SSHOC Archaeological Case Study Workshop

The Roman theatre in Catania from survey to interactive 4D visualisation

25 May 2021, online

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This project is funded from the EU Horizon 2020 Research and Innovation Programme (2014-2020) under Grant Agreement No. 823782

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Introduction to the case study and the Roman theatre in Catania

(Wolfgang Schmidle DAI, Alberto Bucciero, Emanuel Demetrescu, Francesco Giuri, Ivan Ferrari, Bruno Fanini, Alessandra Chirivì, ISPC)

SSHOC task 5.7 “Archaeological Case Study”: for an **archaeological site**, create a unified, cloud-based **workflow** for archaeological data from **excavation and survey** to a **4D reconstruction**

- case study for connecting archaeological data and systems (DIGILAB, bottom-up approach)
- clear interfaces: data can go in and out at any step
- go open-source, share tools and data (FAIR)
- new: create a Linked Open Data Scenario

Work in progress!

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Introduction to the case study and the Roman theatre in Catania

SSHOC Task 5.7 Open Linked Data. Archaeology Case Study

Alberto Bucciero, Researcher, ISPC CNR

SSHOC archaeological case study Workshop - The Roman theatre in Catania from survey to interactive 4D visualisation

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Digital Heritage Innovation Lab (CNR-ISPC) Research Team

Alberto Bucciero

Software Engineer and Big Data analyst

- Eng. **Alberto Bucciero** is a researcher at Institute of Heritage Science (ISPC) of the National Research Council, based in Lecce, with more than 15 years of experience in the field of Software Engineering, he carries out scientific research activities on:
  - Enhanced Learning Management System based on 3D virtual environments.
  - Design of mobile applications, locations and context aware based on GIS systems and GPS / RFID positioning
  - Service oriented architectures and middleware tools supporting B2B e-commerce and Supply Chain Management.
  - Modeling and formalization of the requirements for the analysis of information systems designed to support business processes
  - Big Data analysis and machine learning
- Since 2006 Alberto Bucciero is also an adjunct **professor** of **Big Data** and **Computer Science** at the University of Salento.
- Since 2020 he is the **scientific coordinator of the SSHOC project** for ISPC-CNR (Lecce) and the **head of research of the DIGILAB node in Lecce of E-RIHS**.

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Digital Heritage Innovation Lab (CNR-ISPC) Research Team

Alberto Bucciero

Software Engineer and Big Data analyst

Emanuel Demetrescu

Classic Archaeologist and 3D modeller

Bruno Fanini

Computer Scientist 3D realtime/CGI

Francesco Giuri

Art Historian and 3D modeller

Alessandra Chirivì

Art Historian

Ivan Ferrari

Classic Archaeologist and 3D modeller

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Introduction to the case study and the Roman theatre in Catania

National Research Council of Italy

Consiglio Nazionale delle Ricerche

ISPC ISTITUTO DI SCIENZE DEL PATRIMONIO CULTURALE

ITABC CNR

IBAM ISTITUTO PER I BENI ARCHEOLOGICI E MONUMENTALI

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Case study: Roman theatre in Catania

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Introduction to the case study and the Roman theatre in Catania

- Activities in charge to ISPC@Lecce:
  - Feasibility study for the SSHOC use case (with ISPC@Rome)
  - Providing raw data derived from the documentation and analysis campaign using these tools and methodologies:
    - 3D model by laser scanning;
    - digital photogrammetry images;
    - photos;
    - video shooting with a UAV (Unmanned Aerial Vehicle) and from the ground;
    - scientific literature.
  - Providing the «old» photorealistic virtual reconstruction
  - Application of a new documentation method to the traditional reconstruction pipeline
  - «new» virtual reconstruction linked to metadata (with ISPC@Rome)

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The starting point: the result of the OpenCity project

VIDEO link: https://www.youtube.com/watch?v=ffVRasezAFE&t=100s

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Virtual Museum of Ancient Via Flaminia (V-MUST EU project)

The Virtual Museum of the Ancient Via Flaminia was a Virtual Reality application based on multi-user devices (4 users) installed at the National Roman Museum in Rome.

The Virtual Museum allowed visitors to explore 4 sites in 2 different historical periods (Imperial Roman and Now-a-Day) along the ancient Roman road Flaminia.

