito su gentile concessione della Scuola di Specializzazione in Beni Archeologici dell'Università della Basilicata. Le ortofoto sono il risultato di un precedente rilievo fotogrammetrico ottenuto con drone

[4] Tarquini et al. 2007, TINITALY, a digital elevation model of Italy with a 10 meters cell size (Version 1.0) [Data set]. Istituto Nazionale di Geofisica e Vulcanologia (INGV). HYPERLINK "https://doi.org/10.13127/TINITALY/1.0" https://doi.org/10.13127/TINITALY/1.0; TINITALY è pubblicato con licenza CC BY 4.0

[5] Per approfondimenti https://www.opendronemap.org/

VIRTUAL TOUR REALIZZATO CON PANNELLUM ED INTEGRAZIONE LEAFLETJS

di Martina Frau, Valerio De Luca

Il virtual tour, strumento nato per scopi commerciali, in questi ultimi anni sta conoscendo applicazioni sempre più frequenti nel campo dei beni culturali. La pandemia, e le conseguenti lunghe chiusure che questa ha comportato, e che hanno gravato principalmente su siti di interesse culturale, ha accentuato l'utilità dei virtual tour, rendendoli noti e utilizzati da un pubblico sempre più ampio. Tale mezzo permette di restituire, in maniera realistica ed esaustiva, le caratteristiche di un sito culturale, per quanto l'esperienza *in loco* non possa essere sostituita da quella da remoto.

Il virtual tour si configura, dunque, come un ottimo strumento di conoscenza, potente mezzo di conservazione e valorizzazione, oltre che essere fondamentale nell'ottica dell'inclusione e dell'accessibilità culturale: in qualunque momento, e a prescindere dalla propria posizione geografica, il sito si mantiene totalmente fruibile anche a pubblici che altrimenti non ne avrebbero possibilità.

I virtual tour possono comporsi di sole immagini sferiche -dette anche equirettangolari per il loro rapporto dimensionale di 2:1 tra base e altezza- o, in alternativa, sono integrabili mediante riquadri (*popup*) contenenti testi, immagini, video e modelli tridimensionali -solo per fare alcuni esempi- e svolgendo la stessa funzione dei pannelli informativi *in situ*. Le fotografie sono scelte in modo da rappresentare in maniera esaustiva, ma senza ridondanze, il sito oggetto di interesse e in ordine tale da ricostruire la successione degli ambienti/spazi.

La realizzazione, per lo stesso sito culturale, di nuovi virtual tour, cadenzati nel tempo, permette di sfruttarli per l'osservazione di ogni eventuale cambiamento e/o trasformazione. Sono un utile mezzo di documentazione, ad esempio, di campagne di scavo o per il monitoraggio di fenomeni di degrado.

La digitalizzazione dei siti culturali e la loro accessibilità da remoto permettono di raggiungere e avvicinare alla tematica anche pubblici che diversamente non si sarebbero mai interessati al soggetto.

Dopo anni di sperimentazione con l'applicativo Marzipano Tool[1], è stata avviata dal gruppo di lavoro la prova di uno strumento totalmente open source: Pannellum[2].

Pannellum[3], che si serve di linguaggio di programmazione Python, permette la creazione di virtual tour mediante l'uso del software Hugin[4]. Questo programma, indispensabile per la frammentazione dell'immagine equirettangolare in porzioni quadrate dette *tiles*, fondamentali per la visualizzazione sferica, offre inoltre la possibilità di originare set di *tiles* per un numero di livelli di zoom richiesti. A differenza di Marzipano Tool, non necessita di una connessione di rete e consente di controllare l'intero processo in locale sul proprio dispositivo. Inoltre, Pannellum è a codice aperto essendo distribuito sotto licenza Pannellum MIT.

Nella visualizzazione finale del prodotto, il passaggio da una sfera all'altra avviene mediante pulsanti di collegamento (*linkhotspot*); il collegamento reciproco tra le sfere si ottiene attraverso il posizionamento dei pulsanti per riprodurre il più fedelmente possibile il percorso di visita.

Mediante altri pulsanti (*infospot*) si ottiene l'apertura di *popup* informativi che, integrati con contenuti multimediali, permettono l'approfondimento delle conoscenze del sito in oggetto.

Rispetto alle caratteristiche basilari delle schermate offerte dal software Pannellum, ci si è posti l'obiettivo di arricchire il prodotto con una barra superiore (*titlebar*) in cui visualizzare il nome identificativo della sfera (*scenename*) che si sta osservando e di una barra inferiore (*footerbar*) utile per l'inserimento di loghi di collegamento e/o *credits* e di pulsanti per: l'interruzione della rotazione automatica delle sfere, la visualizzazione a schermo intero e l'apertura della mappa di navigazione.

Un grande passo avanti è stato rappresentato dalla ricerca che ha permesso di integrare ai virtual tour l'applicativo Leaflet[5], con il quale è possibile introdurre mappe o planimetrie del sito totalmente personalizzate.

LeafletJS è tra le librerie *open source* più diffuse per la realizzazione di mappe interattive, sia per dispositivi *desktop* che *mobile;* è scritto in JavaScript ed estremamente leggero considerando che il suo codice è di appena 38 KB. Per tale motivo, e per la sua facilità di integrazione con altri applicativi, si è scelto di utilizzarlo per la creazione della mappa interattiva del virtual tour.

LeafletJS ha codice aperto essendo distribuito sotto licenza BSD a 2-clausole.

L'inserimento della mappa è stato considerato indispensabile poiché facilita l'orientamento del fruitore nella navigazione. L'utente ha la possibilità di scegliere liberamente quali aree di interesse "esplorare" mediante i pulsanti di collegamento (*marker*) denominati in tal caso *linkhotspot*. I *marker*, che consistono semplicemente in numeri che ordinano le sfere secondo il percorso di visita ideale, sono stati inoltre integrati da *tooltip* (piccolo riquadro informativo che appare al passaggio del *mouse*) che indicano la sfera a cui il *linkhotspot* si collega mediante lo stesso identificativo che verrà riportato nella *scename*.

Il modello è stato sperimentato su un sito romano estremamente ricco di storia: Villa Glori o Parco delle Rimembranze; lo schema adottato diviene però facilmente replicabile ed adattabile su qualunque contesto culturale, da singoli edifici fino a siti estesi e diffusi quali borghi o aree archeologiche.

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Abstract

Il virtual tour è uno strumento di conoscenza, conservazione, valorizzazione, inclusione e accessibilità.
Pannellum si serve di Python e del software Hugin per generare le *tiles* delle immagini sferiche e l’intero processo avviene in locale.
Ai pulsanti standard *linkhotspot* e *infospot* sono stati aggiunti una barra superiore (*titlebar*), una inferiore (*footerbar*) e dei pulsanti per l’interruzione dell’autorotazione, visualizzazione a schermo intero e apertura della mappa personalizzata creata con Leaflet.

Keywords

Virtual tour; Pannellum; immagini equirettangolari; foto 360; LeafletJS

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Una Quantum inc., Roma, Italia[1]

List of FLOSS software used/ data repository and licence

[1] Pannellum, MIT license; 2 Hugin, GNU GPL v[2];
[3] LeafletJS, BSD license

End notes

1. https://www.marzipano.net/tool (accessed 18/08/2021)
2. https://pannellum.org/ (accessed 24/08/2021)
3. https://github.com/mpetroff/pannellum (accessed 0/08/2021)
4. http://hugin.sourceforge.net/ (accessed 27/08/2021)
5. https://leafletjs.com/ (accessed 24/08/2021)

THE ROMAN VILLA OF L'ALBIR (ALICANTE, SPAIN). THE USE OF BLENDER AND THE EXTENDED MATRIX IN THE VIRTUAL RECREATION

by Jaime Molina, Carolina Frías, Javier Muñoz, Laia Fabregat, Alejandro Martín, Daniel Tajerina,

The Villa Romana de L'Albir project began in 2011 with the basic premise of enhancing an urban archaeological site that had been abandoned since the 1980s. Different phases of intervention are established, which begin with their cleaning and documentation, continue with their systematic excavation and end with their consolidation, enhancement and musealization.

In this last section of the value enhancement work, the team from the University of Alicante, Patrimonio Virtual, comes into play, which is committed to a research and innovation project that will aim to create an Augmented Reality application for visiting the site. This pioneering project allows the development of a tool that allows to visualize the reconstruction of the site in the open air, something that at that time was a unique case. After considering several possibilities, we finally opted for a software that guaranteed the stability of the image from the user device and, on the other hand, allowed a comfortable and natural mobility.

This first project allowed us to see the importance of guaranteeing traceability in decision-making when it comes to virtualizing the different elements within the village, as well as the need to make this decision-making visible through a tool that in parallel to the archaeological discussion was reflected in the reconstruction. For this reason, we believe that the use of Extended Matrix becomes a fundamental tool when it comes to making decision-making transparent and, on the other hand, that the whole team can see quickly and comprehensively how the reasoning and proposals evolve virtualization.

In this way, the second major virtualization project that we cover within the framework of the Roman Villa of L'Albir, has incorporated the use of the Extended Matrix as a tool for making decisions and recording them visible. To all this, it is added that the space where the project has been developed was excavated in 2015, using digital photogrammetry during this process. Obtaining the photogrammetric model has constituted the basis for the development of the Extended Matrix, facilitating even more the visibility of decision-making.

The space corresponds to an oecus from the low imperial period, which is part of a large town that is partially missing. In a complementary way to the Augmented Reality application, the creation of a Virtual Reality application is proposed that allows visiting not only the initial thermal space, but also that we can visit other spaces of the residential complex, including a porticoed peristyle and the existing oecus, where a banquet would be held.

In the reconstruction process of this virtual tour there is not only a proposal for the restitution of volumes within the archaeological spaces, but there is also a reconstruction work that affects the creation of characters, their clothing and even the elaborated script. These elements are beyond the functionality of the Extended Matrix, hence we have added the Reconstructive Unit (Unidad Reconstructiva, UR) sheets prepared by our team to the traceability system.

This tool allows incorporating elements that do not necessarily have a material base present in the site, but that are essential to carry out the Virtual Reality application. The objective is not only the architectural recreation but also the recreation of the space and the inhabitants of the town. Thus, a story has been created with a script that is based on a series of historical events and an economic, social and political environment that is reflected in the dialogues that the characters have. The elaboration of this story required the creation of four characters of high economic status and a series of secondary characters who participate in the application in an auxiliary way. This character framework required, on the one hand, the choice of a specific type of physique for each avatar, which includes a hairstyle according to the time and, on the other hand, the making of a clothing that corresponds to the chronological framework in which the Roman villa is at its peak.

In addition to the characters, we also proceeded to create a series of movable objects that accompany the architectural reconstruction, such as curtains or furniture, and a series of objects that are essential for the narration of the different scenes. A clear case in this sense is the banquet that takes place in the oecus, which needs both specific furniture, as well as ceramic and metallic objects that have not necessarily had to be found in the site, although we know of their need to carry out the proposed scene. As we have already commented, these objects are complicated to pose with a system based solely on the Extended Matrix, hence we have resorted to an auxiliary system that allows us to collect all the existing reasoning for the incorporation of the objects within the reconstructed scene.

In relation to the development of the Virtual Reality application developed for the Roman Villa of L'Albir, this has been proposed in three phases that we have called pre-production, production and post-production. In the pre-production phase, the development of the script has been carried out and in parallel all the research work necessary to provide a historical framework to the story told, as well as the auxiliary elements that would be taken into account for the elaboration of the reconstruction movable and immovable.

During the production phase, a motion capture was made of the actors used to provide realistic movements to the avatars that we could later see in the Virtual Reality application. During this same production phase, the audio recording corresponding to the dialogues of the characters was made, in three languages, which later to be incorporated in the next phase.