The Virtual Museum has been closed in June 2011, due to problems in keeping and maintaining the installation (hardware and set-up were needing).

v-must
Virtual Museum Transnational Network

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A new life for Livia’s Villa project

Flaminia Reloaded:

porting on Unity 3D

focus on natural interaction and storytelling

Behind Livia's Villa:

Re-use of digital assets

Focus on make accessible online metadata about reconstruction processes

Based on WebGL (X3Dom)

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Issues in re-usability

Metadata about reconstructions were available only as a traditional scientific publication. Unfortunately several reconstructive processes remained in the mind of the archaeologists.

Obsolescence of the technologies

other technical issues

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Same situation in Catania.

Metadata only as a scientific publication

An existing reconstruction -> “posthumous” protocol needed

Open data, open formats (from Cinema 4D to Blender)

Dissemination (through EMviq)

Connecting platforms (Aton 3, EM and iDAI)

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The EM - posthumous protocol edition

Numero di unità stratigrafica:

01

Colore del proxy: rosso

Proprietà

Stile: <- "[Pensabene2005] piedistallo di colonna" <- D.27 pp.193-194

Altezza: 95 cm <- "usiamo queste indicazioni come suggerito da Pensabene" <- D.28 p.206

Larghezza fronte: 1.05 m <- "usiamo queste indicazioni come suggerito da Pensabene" <- D.28 p.206

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Geometria: {IMG} <- "usiamo questo capitello seguendo le indicazioni di Branciforti" <- D.01 p. 204 fig. 106 {IMG}

Epoca:

Materiale: marmo bianco "zuccheroso" a cristalli piccoli/piccoli-medi leggermente brillanti <- "usiamo queste indicazioni come suggerito da Pensabene" <- D.28 p.206

D.01 - M.G. BRANCIFORTI, *Da Katáne a* Catina pp. 203-204 in Tra lava e mare. Contributi all'archaiologhia di Catania. Atti del Convegno a cura di Maria Grazia Branciforti e Vincenzo La Rosa. 2010

D.02 – foto da rilievo

D.03 – foto da rilievo

D.27 - P. Pensabene, *La decorazione architettonica del teatro di Catania,* pp. 193-194, 2005

D.28 - P. Pensabene, *La decorazione architettonica del teatro di Catania,* p. 206, 2005

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Digital Heritage Innovation Lab (CNR-ISPC) Research Team

Emanuel Demetrescu

Classic Archaeologist and 3D modeller

- **Emanuel Demetrescu** is a researcher at Institute of Heritage Science (ISPC) of the National Research Council, based in Roma, with more than 15 years of experience in the field of Digital Archaeology,
- he carries out scientific research activities on:
  - creating methodological and technical links between creators of the cultural heritage record and **creative industries**
  - methods and tools for the creation of **Digital Replicas** of CH
  - methods and tools to improve both scientific and aesthetic aspects related to **virtual reconstruction** of ancient sites/objects
- Since 2020 he is the scientific coordinator of the SSHOC project for ISPC-CNR (Rome)

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Roman theatre in Catania: from survey to virtual reconstruction

SSHOC Task 5.7 Open Linked Data. Archaeology Case Study

Francesco Giuri, Technician, ISPC-Lecce

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Digital Heritage Innovation Lab (CNR-ISPC) Research Team

Francesco Giuri

Art Historian and 3D modeller

I graduated in Cultural Heritage in 2003 at the University of Salento in Lecce (Italy) discussing a thesis in "History of restoration".

Since 2006 I have been collaborating with the ITLab - Information Technologies Laboratory of the ISPC - Institute of Heritage Science of the National Research Council of Italy in Lecce.

I took part in several national and international projects concerning the study, survey and development of reconstructive hypotheses of monuments and archaeological sites, aimed at the knowledge, enhancement and fruition of Cultural Heritage.

I'm specialized in 3D modelling, photorealistic rendering and survey.

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Today I will show the results achieved in the **Open City** project in 2016.
Main focus: The virtual reconstruction of Roman Theatre of Catania in Sicily (Italy).
Authors: F. Gabellone - I. Ferrari - F. Giuri

Historical note

Periods

- Greek (4th century B.C.)
- Julio-Claudian (27 B.C- 68 A.D.)
- Antonine (138-192 A.D.)
- Severan (193-235 A.D.)

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Workflow

Bottom up /top down strategies

DOCUMENTATION

Hello[KR88] and Goodbye[Lov10]

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Only books!

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SURVEY

DATA PROCESSING / INTERPRETATION

3D RECONSTRUCTION HYPOTHESIS

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Documentation

The first type of data, to support the philological reconstruction concerns the whole bibliography, the written and iconographic sources related to the object investigated, and, when possible, also the data already organized and structured (archaeological excavation data).