The post-production phase has focused on the rendering of the scenes, the incorporation of both the audio corresponding to the characters and the addition of environmental

sound effects. Finally, within this same phase, the export of the footage to the virtual reality application has been carried out, as well as the creation of the start interface.
The final objective of the entire process is its incorporation into the museum proposal of the archaeological site Villa Romana de L'Albir, and which tries to communicate to visitors in a pleasant and highly visual way the importance of the excavated archaeological remains. In parallel, we also try to offer a transparent vision in the decision-making that has led us to the reconstruction of the low-imperial town. This decision-making has always been carried out in a rigorous way and supported by a scientific study that comes from the management of the archaeological site itself.

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Abstract

This paper describes the workflow used to develop a 360-degree short film set in the Roman Villa in l'Albir (Alicante, Spain). This project has included the virtual reconstruction and recreation of the entire archaeological site, as well as the use of the Extended Matrix tool to record the different stages and the decision-making process.

Keywords
Virtual Reality; archeology; extended matrix; reconstructive unit; museum

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List of FLOSS software used/ data repository and licence:

Numbered and comma and semicolon separated ex.: 1 QGIS, GNU Public License (GPL) Version 2; 2 BraDypUS, MIT license; 3 WebODM, GNU Affero General Public License v3.0 - *remember FLOSS means Free Libre and Open Source Software.
[1] Blender, GNU Public License (GPL) Version 2.93; EMBT GNU Public License (GPL) Version 1.1.7.5

USE OF 3D MODELLING AND OPEN-SOURCE PROGRAMS FOR STUDENT RESEARCH PROJECTS ON THE ANCIENT MAYA SITE OF PACBITUN, BELIZE

by Sheldon Skaggs, Hadja Jalloh, George J. Micheletti, Terry G. Powis

Fig. 1 - View looking north at the first model of the first ceremonial structure (600-300 BC) at Pacbitun, Belize.

Taking photographs of archaeological excavations and artifacts is standard practice for all archaeologists today, and with the advent of digital cameras, the limits on the number of photographs that are taken have disappeared. The creation of 3D models from photographs has advanced greatly from close-in methods using targets and point measurements by skilled technicians to automated software algorithms such as Structure from Motion (SfM) and made the process cheap and widely available (Sapirstein and Murray 2017). Many current excavations now take advantage of this revolution, with 3D models found in presentations, peer-reviewed publications, and public displays of results. This has led to much debate about the accuracy of the models and attempts to establish uniform methods and best practices (Fabrizio 2016; Sapirstein and Murray 2017). The cost of the automated software programs, storage space for a large number of photographs, and means to display the 3D models can all be barriers to the implementation of these technologies. The current case study outlines our work with photogrammetry datasets and open-source, or low-cost means of incorporating some of the labor required into student (graduate and undergraduate) research projects at the ancient Maya site of Pacbitun, Belize using programs such as Meshroom and Blender, and services such as Sketchfab and Youtube.

At the site of Pacbitun, photogrammetry of excavation units and artifacts, as well as terrestrial laser survey (TLS) and unmanned aerial vehicles (UAV), have been used experimentally since 2013 (Vaughan *et al.* 2020). Pacbitun is set in an ecologically diverse location between the Pine Ridge of the Maya Mountains to the south and the rain forests of west-central Belize to the north (Healy *et al.* 2007:19). Occupied from 900 BC to 900 AD, excavations conducted at the site by Paul Healy (Trent University) in the 1980s and 1990s and later by Terry Powis (KSU) suggests that Pacbitun's height of development occurred in the Late Classic period (550-800 AD) evinced in the major architectural renovations, the erection of several stone stelae (the most at any site in the Belize Valley), and the commencement of several other new construction projects (Healy 1990:257). At the heart of the site lies Plaza A, one of five plazas in Pacbitun's site core. Considered as the site's ceremonial center, Plaza A holds the site's oldest monumental architecture and has the longest history of construction, the location retaining its sacredness throughout Pacbitun's existence. The configuration of Structures 1, 2, 4, and 5 in Plaza A resembles a common Maya ceremonial archetype known as the E Group complex. However, after the Late Classic renovations, these structures were not only altered physically but also began to function in a completely different manner (Micheletti 2020). Most importantly for this project, in the summer of 2013, *El Quemado* (*El Q*) was discovered in Pacbitun's main plaza, Plaza A, while investigating an anomaly detected by ground-penetrating radar (Skaggs and Powis 2014). Radiocarbon samples taken from a test unit exploring the structure's presumed midpoint correspond with the ceramic evidence and confirm a Middle Preclassic date (*ca.* 900–600 BC). Very few monumental structures dating to the Middle Preclassic have been discovered in this region, resulting in a dearth of knowledge on the subject, which makes it important to model both the overall structure of *El Q* and its relationships over time with the other structures surrounding Plaza A.

The restrictions caused by online-only instruction and research forced the primary author to get creative in how new undergraduate research was going to be conducted in 2021. Since we had already used paid services such as Photoscan, SketchUp, and Zehpr 3DFlow to create 3D models and used those results in both publication and internal research, it made sense to continue to use the photographs and models for the undergraduate remote research projects.

From previous work with undergraduate students, it was understood that a free, open-source resource was the best option for any research since there were limited university resources available for home use. The initial plan was to recreate all the models created previously, such as an Ulua Valley Marble Vase Fragment (Skaggs *et al.* 2019). However, the student found the installation of the required software on an Apple product platform difficult with only remote instruction. After numerous false starts, we eventually decided to use the existing Sketchup models imported to the open-source software Blender, which the student was able to use. From there, we created a test animation to demonstrate animation on a building[2]. Next, animations were created to show the sequence of events and building modifications that occurred in Plaza A over time. Using the open-source program, Meshroom also proved to be a success, allowing the creation of models which could be 3D printed, or imported to Sketchfab for display on the website or to include embedded links on poster presentations. The large file sizes and the need to have private models which were only available to project researchers determined that we use a paid service for hosting, but users of only public models would be able to use Sketchfab for free. Finally, the animations are exported to a free-to-use video platform, Youtube, and then embedded as links within the project website.

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Abstract

Since the pandemic curtailed normal operations in Belize, the Pacbitun Regional Archaeological Project (PRAP) has used multiple photographs of excavation units and artifactsto continue student-centered archaeological research of the ancient Maya city. Legacy models from paid software are combined with new models made with Meshroom, and then animated and turned into video presentations using Blender. These are then uploaded to websites and Youtube channels freely available to the general public.

Keywords

Photogrammetry; Maya; Archaeology; Blender; Belize

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List of FLOSS software used/ data repository and license

Sfm : Zefher3dFlow – Paid; Meshroom – 2021.1.1.0 MPL2;
Animation/modeling: Skecthup - Paid
Blender – 20.90.1 GNU GPL; Display: Sketchfab – Standard https://help.sketchfab.com/hc/en-us/articles/115004276346-Licenses#standard
Youtube – https://support.google.com/youtube/answer/2797468?hl=en

End notes

[1] Website address of the model using a SketchFab plugin to on the project site website: http://pacbitunarchaeology.com/multimedia/ ; and https://skfb.ly/opJpV

[2] Website address of a quick sample animation created using blender to demo how to create fire on a building and host on Youtube: https://www.youtube.com/watch?v=ifJrcX2l5LM

COMBINATION OF STANDARDISED METHODS TO CREATE A DETAILED SOURCE-BASED RECONSTRUCTION OF THE *TEPIDARIUM* AT L'ALCUDIA DE ELCHE, ALICANTE, SPAIN

by Cristina Gonzalez-Esteban

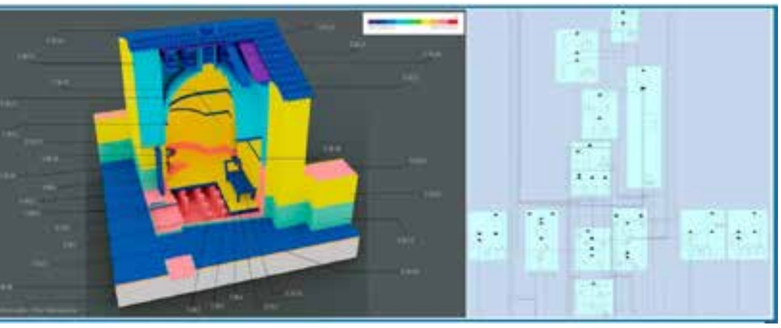

Fig. 1 - Standardised recording of metadata and paradata for the proposed reconstruction of the Tepidarium of the Western Thermae of L'Alcudia de Elche, Alicante, Spain.

This project started as a MA Virtual Heritage study (2019), when Prof. Molina and Prof. Muñoz (University of Alicante) shared data from the site of L'Alcudia de Elche to create a source-based Virtual Reconstruction [V-R] of the Eastern *Thermae Tepidarium*, testing different techniques of metadata and paradata standardisation.

The main objective was to create an exhaustive and easy-to-read 3D archive of the site and its reconstruction process. This would boost Virtual Archaeology [VA] as a scientific discipline and promote V-R as new tools characterised by historical rigour and scientific transparency. They could help further archaeological research and bring accurate and interactive narratives of the past to the public.

This article combines three standardisation techniques: Extended Matrix [EM] by Dr Demetrescu (CNR); Reconstructive Units [RU] from Prof.Molina and Prof.Muñoz; and Graphic Scale of Historic-Archaeological Evidence [GS] by Aparicio and Figueiredo.

Standardisation techniques

Advances in technology coupled with increasing usage of computers and data management since the mid-20th-century has shown a growth in recordings and displays of archaeological remains (reality-based models). However, archaeology aims to interpret and learn of past societies through their material culture, not just the recording of objects.

Nevertheless, representations of archaeological interpretative components are developing much slower, especially because hypotheses are based on the researcher's analysis (subjective). Therefore, the accuracy of V-R cannot be objectively measured. The experts mentioned above have already seen these obstacles, leading to the creation of source-based V-R to include metadata (sources) and paradata (thoughts) needed for creating interpretive models from reality-based ones.

This project focuses on making the model's information accessible to read, enjoy and reuse, through standardisation techniques that guide the creation of source-based models and help the user understand its content. Many techniques have been developed over the years, but this paper focuses on three:

- **EM** (Demetrescu 2021): It is based on the Stratigraphic units and Harris principles and the semantic tools of reality-based models. A series of nodes represent the hybrid notion of V-R: remains, sources (metadata) and thoughts (paradata). The resulting "query-able" proxy contains the information used for the hypothesis, becoming a new way to record and publish transparent and verifiable interpretations of archaeological remains.
- **RU** (Molina Vidal and Muñoz Ojeda 2015). Originally in Access but done in LibreOffice. They are context sheets to scientifically validate V-R, focusing on documentation and metadata publication issues through dropdowns and keywords to ease the creation and accessing of the data. It records the Graphic Scale.
- **GS** (Aparicio Resco and Figueiredo 2016). Based on "Byzantium 1200". Represents data granularity and authenticity. It aims to eliminate the "Black Box Effect" of the Reconstructions and promote visual, understandable and "cross-lingual" representations of source liability using a range of warm (better sources) to cold (imagination) colours.

Tepidarium of L'Alcudia

The site is located outside Elche, Alicante, on an elevated platform; hence its Arabic name "L'Alcudia". Human settlement date back to the 4th-millennium BC, Iberian, Roman and Visigoth/Byzantine periods, until the founding of the current city during the Muslim Era (8th-century AD). Afterwards, this land was farmed and looted, as rich remains were unburied. Archaeological excavations started in 1933, but it would not be until the 21st-century when the University of Alicante bought the land and, together with local authorities, established the archaeological site.

The reconstructed room (Ambiente28) is part of the Roman Eastern *Thermae* complex (1st to 3rd-century AD). The presence of different construction styles indicates at least two phases and a series of targeted repairs. During the 4th-century AD, the site lost its function and split into different rooms for habitation. During the 7th-century AD, the Visigoth Era, most structures were semi-ruined, and the area became a dumpsite (Tendero Porras *et al.* 2014).

Ambient28 was initially catalogued as the *Caldarium* due to its small size. However, further excavation revealed that the heating ovens were separated by another room, probably making the water arrive lukewarmly. Therefore, it was renamed *Tepidarium.* The room shows its history of repairs, reuse, and abandonment/looting until becoming a dumpsite *c.*7th-century AD.

Methodology

Diverse projects have used these techniques (Aparicio Resco and Figueiredo 2016; Demetrescu and Ferdani 2021; Gonzalez-Esteban 2019, 2021), but not many have combined the three of them.

The project methodology is summarised below:

1. Documentation and historical study of the site, building or object
2. Collection of reality-based data: photogrammetry/ 3D scanner
3. Designing the hypothesis
4. 3D modelling
5. Writing the RU

6. Creating the EM
7. Establishing the Graphic Scale
8. Creating the outcomes: renders/ videos/ VR

Discussion

The results reached the main objective, achieving a deep understanding of the room, its construction and usage thanks to a detailed study of the remains, comparative examples and other sources.
Nevertheless, a series of limitations evidence the need to polish the process:

1. **Lack of versatility**. The method separates each step and suggests finishing them before moving on. In reality, the workflow could be simplified (Demetrescu and Ferdiani 2021, Gonzalez-Esteban 2021) and should be more fluid and understandable of changes and new interpretations, as they are very common in Archaeology (e.g. the *Caldarium* switched into a *Tepidarium*).
2. **Novelty**. Despite the techniques being from the mid-2010s, its application has not expanded yet, meaning that there are not many source-based models for comparative studies.
3. **Incipient discipline**. There are still not many experts on the techniques, hindering cross-referencing the use of the process.

Despite these improvements, the outcomes are very favourable, especially regarding:

1. **Time/Effort** invested in the source-based reconstruction compared to "traditional" undocumented 3D models of heritage sites.
2. **Potential** of sourced models as interactive, transparent and historically accurate tools for public engagement and as references themselves to further academic research.

Furthermore, it would be possible to add the stratigraphic layer of the site, recreating the history of the area (4D model).

Conclusions

This project shows areas of improvement but also great potential over the current panorama of VA. It will need more case studies to consolidate the process in a discipline as heterogeneous as Archaeology and a platform to host the models and their content (e.g. EMViq, Fanini and Demetrescu 2019). However, the results of this project are a great first stage of combining three different standardisation techniques to create an accessible, sourced and understandable V-R of the *Tepidarium* of L'Alcudia de Elche.

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Abstract

This study proposes a combined method for Virtual Archaeological Reconstructions (Extended Matrix, Reconstructive Units and Evidence Graphic Scale) to ease understanding, recording and display of archaeology. It aims to create new questions and challenges to increase knowledge.
The *Tepidarium* project at L'Alcudia de Elche, Spain, showed the need to reduce duplicity and quicken the tested workflow; however, it increases the possibility of comparative studies due to similar results in other projects.

Keywords

FLOS Software; Source-based Virtual Reconstructions [V-R]; L'Alcudia de Elche; Standardisation Techniques; Extended Matrix [EM].

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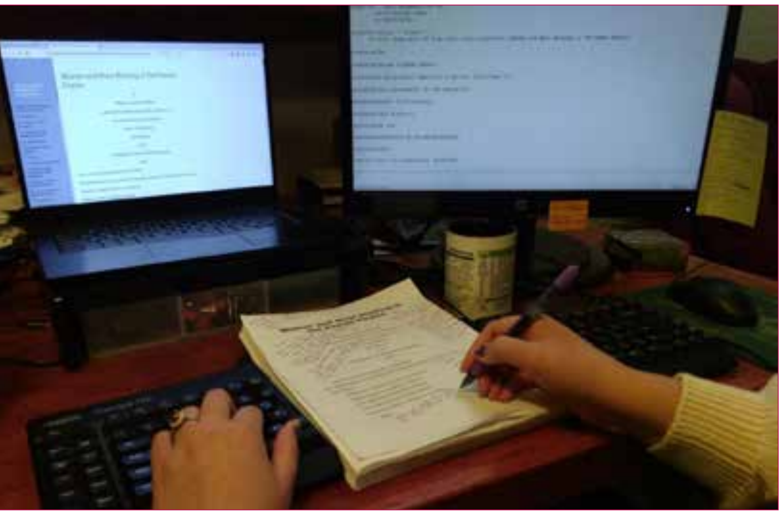
List of FLOSS software used/ data repository and licence

1. Blender, GNU Public License (GPL) Version 2.83 and 2.90; 2. yEd, Freeware Version 3.20.1; 3. LibreOffice, MPLv2.0 Version 7.1.5; 4. Inkscape, GNU Public License (GPL) Version 1.0.1.

USING PROGRAMMING ENVIRONMENTS FOR ACADEMIC RE-SEARCH AND WRITING

by Morgan Lemmer-Webber



Morgan Lemmer-Webber's dissertation workflow as she incorporates notes written on the physical draft of her dissertation into the scribble sourcecode (right monitor), which is displayed via html in the browser (left monitor)".

I have been an active user of free and open-source technology for about fifteen years and have run Linux distributions for the operating system on my primary computer for over a decade. For most of that time, my free software advocacy and use has run in parallel with my academic career with little overlap. However, when I started getting involved in digital humanities projects, I had more tangible reasons to incorporate that technology into my academic projects.
My wife and I co-developed and ran a series of digital humanities workshops to teach the basics of programming to students with no computer science background. For these workshops, we decided to use the programming language Racket[1] because it had a code editor, Dr. Racket, and markup language, Scribble, built in. My wife created a programming tutorial using Racket, and I created a tutorial for using Scribble[2] to write an academic paper[3]. The objective of the three-hour workshops was to give a basic introduction to programming with a deliverable skill of writing using Scribble (Fig. 1).
When it came time to write my dissertation (Lemmer-Webber 2021), I decided to practice what I preach and use Scribble. The use of this technology provided many advantages over standard word processors. I was able to write one source file and export it from there to multiple file formats, including html and pdf. Since Scribble is associated with the programming language Racket, I was able to code functions directly into the source document. This allowed me to customize and automate certain aspects of my work, such as the bibliography, image list (which drew from a CSV database), and index. I was able to comment out text that was not immediately relevant but could be useful elsewhere. As I was already using programming tools for my dissertation, I further enhanced my workflow by using revision control, permitting the time-traveling view of document history that programmers enjoy applied to my own writing. Since git on its own does not handle images well, I used git annex on top of git in order to include all of the files necessary to export my dissertation in the same repository[4].
Unfortunately, achieving these benefits came with its own share of obstacles. While Scribble on its own has a relatively low barrier to entry for the boilerplate options, I did have to rely on assistance from a more experienced developer for higher-level functions and customization. Similarly, the built-in option to export to pdf had formatting set to computer science paper conventions and did not incorporate an easy way to reset the formatting parameters of the output. Formatting LaTeX to a specified style guide is already a feat. Formatting generated LaTeX from a markup language adds a further layer of difficulty. In the end, we were only able to get about 90% of the formatting to output correctly on export. Incorporating git and git annex as someone with minimal development experience likewise had a steep learning curve.
Many of these and other obstacles were overcome simply by experience and experimentation with the tools. For revision control, we set up a git annex to auto-commit progress on my dissertation daily. This removed the burden of using the command-line interface on a regular basis and ensured I did not simply forget to commit for long periods. We were never able to fully overcome our LaTeX issues, so instead, my wife, Christine Lemmer-Webber, wrote an Open Document Format (ODF) exporter for Scribble. With this tool, I was able to manually complete the last 10% of the formatting that we were having difficulty with manually using Libre Office (though ODF can be open with any word processor).
The decision to use Scribble was mostly made based on our decisions for the digital humanities workshops we'd designed. For the workshops, we'd decided to use the code editor Dr. Racket since it was purpose-built for Racket, had a low barrier to entry for new users, had a repl (a "read eval print loop" or a tool for programmers that provides a space for experimentation and to show progress on a program during development), and had an auto-export-to-html button for Scribble documents. Since the timeframe of the workshops was constrained to three hours, this efficiency out of the box made the process easier to pick up. Once our custom ODF exporter is cleaned up and released publicly, this will further expand the adaptability of this resource to people who are just beginning with programming environments as research and writing tools.
In retrospect, however, we realized that using a more developed code editor such as Emacs[5] or Vi, would have been a more logical choice. In the months following the submission of my dissertation, I have begun learning to use Emacs, which is a much more powerful tool for long-term projects because it has more features and can be used with any programming language. It has a calendar system and an organizational system, Org Mode, built in which allow for outlining, task assignment, and planning. It already has an ODF exporter, which Christine used as a model for creating the Scribble ODF exporter. Emacs has "Magit", an integrated and more intuitive interface for git, permitting the staging and committing files from within the same tooling one uses for document authoring rather than dropping to git's difficult to use command-line interface[6]. However, Emacs has a much higher barrier to entry because it was created in the nineteen seventies and therefore, its keyboard commands predate and differ from most of the standard commands used today.
My experience using Scribble to write my dissertation was unique and, in many ways, experimental. There were learning curves along the way that exceeded most dissertation experiences. However, I believe that incorporating these

```
#lang scribble/base

@(require images/logos
          scribble/sigplan)

@centered{
 @larger{@larger{@larger{@bold{Programmable Publishing}}}}}

@centered{
 @larger{@bold{One markup language to rule them all!}}}

@centered{@(plt-logo #:height 65)}

@centered{@larger{Want to learn computer programming, but don't think you're
 enough of a math / computer science person?
 Have we got the workshop for you!}}

Using the Racket programming language, the user-friendly text editor
DrRacket, and the markup language Scribble, participants will learn:

@itemlist[
 @item{
  The basics of learning to program... not by crunching
  numbers, but by making pictures!}
 @item{
  Use Scribble and DrRacket to write papers in one source file,
  but export to HTML, PDF, and other formats!}
 @item{
  Integrate data analysis right into your documents!
  How many times @emph{did} Jane Austen mention tea in her writings?}
 @item{
  Write custom tools to fit @emph{your} research needs.
  Tired of formatting and reformatting image lists?
  Why not let your program do it for you?}]

The workshop will be held at WisCon on Sunday May 27 from 3-4:45 in CIRC

You @emph{can} learn to program... yes, you!

@centered{@emph{Pssst... flip this flier up to see its source code!}}
```

Fig. 2 - Sample Scribble source code used to generate the flier for the Programmable Publishing workshop. The flier displayed the PDF output on the front, and the source code on the reverse.

types of programming tools into research workflows has significant merit, particularly for multi-researcher projects, projects that involve large amounts of data analysis, or for those projects whose needs exceed standard word processors. Any project which requires multiple users to edit a document could benefit from revision control which monitors who made changes, when and preserves older copies of the document in the event that an error is made. Furthermore, having a publicly available git repository where the data, source code, methods, and reports are available greatly increases reproducibility. While digital tools and processes have increasingly revolutionized the way that data and research are interpreted, visualized, and shared, the writing workflow for many scholars has remained relatively unchanged. Imagine how much more we could achieve if we think outside of the .docx.

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Lemmer-Webber Morgan (2021) "Women and Wool Working in the Roman Empire." PhD diss., University of Wisconsin Madison, 2021. https://mlemmer.org/dissertation/

Abstract

Developer tools, such as code editors, markup languages, and revision control have a greater range of functions than word processors. As a scholar engaged in both Digital Humanities and the FOSS community, I have become increasingly interested in how these tools can be applied to research workflows. I wrote my dissertation in the editor Dr. Racket using Scribble, allowing me to incorporate code directly into my document. In this talk, I will discuss the benefits and pitfalls of this decision.

Keywords

Digital Humanities; Markup languages; Revision control;

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List of FLOSS software used/ data repository and licence

1 Scribble, Apache License v 2.0; 2 Racket and Dr. Racket, MIT license and the Apache version 2.0 license (some components distributed under the GNU Lesser General Public License, version 3); 3 git-annex, AGPL version 3 or higher (parts of git-annex are licensed under the GPL, BSD, and other licenses); GNU Emacs, GPL; Libre Office, Mozilla Public License v2.0.