BUDA G. 2015, Teatro antico di Catania. Lavori tra il 2014 e il 2015. In: F. NICOLETTI (ed.), Catania antica. Nuove prospettive di ricerca, Palermo, pp. 247-279

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Survey

The survey is fundamental for the formal knowledge and study of the object itself.
The problem faced by an interpretative and reconstructive study essentially lies in the absence of accurate and updated graphic documentation. To remedy this lacuna, it was decided to undertake a survey campaign using a laser scanner (theatre) and digital photogrammetry (decorative elements).

A **laser scanner** is a high definition survey instrument able in measuring million of points of a 3D object with great precision, accuracy and high rapidity.

The system throw out light waves that bounce on the surfaces and reflect back to the sensor. The sensor then calculates how far away the surface is by measuring the time taken for the light beam to complete its journey. The distance measured is then used to calculate a coordinate for each point of the surface hit by the laser beam.

Digital Photogrammetry provides extremely dense and precise 3D surface data with an appropriately limited number of photos, captured with standard digital photography equipment, in a relatively short period of time.

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Laser scanner survey

Laser scanner survey was performed using a Leica P20 instrument. The coverage of all wall surfaces required the use of 39 stations points, each set at a resolution of 6 mm on a dome of 10 m.
The acquired data were first processed in Cyclone software (v 8.1.1) to align the point clouds and to export them in a single .pts file of 100 GB with 3 billion points points.

Screenshot from Leica Cyclone software: Point cloud (about 3 billion point, 100 GB file . pts)

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Screenshot from Geomagic Studio: partial mesh reconstruction from point clouds. Due to the excessive number of points it was necessary to divide the point cloud into four parts for mesh reconstruction.

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Polygonal mesh with a good level of detail easy to manage: the 3D model of 10 million polygons was exported in .obj file of about 900 MB.

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- definition of the cavea's slope and exact positioning of the heights of the floor levels relating to the walkways and intermediate passageways.
- to identify of the levels at which the spectator access points from the exterior to interior were positioned.

Cut sections from laser scanner 3D model.

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Screenshot from software Autodesk Autocad: cut sections from laser scanner 3D model.

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Digital photogrammetry survey

Screenshot from software Agisoft Photoscan: photogrammetric survey of the sculptures.

Digitalization of the sculptures and their recontextualization inside the virtual scene.

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Data Processing

Once the metric characteristics were acquired, and the data cross-checked with the published material, it was thought opportune to link the hypothetical reconstruction to one of the monument's most interesting phases.
It began in the Antonine period and probably continued until the Severan period.

Radical restoration:

- Enlargement of the entire structure with the building of the third walkway.
- A new scaenae frons
- A new external facade

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Virtual reconstruction (Antonine-Severian period)

The final model has 20 million of polygons and 138 MB of textures

Maxon CINEMA 4D software: modeling, texturing, animation

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Virtual reconstruction

Laser scanning survey

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Render of 3D reconstruction of the Roman theatre of Catania: aerial view.
V-ray was the render engine used for rendering.

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B Section A-A'

C Section B-B'

This project is

Figure 4. Orthographic views of the laser survey (A) and planar sections of the Roman theatre 3D model (B, C, D).

Figure 6. Vertical sections of the 3D model hypothetical reconstruction.

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Odéon

Thank you for watching

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Applying the Extended Matrix to the Catania Roman Theatre

SSHOC Task 5.7 Extended Matrix: Archaeology Case Study

Emanuel Demetrescu, Researcher, ISPC CNR

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Place

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V-MUST lesson 2: metadata during the project

Survey among the partners

When do you ingest the metadata ?

→ At the end of the project, with extra effort

Possible solution: metadata as a scientific tool to be used in production

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A world made of Fragments

“fragment of” volute, Corinthian capital

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Reconstruct to **understand**

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Studies in Cultural Heritage
(Archaeology, History,
Anthropology etc.)

3D as a research tool

academic dissemination
Papers
books
research projects

content validation

Industry of
Digital libraries
Virtual Museums
Games

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http://osiris.itabc.cnr.it/extendedmatrix/

Extended Matrix in a nutshell

1. What is the Extended Matrix (EM) ?

The Extended Matrix is a formal language with which to keep track of virtual reconstruction processes. It is intended to be used by archaeologists and heritage specialists to document in a robust way their scientific activities. It organises 3D archaeological record so that the 3D modelling steps are smoother, transparent and scientifically complete. It has been developed by E. Demetrescu at CNR-ITABC (Rome). EM is at its 1.0 version (a 2.0 version is currently under development).