End notes

[1]"Racket, the Programming Language," accessed September 1, 2021, https://racket-lang.org/.
[2] "Scribble: Describing Multi Party Protocols," accessed September 1, 2021, http://www.scribble.org/.
[3] Lemmer-Webber and Lemmer-Webber 2018, accessed September 1, 2021, "Programmable Publishing: Digital Humanities for Everyone!" https://dustycloud.org/misc/digital-humanities/.
[4] "Git-annex," accessed September 1, 2021, https://git-annex.branchable.com/.
[5] "Gnu-Emacs," accessed September 1, 2021, https://www.gnu.org/software/emacs/.
[6] "Magit, A Git Porcelain inside Emacs," accessed September 1, 2021, https://magit.vc/.

RE3DRAGON – A RESEARCH REGISTRY RESOURCE API FOR DATA DRAGONS

by Florian Thiery, Allard W. Mees

Fig. 1 - re3dragon ⇒ https://cloud.rgzm.de/index.php/s/2JaboQ6TTeLPXgC.

Cartographers in historical maps used the phrase *Hic sunt dracones* (historically translated as: here be dragons) to describe areas which were beyond the known world of the map creator. Today, the digital data universe is full of unknown data, which have to be made FAIR (Findable, Accessible, Interoperable and Reusable) to integrate them in archaeological research. The World Wide Web offers researchers the possibility to share research data and enables the community to participate in the scientific discourse in order to generate previously unknown knowledge. However, much of this data is neither directly comparable and alignable nor findable or accessible, thus resulting in modern unknown Data Dragons (Thiery et al. 2019). These Data Dragons lack connections to other datasets, which leads to a lack of interoperability and, in some cases, unusability. A set of techniques, standards and recommendations can be used to overcome these shortcomings: Semantic Web and Linked Open Data (LOD) (Berners-Lee 2006) and consequently Linked Open Usable Data[1] (LOUD). The CAA Special Interest Group (SIG) on Semantics and LOUD in Archaeology (SIG-DataDragon[2]) was established in 2020 to tame and unveil the modern data dragons. Those require a safe location, a so-called Dragon Lair, where they can be clustered and made accessible. This data dragon LOD lair location and its machine-readable accessibility are combined in the re3dragon tool - the REsearch REsource REgistry for DataDragons. The FLOSS re3dragon tool envisages two aims. 1st: publication of open extendable archaeology related LOD resource catalogue (the Dragon Lair) including authority data (e.g. Integrated Authority File - GND), thesauri (e.g. Getty AAT, Heritage Data Vocabularies), controlled vocabularies, gazetteers (e.g. GeoNames, Pleiades), space-time gazetteers (e.g. ChronOntology, PeriodO), as well as typologies and domain-specific resources (e.g. Roman Open Data, Nomisma, Linked Open Samian Ware). 2nd: offering an API for requesting distributed LOD resources (so-called Dragon Items), providing resources in a standardised JSON format based on JSKOS (Voß et al. 2016; Voß 2021). The tool is currently being implemented as part of the RGZM digital research data infrastructure. It plays an essential role in the design of an overarching keyword registry (Meta-Index), which enables aggregating external distributed data resources in order to qualify internal data (e.g. the Meta-Index term Mainz may refer to Roman, medieval[3] or modern Mainz[4], resulting in different aggregation references). This process to transform a vocabulary term into a label by linking it to reference thesauri concepts has been described in Piotrowski et al. (2014). This approach enforces interoperability and reusability, enabling mapping on external major union systems like Europeana. Moreover, these aspects play a pivotal role in the planned German National Research Data Infrastructure (NFDI) consortium NFDI4Objects. Based on creating a JSKOS-enhancement NFDI4Objects[5]. Based on creating a JSKOS-enhancement (JSKOS+), re3dragon supports the furtherance of interdisciplinary major existing knowledge hubs such as the BARTOC[6] registry and the accompanying SKOS based mapping tool Cocoda[7].

The re3dragon API is coded in JAVA using Maven and Apache Jena and is published Open Source on GitHub[8] (Thiery 2021). The re3dragon is based on the Labeling System approach (Piotrowski et al. 2014; Thiery and Engel 2016) and the re3cat API[9].

The basis of re3dragon is an online catalogue of Linked Open Data resources (the Dragon Lair), which includes norm and authority data resources (e.g. Getty AAT, Wikidata) as well as domain-specific typologies and archaeological data (e.g. Terra Sigillata production centres, distribution sites, potters and ceramic typologies), stored as RDF in an RDF4J triplestore. Dragon Lairs are semantically modelled using the LADO ontology (RGZM Linked Archaeological Data Ontology), which is based on the RSE Tools Ontology (Thiery 2019). Table 1 demonstrates exemplary the Getty AAT Dragon Lair using the prefixes *lado*[10] and *wd*[11]:

The re3dragon offers three types of API services. 1st: a search API service for LOD resources with string and distance similarity; 2nd: an API resolving service for LOD resources related to specific URIs. 3rd: a catalogue API for Dragon Lairs. Service types 1 and 2 offer results according to the JSKOS+ format and HTML; service type 3 provides an interoperable output which is integrable in other research tools, e.g. the Labeling System.

property	value
rdf:type	lado:DataDragonLair
owl:sameAs	wd:Q611299
rdfs:label	Getty AAT
lado:description	controlled vocabulary used for describing items of art, architecture, and material culture
lado:author	Getty Research Institute
lado:sparqlendpoint	http://vocab.getty.edu/sparql
lado:hasLegalType	lado:ResearchInstitution
lado:language	lado:en

Tab. 1 - Dragon Lair example as RDF (Getty AAT).

/re3dragon/rest/search?repo=gettyaat&q=lion


```
[{
    "displayLabel": {
        "en": "Panthera leo (species)"
    },
    „type“: [„http://www.w3.org/2004/02/skos/core#Concept“],
    „lair“: {
        „scheme“: „Getty AAT“,
        „legaltype“: „lado:ResearchInstitution“,
        „id“: „ULBU3XXM“,
        „type“: „Thesaurus“,
        „wikidata“: „wd:Q611299“,
        „quality“: „lado:qualityHigh“,
        „group“: „lado:chreferencethesauriGroup“
    },
    "uri": "http://vocab.getty.edu/aat/300310388",
    „displayDesc“: {
        „en“: „Large, powerful species of cat that is well-muscled, with a large head, short legs, size and appearance that varies considerably between the sexes, and is unique among the cats in living in family groups or prides. [...]“
    },
    „similarity“: {
        „levenshtein“: 20.0,
        „dameraulevenshtein“: 20.0,
        „jarowinkler“: 0.52,
        „normalizedlevenshtein“: 0.91,
        „searchstring“: „lion“,
        „lairstring“: „Panthera leo (species)“
    }
}]
```


Tab. 2 - Dragon Lair example as RDF (Getty AAT).

The JSKOS (JavaScript Object Notation for Simple Knowledge Organization Systems) format defines a JavaScript Object Notation (JSON) structure to encode Knowledge Organisation Systems (KOS) (Voß 2021). JSKOS+ provides a standardised (Geo-)JSON(-LD) data model according to JSKOS as a response to an API request. Table 2 demonstrates the JSKOS+ JSON results for Getty AAT requests, showing JSKOS items in red and JSKOS+ items in blue. This enables future enhancements of the JSKOS standard, e.g. semantic location descriptions, mapping properties, as well as space and time typologies (Dimensionally Extended 9-Intersection Model, Allen's Interval Algebra).

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Voß Jakob, Andreas Ledl and Uma Balakrishnan (2016) '*Uniform Description And Access To Knowledge Organization Systems With Bartoc And Jskos*', October. Zenodo. doi:10.5281/zenodo.438019.

Abstract

The re3dragon (REsearch REsource REgistry for DataDragons) FLOSS tool envisages two aims: 1st: publication of an archaeology related open extendable LOD resource catalogue including authority data, thesauri, gazetteers, (space-) time gazetteers as well as typologies and domain-specific resources. 2nd: re3dragon offers an API for requesting distributed LOD resources, returning resources in a standardised JSON format based on JSKOS. The re3dragon is coded in JAVA, and Open Source is published on GitHub.

Keywords

Linked Open Data; SKOS; JSKOS; JAVA; Thesauri Catalogue.

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List of FLOSS software used/ data repository and licence

1 re3dragon, MIT License; 2 Netbeans, Apache 2.0 License; 3 Apache Maven, Apache-License, Version 2.0; 4 Apache Jena, Apache-License, Version 2.0; 5 Eclipse Jersey, Eclipse Public License 2.0

End notes

[1] https://linked.art/loud/ (accessed 31/08/2021)

[2] https://caa-international.org/special-interest-groups; http://datadragon.link (accessed 31/08/2021)

[3] https://pleiades.stoa.org/places/109169 ; http://imperium.ahlfeldt.se/places/3 (accessed 31/08/2021)

[4] http://sws.geonames.org/2874225 ; https://www.wikidata.org/entity/Q1720 (accessed 31/08/2021)

[5] https://osf.io/4t29e/wiki/home/ (accessed 31/08/2021)

[6] https://bartoc.org/ (accessed 31/08/2021)

[7] https://coli-conc.gbv.de/ (accessed 31/08/2021)

[8] https://github.com/RGZM/re3dragon (accessed 31/08/2021)

9 https://github.com/mainzed/re3cat (accessed 31/08/2021)

[10] http://archaeology.link/ontology# (accessed 31/08/2021)

[11] http://www.wikidata.org/entity/ (accessed 31/08/2021)

EPIGRAPHIC DATABASE ROME (EDR) TOWARDS RELATIONAL OPENNESS: DEVELOPMENT OF THE JSON FORMAT

by Silvia Orlandi, Saverio Giulio Malatesta, Lanfranco Fabriani

Epigraphic Database Rome (EDR) is a huge epigraphic database, a constituent part of the International Federation of epigraphic databases called "Electronic Archive of Greek and Latin Epigraphy" (EAGLE). As such, it is expected that it can be consulted both on its own and together with the other federated banks through the EAGLE portal (www.eagle-eagle.it). In addition to EDR, the Federation currently includes the *Epigraphische Datenbank Heidelberg* (EDH), the Epigraphic Database Bari (EDB) and *Hispania Epigraphica* (HE).
As part of EAGLE (which proposes the registration of all inscriptions prior to the 7th century AD, Greek and Latin, according to the best existing edition, possibly with further checks and amendments and with the accompanying of some fundamental data and images) EDR has been given the epigraphy of Rome - except the Christian one, competence of EDB - of the Italian peninsula, Sicily and Sardinia.
At the moment it collects as many as 99347 inscriptions, thus divided according to the ancient Augustan *regiones* in which Italy was divided: *Aemilia* 1184, *Apulia et Calabria* 4041, *Bruttii et Lucania* 1216, *Etruria* 5431, *Latium et Campania* 23664, *Liguria* 1303, *Picenum* 1644, *Regio incerta* 409, *Roma* 34741, *Sabina et Samnium* 4142, *Sardinia* 1643, *Sicily* 3380, *Transpadana* 2903, *Umbria* 4064, *Venetia et Histria* 9581.
64968 photos are added to this extraordinary documentary heritage.
EDR currently avails itself of the collaboration and technical support of DigiLab, the interdepartmental center for research of the University of Rome - La Sapienza, and is presented as a branched structure, which has its headquarters in Rome at the Latin Epigraphy Chair of the Department of Sciences of the Antiquity of the University of Rome - La Sapienza, with a vast network of collaborators including Universities, Superintendencies, other entities and individual scholars. The current organization of the work requires that each text entered on the network has been checked at least twice by a committee of experts to ensure greater control and greater uniformity of the data entered.
In 2009 an *ad hoc* International Scientific Committee decided to include EAGLE / EDR, in its Roman component, among the projects of excellence of Sapienza - University of Rome and for this reason the Sapienza Research award was awarded to its current managers, Gian Luca Gregori and Silvia Orlandi, in the presence of the President of the Italian Republic.
From the beginning it has been a highly collaborative work, thanks to contributions born in the context of degree theses, collaboration contracts or the supervision work that the heads of the various work groups carry out almost daily on the epigraphs of their competence, never separated from a broader look at the other entries in the database and generally available online.
The willingness to open information, the widest possible sharing of knowledge, freedom of access to data, was further confirmed by joining the European project EAGLE, "Europeana network of Ancient Greek and Latin Epigraphy": it is a best-practice network co-funded by the European Commission, under its Information and Communication Technologies Policy Support Programme. The European project will provide a single user-friendly portal to the inscriptions of the Ancient World, a massive resource for both the curious and for the scholarly.
The EAGLE Best Practice Network is part of Europeana, a multi-lingual online collection of millions of digitized items from European museums, libraries, archives and multi-media collections. EAGLE will collect, in a single readily searchable database, more than 1.5 million items, currently scattered across 25 EU countries, as well as the east and south Mediterranean. The project will make available the vast majority of the surviving inscriptions of the Greco-Roman world, complete with the essential information about them and, for all the most important, a translation into English. A multilingual Wiki will be set up for the enrichment and enhancement of epigraphic images and texts, which will provide a basis for future translations of inscriptions into other European languages.
The enormous amount of data that has been generated therefore constitutes a very precious tool for study and historical-archaeological investigation, but not only. The systematic work that has been carried out in recent years, by various EDR collaborators, of research on the antiques market, through the scrutiny of the auction catalogs, both paper and online, of published and unpublished ancient inscriptions, genuine or imitation , is leading to interesting results not only in the study of the phenomenon of epigraphic falsification and the channels of the antiquarian trade, but also for the purpose of a more correct use of the material thus traced as a historical source, thanks to a more precise chronological positioning of documents whose characteristics of both the text and the support are now known.
To increase the system's ability to interact in this way, from March 2021 an API (Application Programming Interface) system is being developed through a series of functions, procedures and variables designed to make the information stored in EDR immediately interrelated. As a data exchange format, JSON (JavaScript Object Notation) was chosen, in relation to the language used, PHP. The structure of the JSON follows that of the EDR card, with the addition of URI, data license, authority and file creation data.
To illustrate all the search combinations, the possibilities and the possible outputs, a timely support documentation

is being developed, which will be made available on the official website when the testing phase will be completed.

Instead, the management of the images is problematic: in the testing phases, in progress, the photographs relating to the epigraphs were also taken in consideration, but unfortunately often fall under full copyright by the institutions hosting the textual documents; their disclosure outside the EDR framework, therefore, appears not possible at the moment. From this point of view, we therefore hope for greater awareness of the opening and sharing of information, aimed at spreading knowledge and creating new research and application possibilities.

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Abstract

EDR is one of the international reference points for classical epigraphy: inaugurated in 2003, it is about to reach the milestone of 100,000 epigraphs. To make as much data as possible accessible and shareable under CC license, are being developed a webGIS for georeferencing of epigraphs and an API system to release data in JSON format, so as to be able to interact with other repositories, encourage scientific research and re-use in other projects, including apps, AR/VR and gamification systems.

Keywords

Epigraphy; database; json; interoperability; LOD

List of FLOSS software used/ data repository and licence

EDR data are released under CC-by-SA 4.0 licence.

FULL IMMERSION IN CULTURAL HERITAGE ENVIRONMENTS: A NEW IDEHA FOR DATA MANAGING AND DISPLAYING

by Luca Bevilacqua, Bruno Fanini, Nicola Mariniello, Augusto Palombini, Vladimiro Scotto di Carlo, Antonio Sorgente, Paolo Vanacore

IDEHA (Innovation for Data Elaboration in Heritage Areas), is a PON project coordinated by CNR, aimed to an open platform for real-time aggregation of Cultural Heritage elements (sites, monuments, etc.) data; and their "packaging" in sets of informations for different targets of outlined public. The main tool conceived for displaying data (spread from different sources: news, digital libraries, IoT, etc.) is an immersive viewer capable to display 360° images and videos, all multimedia inserts html5-compatible, and multi-language audio-sinthesized messages. Such a tool is here presented. It has been planned thanks to the effort of CNR and Engineering, and will be released according to the LGPL, to become a trigger of further initiatives both commercial and free.

BDUS4 REST API: PROGRAMMATIC ACCESS TO BDUS4 WEB DATABASES TO BUILD RICH INTERNET APPLICATIONS OR DESKTOP APPS

by Julian, Bogdani

REST APIs are a popular way for data exchange between web apps. Based on JSON, they are extremely easy to consume. Bradypus webDB integrates a secure API to expose the contents of a database through HTTP using JSON. The workshop will focus on a complete overview of this functionality and will introduce the participants to shortSQL, a secure and compact version of SQL used to communicate with BDUS4. The API can be used to build web apps or to consume data on Desktop applications (es. QGIS).

DAL CIELO ALLA TERRA FIN SULLA CARTA CON PYARCHINIT

by Roberto Montagnetti

Il Workshop tratterà di tutto l'impianto di gestione di uno scavo archeologico attraverso QGIS e il suo plugin per l'archeologia Pyarchinit 3. Il partecipante sarà in grado di gestire tutto il processo dall'impianto del rilievo dalla fotogrammetria da drone fino alla relazione stampata. In questo workshop illustreremo infatti come far interagire tra loro più procedure adottate negli scavi archeologici di ricerca o legati all'archeologia preventiva e alle Carte di potenziale archeologico. Vedremo vari metodi di allineamento di più progetti di scavo su un'unica base GIS, come georiferire la stratigrafia, gestire le schede US, periodizzare e raggruppare le US in strutture, generare matrix e tavole composite di fase, fino alla creazione di una relazione.

DIRETTIVA 2019/790/UE E BENI CULTURALI

di Marco Ciurcina, Piergiovanna Grossi

Lo scorso 7 giugno 2021 sono scaduti i termini per il recepimento della Direttiva 2019/790/UE, sul diritto d'autore[1].

Lo Schema di decreto legislativo recante attuazione della direttiva (UE)2019/790 sul diritto d'autore e sui diritti connessi nel mercato unico digitale e che modifica le direttive 96/9/CE e 2001/29/CE (295) è attualmente all'esame del Parlamento per il previsto parere parlamentare; a breve è attesa la conclusione del procedimento[2].

La direttiva 2019/790 valorizza gli istituti di tutela del patrimonio culturale, definiti all'art. 2, n. 3.

All'art. 3 prevede un'eccezione per le riproduzioni e le estrazioni effettuate da istituti di tutela del patrimonio culturale ai fini dell'estrazione, per scopi di ricerca scientifica, di testo e di dati da opere o altri materiali cui essi hanno legalmente accesso.

All'art. 6 prevede un'eccezione per consentire agli istituti di tutela del patrimonio culturale di realizzare copie di qualunque opera o altri materiali presenti permanentemente nelle loro raccolte, in qualsiasi formato o su qualsiasi supporto, ai fini di conservazione di detta opera o altri materiali e nella misura necessaria a tale conservazione.

All'art. 8 prevede:

- che un organismo di gestione collettiva, conformemente ai mandati ad esso conferiti dai titolari di diritti, a certe condizioni possa concludere un contratto di licenza non esclusiva a fini non commerciali con un istituto di tutela del patrimonio culturale per la riproduzione, la distribuzione, la comunicazione al pubblico o la messa a disposizione del pubblico di opere o altri materiali fuori commercio presenti in modo permanente nella raccolta di detto istituto, indipendentemente dal fatto che tutti i titolari dei diritti oggetto della licenza abbiano o meno conferito un mandato all'organismo di gestione collettiva;
- un'eccezione o una limitazione ai diritti per consentire agli istituti di tutela del patrimonio culturale, a certe condizioni, di mettere a disposizione, a fini non commerciali, opere o altri materiali fuori commercio presenti in modo permanente nella loro raccolta.

Lo schema di decreto legislativo attua tali articoli prevedendo l'adozione di nuove disposizioni della Legge 633/1941; in particolare prevede:

- all'art. 1, comma 1, lett. e, l'adozione dell'art. 68, comma 2-*bis*;
- all'art. 1, comma 1, lett. g, l'adozione dell'art. 70-*ter*;
- all'art. 1, comma 1, lett. m, l'adozione degli articoli da 102-*undecies* a 102-*septiesdecies*[3].

Qualora recepite, tali norme favorirebbero gli istituti di tutela del patrimonio culturale consentendogli di realizzare copie per scopi di ricerca scientifica e/o di conservazione delle opere e di utilizzare liberamente (anche mettendole a disposizione degli utenti) le opere fuori commercio presenti nelle loro raccolte.

La direttiva 2019/790 all'art. 14 prevede che gli Stati membri provvedono a che, alla scadenza della durata di protezione di un'opera delle arti visive, il materiale derivante da un atto di riproduzione di tale opera non sia soggetto al diritto d'autore o a diritti connessi, a meno che il materiale risultante da tale atto di riproduzione sia originale nel senso che costituisce una creazione intellettuale propria dell'autore.

L'art. 14 verrebbe attuato ai sensi dell'art. 1, comma 1, lett. a), dello Schema di decreto legislativo introducendo alla legge 633/41 il nuovo art. 32-*quater*[4] che, nell'attuale formulazione, espressamente prevede che "Alla scadenza della durata di protezione di un'opera delle arti visive, anche come individuate all'articolo 2, il materiale derivante da un atto di riproduzione di tale opera non è soggetto al diritto d'autore o a diritti connessi, salvo che costituisca un'opera originale. di protezione di un'opera delle arti. Restano ferme le disposizioni in materia di riproduzione dei beni culturali di cui al decreto legislativo 22 gennaio 2004, n. 42.".[5]

L'ultima parte è di particolare interesse in quanto supera le ipotesi[6] secondo le quali la nuova direttiva avrebbe potuto impattare sul disposto degli artt. 106 e seg. del decreto legislativo 22 gennaio 2004, n. 42[7] che, in sintesi, consente l'uso commerciale di riproduzioni di beni culturali di proprietà pubblica solo previo accordo ed eventuale pagamento di un canone all'ente custode del bene o dei beni riprodotti.

Con il recepimento della Direttiva Europea 2019/790, stando allo Schema di decreto legislativo attualmente in esame, nulla cambia nella sostanza in merito al regime autorizzatorio di riproduzione dei beni culturali di proprietà pubblica previsto dal Codice dei Beni Culturali. Gli artt. 106 e seg. del Codice continuano a rimanere il riferimento per l'autorizzazione amministrativa nel caso di riproduzioni a scopo di lucro e negli altri casi previsti.

Invece, il nuovo art. 32-*quater* interferisce con gli artt. 87-92 della Legge 633/41, Protezione del diritto d'autore e di altri diritti connessi, i quali normano le fotografie semplici[8].

All'art. 87 si fa esplicito riferimento alle "riproduzioni di opere dell'arte figurativa" mentre "Non sono comprese le fotografie di scritti, documenti, carte di affari, oggetti materiali, disegni tecnici e prodotti simili.".

Ma alle riproduzioni di opere dell'arte visiva che siano in pubblico dominio si applicherebbe il nuovo art. 32-*quater* previsto dallo Schema di decreto legislativo, che fa venir meno il diritto connesso sulle fotografie semplici previsto dagli artt. 87 e seg. (diritto che dura solo 20 anni e che si applica alle fotografie che non sono opere creative).

Nella sostanza, le semplici fotografie (non quindi le fotografie che siano originali nel senso che costituiscano una creazione intellettuale propria dell'autore) di opere dell'arte visiva in pubblico dominio non saranno più tutelate.

Workflow:

Il Workshop si divide in due sezioni:

- un'esposizione frontale, mirata a introdurre sinteticamente il contesto legislativo attuale in materia di beni culturali;
- uno spazio di discussione, in cui verranno proposti approfondimenti specifici e in cui i partecipanti saranno invitati a intervenire con domande o osservazioni.