2. Yet another Formal Language ?

Virtual reconstructions in archaeology are, at times, considered "artistic" or "aesthetic" endeavors, as the complete list of sources used is not necessarily provided as a reference along with the 3D representation. The lack of a shared language in which to store and

The Extended Matrix

Oriented graph, not hierarchical

Metadata US/USV + paradata

Schema-less

WYSIWYG approach

GraphDB GraphML ISO (EM v.1)

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graph db are great but...

standard graph

EM

we need a human readable “spatial rule”: y=time; x=data load

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Data base schema-less/modular schema (GRAPH DB approach)

Schema-less

iterative ingestion

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Data base schema-less/modular schema (GRAPH DB approach)

descript.	node	content
virtual stratigr. unit	USV 101	wall
property	material	opus latericium
extractor		
source		

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Documenting the gap through negative SU

Annotate them in a formal way

putting in a temporal relation the presences with the absences

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Filling the gaps with Virtual Stratigraphic Units

we can restore what likelihood was in the past

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The USV fill the gaps

EM nodes

Virtual Stratigraphic Unit node
reconstructive unit

Property Node
describes the size, appearance, material, etc. of the reconstructed USV

Combiner node: reasoning
interpolates multiple sources and declares the logical process followed to that end

Extractor knot: interpretation
states which part of the source was used and its interpretation

Sources node: objective data
Explicit the source used (images, reports, essays, etc.)

Node of the Stratigraphic Units
US, USR, USM ...

PARADATA

DATA

EXTENDED MATRIX

MATRIX

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Cerveteri Onde Marine - reconstruction

Cerveteri Onde Marine - reconstruction

Cerveteri Onde Marine - reconstruction

Data on the Roman theatre

Ø External sources

1 Point clouds

2 Reality based models

3 Source based models

4 Derived 2D blueprints CAD

5 Rendered 2D images

6 Images for photogrammetry

7 Photogrammetry projects

8 HDRI images for lighting

9 Frame animation

10 videos from UAV (drone)

11 open format version of SB

Extended Matrix WIP

EMviq online publication WIP

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Plinth with trophy and victories from *scena*: R. J.A. WILSON, *Sicily under the Roman Empire. The archaeology of a Roman province. 36 B.C. - A.D. 535*, Warminster 1990,p. 58. fig. 58

Entablature from second order: M.G.Branciforti-G.Pagnano (a cura di), Il complesso archeologico del Teatro e dell'Odeon di Catania, Palermo 2008

Frieze from *scena:* M.G.Branciforti-G.Pagnano (a cura di), Il complesso archeologico del Teatro e dell'Odeon di Catania, Palermo 2008.

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EM file name-space

folder tree

EM	20/05/2021 18:11	Cartella di file	
Istruzioni EM	13/04/2021 17:08	Cartella di file	
rawdata	13/04/2021 17:01	Cartella di file	
RB	19/05/2021 15:03	Cartella di file	
SB	21/05/2021 18:13	Cartella di file	
raw data filelist.txt	13/11/2020 15:19	Documento di testo	310 KB

RB.blend — Digital replica

TeatroCatania_SB.blend — Representation Model

Proxy.blend — Proxy Model

#0 EXTERNAL SOURCES	27/01/2021 22:06	Cartella di file
#1 PTS	22/09/2020 14:58	Cartella di file
#2 OBJ	23/09/2020 15:43	Cartella di file
#3 C4D+texture	28/10/2020 17:11	Cartella di file
#4 DXF-DWG	22/09/2020 18:33	Cartella di file
#5 PSD-JPG render	22/09/2020 18:33	Cartella di file
#6 JPG-RAW Survey Photo	22/09/2020 18:33	Cartella di file
#7 PSZ +texture	30/11/2020 16:07	Cartella di file
#8 HDRI	23/09/2020 15:42	Cartella di file
#9 DIGITAL FRAME ANIMATION	23/09/2020 15:30	Cartella di file
#10 MOV aerial survey drone	22/09/2020 14:33	Cartella di file

raw data

Dossier Comparatif

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Blender (EM tools) and yED

semantic enrichment process

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EM tools and yED

This project is funded from the

EM in action

DR and RM annotated with proxies

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DAI systems and norm data

(Wolfgang Schmidle, DAI)

idai.world

- Arachne: archaeological database, e.g. records connected with the Roman theatre (“proto-LOD”)
- gazetteer (proper LOD)
- ChronOntology: time gazetteer
- idai.field: excavation documentation, Harris matrix

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Integrating the systems and data

(Wolfgang Schmidle DAI, Alberto Bucciero, Emanuel Demetrescu, ISPC)

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Integrating the systems and data

Virtual reconstruction process

external sources
(papers, pictures, etc.)

laser scanner,
digital photogrammetry,
photo and video shooting

post processed data
(from the poin cloud
to the 3D model)

3D model optimization,
texturing, illumination, etc.