Abstract

Il 7 giugno 2021 è scaduto il termine di recepimento della direttiva 2019/790/UE sul diritto d'autore. Il testo della direttiva fa riferimento in diversi punti al "patrimonio culturale" e agli "istituti di tutela del patrimonio culturale". D'interesse sono gli artt. 3, 6, 8 e l'art. 14, che è destinato a interferire con il diritto ex art. 87 e seguenti della Legge 633/1941 in merito alle riproduzioni dei beni culturali.

Keywords

Direttiva 2019/790/UE; Codice dei Beni Culturali e del Paesaggio (D. Lgs. 42/2004); Legge sul diritto d'autore e sui diritti connessi (Legge 633/1941); riproduzione dei beni culturali; Legislatura 18ª - Disegno di legge n. 1721.

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End notes

[1] "Direttiva (UE) 2019/790 del Parlamento europeo e del Consiglio, del 17 aprile 2019, sul diritto d'autore e sui diritti connessi nel mercato unico digitale e che modifica le direttive 96/9/CE e 2001/29/CE (Testo rilevante ai fini del SEE.)", EUR-Lex, accesso Agosto 30, 2021, https://eur-lex.europa.eu/legal-content/IT/TXT/?uri=CELEX%3A32019L0790.

[2] "Atto del Governo: 295. Schema di decreto legislativo recante attuazione della direttiva (UE) 2019/790 sul diritto d'autore e sui diritti connessi nel mercato unico digitale e che modifica le direttive 96/9/CE e 2001/29/CE (295)", Camera dei Deputati, accesso Agosto 30, 2021, https://www.camera.it/leg18/682?atto=295&tipoAtto=Atto&idLegislatura=18&tab=1; qui la bozza di decreto legislativo trasmessa al parlamento: "Camera dei Deputati, n. 295, Atto del Governo sottoposto a parere parlamentare. Trasmesso alla Presidenza il 6 agosto 2021. Schema di decreto legislativo recante attuazione della direttiva (UE)2019/790 sul diritto d'autore e sui diritti connessi nel mercato unico digitale che modifica le direttive 96/9/CE e 2001/29/CE (295)", Camera dei Deputati, accesso Agosto 30, 2021, http://documenti.camera.it/apps/nuovosito/attigoverno/Schedalavori/getTesto.ashx?file=0295.pdf&leg=XVIII#pagemode=none.

[3] Per i testi degli articoli citati si rimanda allo Schema di decreto legislativo: "Camera dei Deputati, n. 295, Atto del Governo sottoposto a parere parlamentare. Trasmesso alla Presidenza il 6 agosto 2021. Schema di decreto legislativo recante attuazione della direttiva (UE)2019/790 sul diritto d'autore e sui diritti connessi nel mercato unico digitale che modifica le direttive 96/9/CE e 2001/29/CE (295)", Camera dei Deputati, accesso Agosto 30, 2021, http://documenti.camera.it/apps/nuovosito/attigoverno/Schedalavori/getTesto.ashx?file=0295.pdf&leg=XVIII#pagemode=none.

[4] Cfr. nota 3.

[5] Il citato art. 2 della Legge 633/41 descrive le arti visive, al comma 4 le arti figurative: "4) le opere della scultura, della pittura, dell'arte del disegno, della incisione e delle arti figurative similari, compresa la scenografia": "Legge 22 aprile 1941, n. 633. Protezione del diritto d'autore e di altri diritti connessi al suo esercizio. (041U0633). (Ultimo aggiornamento all'atto pubblicato il 24/07/2021)", Normattiva. Il portale della legge vigente, accesso Agosto 30, 2021, https://www.normattiva.it/atto/caricaDettaglioAtto?atto.dataPubblicazioneGazzetta=1941-07-16&atto.codiceRedazionale=041U0633&queryString=%3FmeseProvvedimento%3D%26formType%3Dricerca_semplice%26numeroArticolo%3D%26numeroProvvedimento%3D633%26testo%3D%26giornoProvvedimento%3D%26annoProvvedimento%3D1941&currentPage=1.

[6] Si veda, per una visione d'insieme e complessiva del dibattito: "Adeon, rivista di arti e diritto on line, numero 1, 2021, issn 1127-1345", Adeon, rivista di arti e diritto on line, accesso Agosto 30, 2021, http://www.aedon.mulino.it/archivio/2021/1/index121.htm.

[7] Artt. 106-108, Codice dei Beni Culturali e del Paesaggio: "Decreto Legislativo 22 gennaio 2004, n. 42
Codice dei beni culturali e del paesaggio, ai sensi dell'articolo 10 della legge 6 luglio 2002, n. 137. (Ultimo aggiornamento all'atto pubblicato il 14/09/2020)", Normattiva. Il portale della legge vigente, accesso Agosto 30, 2021, https://www.normattiva.it/atto/caricaDettaglioAtto?atto.dataPubblicazioneGazzetta=2004-02-24&atto.codiceRedazionale=004G0066&queryString=%3FmeseProvvedimento%3D01%26formType%3Dricerca_semplice%26numeroArticolo%3D%26numeroProvvedimento%3D42%26testo%3D%26annoProvvedimento%3D2004%26giornoProvvedimento%3D22&currentPage=1.

[8] "Legge 22 aprile 1941, n. 633. Protezione del diritto d'autore e di altri diritti connessi al suo esercizio. (041U0633). (Ultimo aggiornamento all'atto pubblicato il 24/07/2021)", Normattiva. Il portale della legge vigente, accesso Agosto 30, 2021, https://www.normattiva.it/atto/caricaDettaglioAtto?atto.dataPubblicazioneGazzetta=1941-07-16&atto.codiceRedazionale=041U0633&queryString=%3FmeseProvvedimento%3D%26formType%3Dricerca_semplice%26numeroArticolo%3D%26numeroProvvedimento%3D633%26testo%3D%26giornoProvvedimento%3D%26annoProvvedimento%3D1941&currentPage=1. Le fotografie semplici sono normate agli artt. 87-92, mentre le fotografie che costituiscono opera della creatività sono normate all'art. 2, comma 7.

[9] Per la definizione di "arti visive" e "arti figurative" cfr. nota 5.

DALLA CARTA AL SISTEMA INFORMATIVO TERRITORIALE ARCHEOLOGICO: IL CASO DI RUBIERA (RE)

di Alberto Belussi, Annalisa Capurso, Piergiovanna Grossi, Sara Migliorini

Fig. 1 - re3dragon ⇒ https://cloud.rgzm.de/index.php/s/2JaboQ6TTeLPXgC .

Nel 2019, grazie a un protocollo d'Intesa tra l'Università di Verona (Dipartimento di Culture e Civiltà e Dipartimento di Informatica) e la Soprintendenza Archeologia, Belle Arti e Paesaggio per la città metropolitana di Bologna e le province di Modena, Ferrara e Reggio Emilia, viene avviata una collaborazione mirata alla realizzazione di una Carta Archeologica del comune di Rubiera, portando, a stretto giro, allo sviluppo del Sistema Informativo Territoriale archeologico descritto in questo contributo.

Il territorio rubierese presenta una ricchezza storico-archeologica di straordinario valore. In quest'area, dove la conformazione geologica e il corso del fiume favorirono fin dall'antichità lo stanziamento, le tracce di vita risalgono fino all'eneolitico; numerose sono le successive attestazioni dell'età del Ferro, ma è con l'età romana che, grazie alla presenza della via Aemilia e alla politica di sfruttamento agrario, il territorio inizia ad essere frequentato ed abitato in maniera diffusa: le campagne vengono suddivise in centurie, gli stanziamenti rurali vengono intensificati e, con essi, le infrastrutture connesse (vie secondarie, centri di produzione, necropoli). Numerosi sono i rinvenimenti documentati e gli studi mirati a comprendere gli aspetti culturali e sociali del territorio nell'antichità. Si citano qui, a solo titolo di esempio, il datato ma importante lavoro di sintesi della Società Reggiana d'Archeologia (Carta Archeologica di Rubiera. 1984) e tra i più recenti i contributi del volume On the Road, legato alla omonima mostra tenutasi nel 2017-2018 presso i Musei Civici di Reggio Emilia (On the road. 2017).

Obiettivo del progetto era dunque la realizzazione di una raccolta digitale complessiva dei dati di archivio e editi, aggiornabile e consultabile pubblicamente on line, per favorire la conoscenza dello straordinario patrimonio storico-archeologico comunale.

A partire dal modello dei Sistemi Informativi Archeologici delle città di Roma (SITAR Project)[1] e Verona (SITAVR)[2], già ampiamente testati, è stato dunque deciso di implementare un Sistema Informativo per l'area comunale rubierese. Il sistema, ospitato dal Dipartimento di Informatica dell'Università di Verona, è stato realizzato con software libero (PostGIS, Geoserver); si basa sugli standard internazionali archeologici CIDOC CRM[3], sugli standard internazionali catalografici e geografici (OGC[4], INSPIRE[5]), sul vocabolario "Art & Architecture Thesaurus" del Getty Institute[6] e sul linguaggio di modellazione GeoUML, un'estensione dello standard UML per la gestione del dato geografico[7]. Lo schema dei precedenti progetti, la documentazione relativa ai metadati e il modello dati sono documentati e pubblici, scaricabili assieme ad alcuni articoli che illustrano nel dettaglio la progettazione e i software impiegati.[8]

L'inserimento dati ha costituito una sezione di test della piattaforma, sia per quanto riguarda la modellazione sia per quanto riguarda la fruibilità dei dati nel particolare contesto rubierese, un territorio prevalentemente non urbanizzato, estremamente diverso da quello delle grandi città di Roma e Verona su cui era strutturato il modello dati di partenza.

Il sistema raccoglie attualmente in modo sistematico e integrato i dati bibliografici, d'archivio, e cartografici relativi ai rinvenimenti archeologici del comune, per un arco cronologico compreso tra l'Eneolitico e il Medioevo.

Per ogni sito archeologico sono disponibili: una scheda descrittiva delle modalità di rinvenimento (codice OI=Origine dell'Informazione) e una o più schede illustrative dei reperti (codice PA=Partizione archeologica). Ad esse sono collegati record relativi ai documenti d'archivio della Soprintendenza e alle pubblicazioni scientifiche, a volte inserite in copia pdf per maggior dettaglio descrittivo. Quando presenti, sono associate alle schede le immagini degli scavi e dei reperti.

La consultazione è possibile su due livelli: un livello pubblico, aperto a tutti, e un livello privato, per pubbliche amministrazioni o enti di ricerca che necessitino di accedere anche a dati riservati e non divulgabili per particolari motivi di tutela.

L'accesso al database avviene in due modi: i dati possono essere consultati tramite l'interfaccia Web GIS, ovvero tramite ricerca e visualizzazione su base cartografica, consentendo la fruizione al grande pubblico grazie alle maschere di interrogazione semplici e intuitive; possono inoltre essere acquisiti tramite lo standard WFS (OGC standard), che consente a ricercatori, professionisti e personale della pubblica amministrazione di accedere al database direttamente tramite un software GIS, integrando i dati nei propri progetti e rielaborandoli in locale.

Il Sistema Informativo Territoriale Archeologico di Rubiera (acronimo: SITARu) è disponibile a questo link: https://sitavr.scienze.univr.it/sitaru/

L'accesso è pubblico per tutti i dati già editi e non soggetti a norme di tutela (privacy, diritto d'autore, etc.). I dati sono rilasciati con licenza CC-BY-SA, sono liberamente riutilizzabili, previa citazione della fonte e nei limiti consentiti dal Codice dei Beni Culturali per quanto riguarda le immagini. La licenza d'uso è dettagliatamente descritta alla pagina dedicata (cfr. pagina licenza d'uso).

Workflow

Il Workshop si divide in una sezione tecnica, mirata a presentare i software, gli standard e le metodologie utilizzate nella realizzazione del sistema, e una sezione archeologica, mirata ad illustrare il contesto normativo, storico e topografico del territorio rubierese e a descrivere l'accesso e il riuso dei dati pubblicati sul SITARu.

Prima sezione:

La metodologia GeoUML

- Gli standard CIDOC-CRM e OGC
- Il vocabolario AAT

Seconda sezione:

- Inquadramento normativo e storico-archeologico del territorio rubierese
- L'utilizzo dei WFS SITARu tramite QGIS

Prima del Workshop si consiglia di scaricare e installare l'ultima versione di QGIS: https://www.qgis.org/it/site/

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Abstract

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Keywords

Open data; OGC standard; Archaeological Spatial Information System; CIDOC CRM; GeoUML

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List of FLOSS software used/ data repository and licence

https://sitavr.scienze.univr.it/sitaru/wfs.jsf , CC-BY-SA

WIKIMEDIA ITALIA AND ARCHEOFOSS, WIKIPROJECT 2021 THE MEANING AND THE UPLOAD OF THE ARCHEOFOSS 2019-20 ARTICLES IN WIKIBOOKS

By Paolo Rosati

Wikimedia Italia and ArcheoFOSS have stipulated in 2021 an agreement to publish in 'Gold OA' the proceedings of the ArcheoFOSS 2019 and 2020 conferences, for the opening of the articles (texts, citations, bibliographic resources, images) within the platforms of Wiki projects, starting from wikibooks. During the workshop this interesting Wikiproject will be presented, the meaning of the operation, the types of licenses used will be explained and the potential of continuing with such a collaboration for future volumes will be shown.
This will be followed by the practical part of the workshop with the uploading of the articles of the 2019 conference volume in Wikibooks, all the operations will be explained in a very didactic and simple way, everything will be followed by the author of the workshop for ArcheoFOSS and Wikimedia Italia.

ENCODING AND INPUTTING ANCIENT EGYPTIAN AND COPTIC FOR FURTHER DIGITIZATION OF CULTURAL HERITAGE IN THE FUTURE

By So Miyagawa

This paper will first explore the history and current issues of encoding and inputting Ancient Egyptian scripts (Hieroglyphic, Hieratic, Demotic) and Coptic alphabet. Then, the presenter will propose solutions to the problems and show the progress in ongoing projects such as SINUHE the Hierotyper and recent Unicode implementation of control characters for quadrat writings.

#MICH, IL PRIMO CONTATTO: DA PYARCHINIT A EXTENDED MATRIX IN BLENDER PER LE RICOSTRUZIONI 3D DI SEQUENZE STRATIGRAFICHE

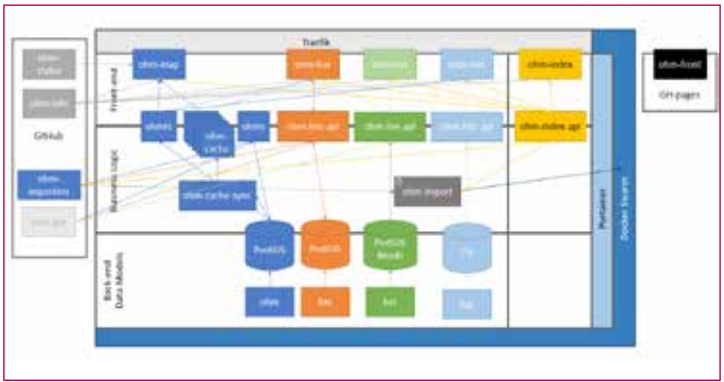
by Enzo Cocca, Luca Mandolesi, Emanuel Demetrescu, Bruno Fanini

In questa prima apparizione ufficiale di #MICH, saranno date delle linee guida perché un progetto possa fruire di questo hastag. Come primo esempio pratico vi faremo vedere i primi due progetti collaborativi #MICH che dialogheranno tra loro attraverso il Matrix stratigrafico per far comunicare pyArchInit verso Extended Matrix. #MICH Modular interconnecting Cultural Heritage suggerisce che un progetto ha delle procedure native per accogliere o esportare dati che vengono raccolti da un altro progetto. L'obiettivo è quello di dare regole base per cui un software, plugin, add-on ecc.. riceva, elabori e restituisca i dati in modo che possano essere reimpiegati da altri applicativi.
Il livello di interoperabilità andrà oltre alla semplice lettura dei dati, ma ci saranno griglie di raccolta, elaborazione e scambio condivise.
Sul web non si andrà più ad aggregare i progetti interconnessi tra di loro tramite repository o siti web dedicati, ma semplicemente tramite il tag #MICH. Progetti indipendenti tra di loro potranno dialogare anche senza che i vari gruppi di sviluppo si accordino sulle modalità specifiche di lavoro dei vari applicativi.
In tal senso si propone un workshop diviso in tre fasi in cui si mostra l'interoperabilità in ambito archeologico tra due sistemi differenti. Nella prima fase verranno mostrate le funzioni principali di pyArchInit. Partendo da dati di scavo 2D, raccolti e gestiti da pyArchinit, si elabora ed esporta un Matrix che verrà inglobato con pochi step nel template di Extended Matrix (EM) attraverso il software multipiattaforma yED (con licenza free, non open). Nella seconda fase, attraverso l'EM verranno registrate le fonti disponibili e i processi di analisi e sintesi che portano dalle evidenze scientifiche alla ricostruzione virtuale per arrivare ad un record archeologico 3D (nel software Open Source Blender) ben strutturato in modo che le fasi di modellazione siano più fluide, trasparenti e scientificamente complete.
In fine, nella terza fase tale modello verrà ulteriormente elaborato per essere condiviso verso altri strumenti web come EMviq (una web-app basata sul framework open-source ATON) che permette a professionisti di esplorare ed interrogare interattivamente l'ambiente 3D multi-dimensionale arricchito dal formalismo dell'EM, direttamente da un comune browser.

https://github.com/pyarchinit/pyarchinit
http://osiris.itabc.cnr.it/extendedmatrix/
http://osiris.itabc.cnr.it/scenebaker/index.php/projects/emviq/
http://osiris.itabc.cnr.it/aton/

OPEN HISTORY MAP - CLOUD FIRST INFRASTRUCTURE FOR DIGITAL HUMANITIES

By Marco Montanari, Lorenzo Gigli



Open History Map Cloud Architecture

One of the key principles of cloud-first infrastructure design is to rely on pre-existing services already available within the cloud infrastructure we are working with. This is in principle optimal for high burn-rate startups with huge funding; however, it might not be an ideal solution for low budget digital humanities projects such as this one and many others. For this reason, we designed an infrastructure that could take advantage of the abstraction of this basic principle and other general principles of software architecture. This allowed creating an efficient architecture that complies with the needs and requirements that come from previous iterations (Montanari 2015) and partnerships (Bernardoni 2017) define the Open History Map platform in all of its aspects (Montanari 2021) but can also offer some of the high-level tools that cloud infrastructures typically lack for use in Digital Humanities.

One of the main factors taken into account during the architectural planning process was the importance of delaying and deferring decisions as much as possible both for us, using the architecture, as well as for its own expandability (Martin 2017). This principle is true when designing an application, an API and a complex architecture. For this reason, most of the API orchestration is delegated to the various interfaces that use the data and compose the elements in the way that fits best. For example, the map front-end uses the Data Index API in order to display information about a given source, using its id as a symbolic reference (which is in itself a symbolic reference to the identifier defined in Zotero). This means a partial delegation of the knowledge of the inner workings of one specific part of the infrastructure to other elements that, at first, might not have to know anything of it; however, thanks to being part of the same ecosystem it allows many elements to be cross-referenced between various interfaces.

The infrastructure is divided into several macro-areas, each of which covers one specific aspect of the platform. Wherever possible, the vertical architecture of the macro-area has been structured with the same pattern:

- Database (PostgreSQL/MongoDB/Redis/file system/InfluxDB)
- Writing API that also controls the database initialization infrastructure (a Python/Flask microservice)
- Reading API (a Python/Flask microservice) with eventually Tile Server
- Front end (an angular application)

This very basic template may or may not have all of its components, as, for example, a service might not need to write to a back-end, while another service might only be using interaction-less writing operations, and as such, might not need a direct reading API. Obviously, if the reading operations are simple enough, they are integrated into the writing component and vice-versa.

The less cross-depending macro-area is the Data Index, being simply a visualization of the data stored in the Zotero collection representing the sources used for populating all other areas. The infrastructure is totally stateless; it has no persistent database, as of now, and downloads the current collection of sources once the Docker image starts, eliminating the need for a back-end of any kind. The API only exposes the endpoints used by the interface and the APIs for other macro-areas to get source-specific data to display on their interfaces. All areas beyond this rely on its presence and on its being up-to-date.

The main user of the Data Index API is the Data Importer, an interface-less system that does the heavy lifting of transforming and importing data into the various databases coordinating the use of the different APIs. This service is stateless as well, not having a persistent database, yet it does connect to the local Docker socket, as it uses the Docker-in-docker methodology to spawn the machines that do the real ETL operations, as well as the test database and test-APIs, in case of import testing. The ETL code is downloaded from a repository and, for each identifier, be it for a specific source or source dataset, taken from the Data Index API, the importer builds the specific docker image and launches it, writing, if already tested, directly on the various production APIs.

The other areas are all full-stack infrastructures, as all rely on one or more databases, APIs and specific front-ends. Starting from the map: the data is stored in a PostGIS database configured automatically via the API module and already set up to be distributed across a cloud infrastructure via partitioning. The partitioning configuration is done based on both layers (that are bound to topics), and the year the dataset starts being valid. Setting up a variable grain to the time-dependent partitions enables a major optimization of the resources for the infrastructure, giving the possibility to move the storage of data-heavy periods (wars, moments of major changes) into separate databases. The API relies, in the writing part, on the possibility of using a redis-based buffer to have a workload manager deciding when to import specific items. This is very important because many polygons are very detailed, and the possibility to do an indirect upload of data gives the client better feedback on operations, even in very complicated cases. The tile server is completely separated from the rest of the API and uses a stored procedure defined in the DB-initialization part of the API. This enables an enormous optimization of the activities, as it relies on the database-native generation of MVT tiles for the specific, requested tile.

Beyond the main map, all other tools are always cartographic as well, being the Event Index and the Historical Street View. Both mainly contain points, in contrast with the multiple types of geometries stored by the main map. The data, in the two cases, is bound to mapping events in

time and (not always) in space and mapping documentation of the form of the world in history, respectively.
The Event Index collects data from various sources enabling the location of specific events in time and space but also tracking particular subjects in their activities through time. With this tool and the right data, it is possible to visualize the course of a specific ship over time, such as, for example, the course of the travels of the Endeavour to New Zealand. In addition to movements, the layer also contains data about anthropic caused events (wars, battles, murders, births and deaths), as well as natural causes (quakes, volcanic eruptions, various forms of disasters). This layer is a pure collection of time-space coordinates with general information about the event and a reference to the external source. This block contains a modified tiles erver, slightly different from the main map, optimized for point management.
Finally, the Historical Street View macro-area simply is, as the Event Index, a storage point for not just space and time coordinates, but also the reference to external sources for documents (photos, paintings of views, videos). These multimedia sources are not stored or cached in the system and are visualized directly from other providers. This is very important in order to guarantee maximum independence from local storage.
Overall the structure of the architecture guarantees a great amount of flexibility in case of additions to the system, as well as a great amount of simplification based on the templatization of the single structures. The transformation of the various parts into microservices gives the whole system additional reliability and resilience, enabling possible changes to the implementation without stopping the infrastructure.

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Abstract

The complexity of the infrastructure behind a project such as Open History Map required an original and cloud-first approach, enabling the optimization of every single aspect of the development, as well as the deployment and the usage of the system. For this reason, a cloud-first approach was used, trying to harness all the features of the most common FLOSS software platforms in order to maximize the quality of the final product.