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Integrating the systems and data

- **Problem**: even if the result of the process was excellent we dramatically were losing (in physical and virtual drives) all intermediate processed data as well as knowledge about the process undertaken itself!

- SSHOC as opportunity to re-think the process traditionally used to go from data acquisition to virtual reconstruction

PUBLICATIONS AND DATA

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Applying FAIRNESS principles to all the phases of the reconstruction workflow

- We need to deploy all intermediate data set (not only the final result) on a centralized repository, in order to ensuring:
  - **Findability**: using proper metadata
  - **Accessibility**: ensuring long lasting
  - **Interoperability**: link to external data sources (i.e. idai.field and ChronOntology)
  - **Reuse**: allowing the sharing of the datasets

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Connecting Extended Matrix to iDAI

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Linked Open Data

addition to workflow: LOD scenario

What can be connected?

- Places
- Periods, Events (that cause stratigraphies)
- People
- Objects

Pelagios, Recogito, RDF

role of ontologies, CKAN, CIDOC CRM ?

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Breakout sessions

Session 1: A CIDOC-CRM based ontology: The SSHOC Reference Ontology (SSHOCro) (Athina Kritsotaki, FORTH)

Session 2: Archaeology and the FAIR Principles (Holly Wright, ADS)

Session 3: The EMviq tool (Bruno Fanini, ISPC)

Summary of the breakout sessions

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A CIDOC-CRM based ontology: The SSHOCro

The SSHOCro ontology: a workflow model

Athina Kritsotaki, FORTH

SHOC Archaeological Case Study Workshop
25 May 2021
Zoom

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The SSHOC Reference Ontology(SSHOCro): Modeling the SSHOC data life cycle

a common metalevel schema, to be used as a top-level ontology for organizing knowledge and information distributed across various primary sources of information in the Social Sciences and Humanities Open Cloud (SSHOC).

to provide a semantic interoperability framework for the description of the SSHOC **data life cycle** in the Social Sciences and the Humanities.

Achieving this goal goes through the following steps:

- Consultation with SSH data producers
- SSHOCro version (RDF/S)
- Mapping selected metadata standards to the SSHOCro

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The SSHOC Reference Ontology(SSHOCro) : Modeling the SSHOC data life cycle

The basic empirical foundations for the formulation of the model was built on:

- representative research workflows used by partners from SSH community, identified in a workshop organized by FORTH
- research papers reporting the methods and results of experimental studies in a number of scientific domains from the social sciences and humanities.
- extensive literature review on metadata standards used by the SSHOC communities
- search on online resources/repositories for metadata records adhering to their respective metadata schemas - retrieving and analyzing records and data from dedicated SSH repositories, such as FSD Data Catalogue, DataverseNO, EMM Survey Registry and LINDAT/CLARIAH-cz Repository
- use of existing top level models:
  CIDOC CRM, CRM-sci, Parthenos, SO ontology

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Replication of

Affirmative Action Policies Promote Women and Do Not Harm Efficiency in the Laboratory

by Balafoutas, L. / Sutter, M. (2012)
in: Science, 335, pp. 579–582

Replication Authors:
Felix Holzmeister, Jürgen Huber, Michael Kirchler, and Julia Rose

In a set of controlled laboratory experiments, Balafoutas and Sutter (2012) study the effects of different affirmative action policy interventions to encourage women's choice to enter competitions. Four different interventions are investigated: quotas, where one of two winners of a competition must be female; two variants of preferential treatment, where a fixed increment is added to women's performance; and repetition of the competition, where a second competition takes place if no woman is among the winners. Compared with no intervention, all interventions encourage women to enter competitions more often and performance is at least as good both during and after the competition.

Hypothesis to replicate and bet on:

With preferential treatment of women — i.e., each woman's performance is automatically increased by one unit in the competition — more women will choose to compete (a comparison of the fraction of women who chose the tournament scheme rather than the piece rate scheme in the 'preferential treatment one (PT1)' versus the 'control treatment (CTR)'; $\chi^2(1) = 5.62$, $p = 0.018$, p. 580).

(This hypothesis was picked by lottery instead of comparing PT2 to CTR; $\chi^2(1) = 10.89$, $p = 0.001$, p. 580).

Power Analysis and Criteria for Replication: First Data Collection

The original sample size is 144 participants and the standardized effect size measured as the correlation coefficient (r) is 0.197. To have 90% power to detect 75% of the original effect size, a sample size of 485 is required. The criteria for replication are an effect in the same direction as the original study and a p-value < 0.05 (in a two-sided test).

Power Analysis and Criteria for Replication: Second Data Collection

If the original result is not replicated in the first data collection, a second data collection is carried out. To have 90% power to detect 50% of the original effect size in the pooled sample (first and second data collection), a sample size of 1099 is required, i.e., a sample size of 614 in the second data collection is required. The criteria for replication are an effect in the same direction as in the original study and a p-value < 0.05 (in a two-sided test) in the pooled data.

Sample

The sample in the first data collection consists of 485 students from the University of Innsbruck. If the original result is not replicated in the first data collection (two-sided p-value < 0.05 in the same direction as the original study), a second data collection consisting of 614 additional students from the University of Innsbruck will be carried out such that the pooled sample size is 1099. Subjects who participated in the experimental sessions of the original studies are excluded from recruiting.

Materials

We use the software of the original experiment programmed in z-Tree (Fischbacher, 2007) along with the original German instructions which have been made available by the authors.

Procedure

We follow the procedure of the original study, with only slight but unavoidable deviations as outlined below. The following summary of the experimental procedure is therefore based on the explanations of the experimental procedure in the article (pp. 579–80) and the section "Notes on the experimental procedure" (p. 3–4) of the Supplementary Information.

Subjects are randomly assigned into groups of three men and three women. All groups go through several stages. The experimental task in each of the stages 1 to 4 is to add as many sets of five two-digit numbers as possible within 3 minutes. Ties between participants are broken randomly in stages 2, 3, and 4. The task in stage 5 is a simple coordination game. At the beginning of the experiment, subjects are informed about the number of stages but not about what the tasks in each of the stages will be. The instructions for each of the task are provided just before every new stage.

In stage 1 (piece rate), each subject receives €0.50 for each correct calculation. In stage 2 (tournament), group members compete against each other. The two members who solve the most calculations correctly are paid €1.50 per calculation. The other four group members receive nothing. Subjects do not receive any feedback on the outcome of the competition in stage 2 until the end of the experiment to avoid that subjects condition their choices on previous outcomes of a competition. In stage 3 (choice), subjects choose whether they want to solve the calculations under a piece rate scheme or a tournament scheme. If the tournament is chosen, a subject's performance in stage 3 is compared with the other group members' performance in stage 2. In this stage, the competition rule across the two treatments PT1 and CTR are varied to examine the effects of the policy intervention: In the control treatment (CTR), the winners are the two group

treatment	order	session	group	subject	period	gender	choice
Preferential	1	161103_0820	1	4	1	Female	
Preferential	1	161103_0820	1	4	2	Female	
Preferential	1	161103_0820	1	4	3	Female	Tournament
Preferential	1	161103_0820	1	4	4	Female	Tournament
Preferential	1	161103_0820	1	4	5	Female	Tournament
Preferential	1	161103_0820	1	4	6	Female	Tournament

the end of the experiment in order to avoid that subjects condition their choices on previous outcomes. At the end of stage 3, beliefs of all subjects regarding their relative performance and their ranks in stages 1 and 2 are elicited. For each stage, subjects have to indicate their expected rank within the group of six members and within their own gender only. Correct guesses are rewarded with €1.00 each, and the feedback is given also only at the end of the experiment. In stage 4 (tournament with policy intervention), all subjects

Documentation of
- sample,
- data collection,
- software and
- stages of data collection phase

in Holzmeister et al., that replicated Balafoutas & Sutter's (2012) experiment

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SSHOCro practical use:

SSHOCro is a workflow model that aims to describe the full **data life cycle** in SSH research

- built on the ground of analytical methods used in various disciplines to inform a common **workflow**:

- **Form of a hypothesis to perform an observation**
- **Perform the observations**
- **Explain the observations made and the gathering of data** (processing)
- **Draw conclusions based upon this data**,
- **Deduce the implications** (test them through further observation, compare the results)
- **Confirm, deny, re-evaluate the original hypothesis**
- **Formulate valid theories** (allow others to repeat the observations)

- uses and extends the **CIDOC CRM (ISO21127),** an **event based** ontology

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SSHOCro practical use:

- It can be applied as a standard to devise and implement metadata capture schemes for tracking the data life-cycle in individual projects/institutions/disciplines.
- Common language between Social Science & Humanities researchers with IT specialists
- Encoded in a semantic data format (e.g. RDF), it can be of use for mapping, transforming and integrating existing data across projects/institutions/disciplines into interoperable pools (semantic repositories) of information for re-use and further exploitation.