Keywords

Digital Humanities; Digital Archaeology; GIS; GLAM; Software Architecture

List of FLOSS software used/ data repository and licence

Docker Community Edition - Apache 2.0
https://github.com/openhistorymap/ohm-stacks - GPL 3.0

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OPEN HISTORY MAP DATA INDEX - MONITORING THE QUALITY AND COVERAGE OF OPEN DATA OF THE PAST

By Marco Montanari

Open History Map Data Index status dashboard

The original Open History Map infrastructure did not define a repository for data sources, while the data quality had to be considered as a secondary element in the definition of the map itself. The infrastructure already had an established hierarchy of data quality definitions, but these were more addressed towards the quality of the single specific geographic information than the sources themselves as a whole. The change of paradigm in the import of the data required a radical change in the quality assessment itself because, obviously, reliable primary sources are way more useful than unreliable ones, and these are themselves more useful than reliable hearsay sources.
For this reason, the definition of source reliability and source quality depends on several important factors and is the result of a series of simplifications based on the most common models for the evaluation of data quality. In addition to a general model for Digital Humanities, a broader information and data quality paradigm was analyzed, also looking into metrics for the world wide web, since many elements could be applied in the Data Index, as it is more generic than a specific collector.

Class	*Dimension*	*Meaning*
Objective	Spatial Coverage	What area or areas does the research cover?
	Period	What time frame or time frames does the research cover?
	Topic	What topic or topics does the research cover?
	Subtopic	What kind of information is collected about the topic?
Process	Reliability	How reliable is the research? What methodologies have been used?
Subjective	Quality	How precise is the information collected?

This considered, (Knight, s.d.) defines 20 dimensions for Information and Data Quality. Some of these are very web-oriented (i.e., Consistency, Security, Timeliness, and others) and, as such, not relevant in our specific case. By contrast, other dimensions are very topic-specific (i.e., Concise, Completeness, Relevancy), and these depend on the subject of our research: a study of a very specific topic relevant to a small number of cities in the ancient Roman age will be way more concise than a broad study on a very common event in modern ages.
In Akoka et al. 2021, a 7-level hierarchy is defined for the categorization of imprecise temporal assertions in an application to the prosopographical database definition area.
Based on these two approaches, with the latest iteration of the Open History Map platform, the Data Index was introduced, creating the structure to gather, classify and evaluate the data quality of the various sources that the platform collects and imports. The importance of an external metadata information collector is incredibly important for defining methodologies and criteria to make import modes uniform for single datasets or dataset groups.
The dimensions defined for this collector are divided into three classes: objective, subjective, and process, and these are into six dimensions.

Space coverage is done using Geonames Identifiers which creates a dynamically populated tree of areas covering the various researches. For the period dimension, the beginning time and end time are the elements classified.
The topics that are being collected as of now are the following:

- **Agriculture** - These datasets and research regard the area of agriculture, such as, for example, identification of agricultural land use or of crops cultivated in the past in specific areas.
- **Climate** - These datasets and research cover the changes in climate in the past.
- **Economy** - These datasets and research regard the changes in the economy and the possible normalizations of the past with modern economic conditions.
- **Entertainment** - These datasets and research regard the world of entertainment, from circus to theatre to cinema.
- **Industry** - These datasets and research cover the changes in the industrial complex of the past.
- **Infrastructures** - These datasets and research regard the transportation infrastructure and its evolution. It is further subdivided into air, water, and land transport.
- **Politics** - These datasets and research regard the changes in borders.
- **Religion** - These datasets and research cover the distribution and activities related to religion.
- **Urban** - These datasets and research regard urban evolution over time.
- **Ephemeral** - These datasets and research regard movements of people, ships, and anything mobile.
- **War** - These datasets and research regard detailed aspects of war.
- **Geography** - These datasets and research regard the changes in nature, both totally natural and anthropic.

All of these topics have specific

sub-classifiers defining the kinds of elements collected. Specifically, these sub-classifiers are:

- **Location** - These research and datasets give us the punctual localization of analyzed items.

Structure - This subtopic covers research that resulted in the creation of open datasets of the plans of buildings, cities, areas.

- **Model** - This subtopic regards activities that resulted in the creation or in the collection of 3D models for specific buildings or items of the main topic.
- **Events** - These datasets and research give us timelines (as datasets or not) about the specific topic in the particular analyzed period.
- **Usage** - These datasets and research give us context and modes for the fruition of the described infrastructure or elements.
- **Indexes** - These datasets and research analyze specific indicators, such as salary over time, GDP normalized, or population.
- **General** - These datasets and research cover the main topic in general or without a specific viewpoint.

These four levels of classification enable the positioning of the specific dataset in a multidimensional grid. This allows the creation of the main visualization of the Data Index.
The quality and reliability evaluations are given as two values ranging from 1 to 6. The reliability score is divided as follows:

- 6 - Academic peer-reviewed research / Excavation Report;
- 5 - In-period source material;
- 4 - Review papers;
- 3 - Not peer-reviewed research;
- 2 - Local public history activities, eventually supervised, but not guaranteed in any way;
- 1 - Hearsay and oral tradition.

while the data quality is divided as follows:

- 6 - Precise dataset with well defined and documented tools and validatable high-level accuracy;
- 5 - Lower fine granularity of data; data is available but less precise;
- 4 - Verifiably incomplete data, some information is missing for accurate identification;
- 3 - Uncertain data, specification of uncertainty for a major part of the data;
- 2 - Uncertain data with no references to other datasets for cross-validation;
- 1 - Low-quality dataset, with obvious discrepancies and/or errors.

The reliability dimension represents the intrinsic quality of the methodology applied in the publication of the data. On the other hand, the data quality depends on the precision of the published data.
The current infrastructure is based on the storage of items in a public Zotero collection where all the accumulated research is described as structured tags.
The following is the description of the CLIWOC dataset:
The datasets can not be described from the front-end, and, for this reason, these are currently defined by a name and, in addition to the previously mentioned ontology, a descriptor for the single dataset or for the whole collection of datasets associated with the project.

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Abstract

Within our work on Open History Map (OHM) we started collecting information about major open datasets available online. The geographic precision, as well as the informational quality, varies a lot between sources, research teams, and projects. These factors brought us to the idea of displaying this variability with the OHM Open Data Index (https://index.openhistorymap.org), where we collect all sources we find and all datasets we import in order to visualize how the world we are trying to describe is somehow already partial.

Keywords

Digital Humanities; Digital Archaeology; Data quality

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List of FLOSS software used/ data repository and licence

https://github.com/openhistorymap/ohm-index-front - Apache 2.0
https://github.com/openhistorymap/ohm-index-api - Apache 2.0

Space coverage	*ohm:area*	geonames:6295630
Period coverage	*ohm:from_time*	1750
	ohm:to_time	1855
Topic classification	*ohm:topic*	ephemeral
	ohm:topic:topic	location
Data quality	*ohm:source_quality*	6
Data reliability	*ohm:source_reliability*	5

OPEN HISTORY MAP

by Marco Montanari, Lucia Marsicano, Raffaele Trojanis, Silvia Bernardoni

Open History Map aims to be a platform that collects and displays data about our past with modern tools and considers several user groups as reference. This means that, unlike classic "collaborative" approaches, it does not rely on a user's single contribution but more on blocks of contributions that are bound to research and to possible publications. This also suggests that despite the original approach wanting to be very ontology-centric (Montanari et al. 2015 and Bernardoni et al. 2017), this maximalist requirement had to be changed to a more realistic and bottom-up approach, where several research groups use different ontologies and different representations for similar aspects. This infers that each research group can give very specific insight into one particular point of view on the same event in history or, on the contrary, similar points of view on very distant events over time.
This led us to a less strict integration methodology, where the ontology is still there, on our side, to enable the interpretation of the data in different ways and to guide users in the interoperability aspects of cleaning data up. On the other hand, this guides us to a completely different approach to the infrastructure and to the architecture of the platform. Specifically, it meant Open History Map was no longer just "the map" and the data connected to it, but also the classification system, the importers, the methodology, the tools around the map itself. Choosing to open the doors to the difference made the platform more robust and solid. This also opened up different elements we had not considered in the beginning. The "map" usually contains only "things that are there", i.e. buildings, trees, objects that shape the world. What about all those elements that do shape the world in a non-direct way? Part of the context we aspired to create about things happening in our past with the original project is defined by the events that happened because the "material" world and the "ephemeral" world are incredibly interwoven and interconnected.
All these elements brought us to rework some of the concepts behind the platform itself. Open History Map is now an ecosystem of tools and points of view on the various aspects of data. This locates the project at a crossroads of several branches of knowledge and study that can be summed up in the broad concept of Digital/Spatial Humanities. Nonetheless, the platform is built with the idea not to force providers to bring data in a specific form, but to have every provider keeping their ontologies and formats in order to facilitate the work on the leaves of the ecosystem, despite giving more work to the data integrator (Zundert, 2012).

Specifically, the ecosystem is now comprised of the following components:

- Open History Map Data Index, to classify data sources and papers;
- Open History Map Data Importer, to define transformations and extractors for the datasets;
- Open History Map Viewer, to display photos, paintings and reconstructions of moments or views of the past located correctly in time and space;
- Open History Map Event Index, to collect references to anthropic and natural events in time and their connections and relationships;
- Open History Map, the core map of the project.

In addition to these already existing parts, the following components are either planned or built but being rewritten to be integrated into the broader platform:

- Open History Map Data Collector, to contain statistical data about several events relating to the different time periods in the various places collected;
- Open History Map Public History Toolkit, a tool to help researchers and groups to collect data about historical events and periods in a structured manner;

GeoContext (Marsicano 2018), a tool to create simple visualizations of self-contained research data; this will be integrated into the OHM Public History Toolkit in order to make the datasets created explorable and navigable as single platforms.
All of these components are various points of view and different ways to read the data contained in the core data storage. Technically, it is not just one database, but it is a constellation of databases interconnected via high-level APIs enabling the maximization of the data throughput for the end-user.
Every single one of these components has a well-defined structural core ontology, on which we can rely to do most of the work, and a weaker "content" ontology part, where elements can be mapped or assigned in various ways and with varying degrees of quality. The core part is the one that the components use to define the main activities for their own function and the general-purpose APIs that interconnect the infrastructure. The rest gives the possibility to expand and adapt the specific dataset or data point into a more complex and advanced structure without requiring the infrastructure to change. This flexibility is radically important in the first phases of the project, as the ontology can emerge from the data collected and can be fixed over time.
The core map has the largest amount of data, being a collection of polygons, lines and points representing the structure of the past in its various moments described by historians, documents and digitized maps. Technically, the information stored is described in a way that is very similar to the OpenStreetMap ontology, except for the fact that for every dataset imported, the source is an identifier that references one specific dataset described in the Data Index.
The other major data collectors are the Event Index and the Viewer. For each, the geometries are simpler, being points, and the API transforms these points into more complex structures connected either by the same subject, by context or by other references. This makes it possible to visualize connections between items and create lines and convex containers representing the area of a specific event (i.e. a war, a cultural presence) or the track of a specific object over time (ship, person, army unit).

The smallest data collected relates to the Data Index. It contains only metadata about the data sources that are imported into the system. This component is one of the core elements of the whole system because it is on this that the definition of the system relies on, as the infrastructure does not in itself have OHM-owned data. The importer relies on this component to define the import methodologies for specific datasets.
The license of all the collected data is CC-BY, considering the academic importance of citing the sources. This is also very important for our own sources: data should be published with licenses that are CC-BY compatible and, most importantly, open (meaning without ND and NC terms). The license of all the code is Apache 2.0 in order to facilitate integration into other products, and the configuration files are under GPL 2.0 in order to testify documentation.

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Abstract

Open History Map (OHM) [https://map.openhistorymap.org], an open map of the past that was already presented as a concept a few years ago, is now in its first year as a functioning infrastructure and collects around 150GB of data from approximately 90 sources. The platform is open in all of its aspects and enables research groups to create new importers for their own open datasets. In addition to that, OHM enables the visualization of "ephemeral" datasets, i.e. representation of vicinity for historical characters and vehicles, battles and events.

Keywords

Digital Humanities; Digital Archaeology; GIS; GLAM

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https://github.com/openhistorymap/hsv-api - Apache 2.0
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