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SSHOCro uses CIDOC CRM E7 Activity

The relations linking instances of E7 Activity to the entities necessary for describing them are inherited by the activities specifically defined for SSHOCro

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SSHOCro (an extension of CIDOC CRM): overview

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The SSHOCro workflow research process

The main phases

- Data Collection phase
  the processes involved in collecting datasets
- Data preparation & connection phase
  how to treat missing values and outliers,
  or to of identify individuals across the datasets
- Data Interpretation phase
  examining or comparing to test theories
  offer plausible explanations regarding the examined phenomena

extending E7 Activity (CIDOC CRM)

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SSHOCro Objects: SHE1 Dataset (input/output resources)

SSHOCro Things:

Things correspond to discrete, identifiable, *persistent items*. They can be material –like any sort of concrete object –or immaterial (f.i. images, texts, datasets, organizational structures etc).

Things are involved in activities in the context of which they are created, used/operated on, modified or destroyed –depending on the nature of the activity.

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The SSHOCro workflow research process

- Among the greatest issues for empirical evidence oriented SSH feature:
  - verification/falsification of the final research results through the revision of primary data.
  - reuse and enhancement of scientific results by means of examining new empirical data.
- documentation of the provenance of knowledge in each phase of the workflow
- provenance documentation is necessary for achieving stepwise documentation

The SSHOCro non linear, iterative phases:

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The Problem:

- The notion of a workflow remains implicit in all examined metadata standards; metadata instances primarily used to document research in SSH are static and adopt the perspective of the archivist, following the completion of a research outcome –typically some sort of publication (data/services/papers).
- Linking publications to their role within a research workflow requires additional effort than originally planned; it involves a close inspection of not only metadata instances, but also actual data and supporting publications.

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Implicit workflow in DDI: the case of **<method>**

Methodology and Processing involved in a data collection. The elements embedded in this node:

- concern the process of data collection and data cleaning
  - sampling procedure followed (sampProc);
  - methods observed that are relevant for the data collection (timeMeth; sampProc; collMode; collSitu, resInstru)
  - data cleaning operations (cleanOps; actMin)
- refer to actions that precede & inform the actual data collection
  - sampling frame used for identifying the sampled population (sampleFrame);
  - desired sample size, given the population size (targetSampleSize)
- concern the data analysis
  - generalizations of the observed patterns across a population (free text descriptions, where any: DataAppr; EstSmpErr; respRate; dataProcessing)
  - Variable manipulation –presented as the output of the data analysis –does not fall under methods.

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Mappings to the SSHOCro

The conceptual mapping process: establishing correspondences among selected elements from indicative metadata standards (e.g DDI, CMDI) with elements/full paths of SSHOCro using the X3ML toolkit

Aims to:

- Facilitate the data integration from various sources of SSH repositories and databases
- To confirm that SSHOCro **approximates the reality** of the SSH research process
- Resolve any discrepancies between SSHOCro and the other metadata standards

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Mappings to the SSHOCro

```
<method>
▼<dataColl>
  ▼<timeMeth>
     Cross-section
     <concept>CrossSection</concept>
   </timeMeth>
   <dataCollector>Taloustutkimus</dataCollector>
  ▼<sampProc>
     <p>Probability: Stratified</p>
     <p>The sample was drawn from the Population Register of
     Finland through stratified random sampling.</p>
   </sampProc>
   <collMode>Telephone interview: Computer-assisted (CATI)
   </collMode>
   <resInstru>Structured questionnaire</resInstru>
   <weight>There is a weight variable bv13 which weighs the
   data to represent the adult population of Finland aged 15
   and over in terms of age, gender, region of residence and
   household size. The unweighted n-number indicates the
   number of interviewees in various population groups and the
   weighted n-number indicates the number of persons in the
   corresponding actual population group (per thousand
   persons).</weight>
 </dataColl>
 <stdyClas type="A">Detailed and specific data description in
 Finnish and English. Variable frequencies, variable and value
 labels, and missing values are checked. If necessary, the
 data are anonymised.</stdyClas>
</method>
```

LIST OF MAPPINGS – STUDY DESCRIPTION: METHODS

DDI Tag	Unit of Information (embedding)	Condition	SSHOCro
timeMeth	codebook/ stdyDscr/ method/ dataColl/ timeMeth		SHE1 Dataset -P94i was created by: E65 Creation -P10 falls within: SHE5 Data Collection -**SHR23 used method: SHE11 Method -P2 has type: E55 Type** {"Time Dimension"} and **SHE11 Method –P3 has note: E62 String**
timeMeth **@method**	codebook/ stdyDscr/ method/ dataColl/ timeMeth @method	@method= ""	SHE1 Dataset -P94i was created by: E65 Creation -P10 falls within: SHE5 Data Collection -**SHR23 used method: SHE11 Method** -P2 has type: E55 Type {"Time dimension"}
sampProc	codebook/ stdyDscr/ method/ dataColl/ sampProc		SHE1 Dataset -P94i was created by: E65 Creation -P10 falls within: SHE5 Data Collection -**SHR23 used method: SHE11 Method -P67i is referred to by: E73 Information Object -P3 has note: E62 String** -P2 has type: E55 Type {"Sampling Method"}
collMode	codebook/ stdyDscr/ method/ dataColl/ collMode		SHE1 Dataset -P94i was created by: E65 Creation -P10 falls within: SHE5 Data Collection -**SHR23 used method: SHE11 Method** -P2 has type: E55 Type {"Data Collection Method"}
collSitu	codebook/ stdyDscr/ method/ dataColl/ colSitu		SHE1 Dataset -P94i was created by: E65 Creation -P10 falls within: SHE5 Data Collection -**P67i is referred to by: E73 Information Object -P3 has note: E62 String**
resInstru	codebook/ stdyDscr/ method/ dataColl/ resInstru		SHE1 Dataset -P94i was created by: E65 Creation -P10 falls within: SHE5 Data Collection -**P125 used object of type: E55 Type**

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Thank you for your attention!

Join our community

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info@sshopencloud.eu

/in/sshopencloud

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Archaeology and the FAIR Principles

A case study from the Archaeology Data Service

Holly Wright, Archaeology Data Service, University of York, UK

SSHOC Archaeological Case Study Workshop
25 May 2021
Virtual

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What are the FAIR Principles?

"In 2016, the '**FAIR Guiding Principles for scientific data management and stewardship'** were published in *Scientific Data*. The authors intended to provide guidelines to improve the **F**indability, **A**ccessibility, **I**nteroperability, and **R**euse of digital assets. The principles emphasise machine-actionability (i.e., the capacity of computational systems to find, access, interoperate, and reuse data with none or minimal human intervention) because humans increasingly rely on computational support to deal with data as a result of the increase in volume, complexity, and creation speed of data."

GOFAIR: https://www.go-fair.org/fair-principles/

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What are the FAIR Principles?

Findable: The first step in (re)using data is to find them. Metadata and data should be easy to find for both humans and computers. Machine-readable metadata are essential for automatic discovery of datasets and services.

Accessible: Once the user finds the required data, she/he needs to know how can they be accessed, possibly including authentication and authorisation.

Interoperable: The data usually need to be integrated with other data. In addition, the data need to interoperate with applications or workflows for analysis, storage, and processing.

Reusable: The ultimate goal of FAIR is to optimise the reuse of data. To achieve this, metadata and data should be well-described so that they can be replicated and/or combined in different settings.

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D5.15 Report on opening access to research data in the Heritage Science and Archaeology domain

Examination of the issues and challenges faced in providing FAIR access to archaeological and archaeological science data, and review of the solutions adopted across Europe

As part of this research, ADS undertook an audit of FAIR compliance for archaeological data, to use as a baseline for further work on the deliverable

https://archaeologydataservice.ac.uk/about/adsFAIR.xhtml

(*after* Bezjak *et al.* 2018.)

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Intro to the Archaeology Data Service

Domain Specific Digital Archive
Set up in 1996
Based at the University of York

Mission: Support research, learning and teaching with free, high quality and dependable digital resources

- Digital preservation
- Free online access to data
- Guidance and support for data creators
- Research

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Intro to the Archaeology Data Service

What do we hold?

- ArchSearch: Online catalogue indexing over 1.3 million metadata records including ADS collections
  - 1000+ Project Archives
  - 62,000+ Grey Lit Reports
- Metadata harvested from over 30 UK national and regional historic environment inventories.

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ads ARCHAEOLOGY DATA SERVICE

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Intro to the Archaeology Data Service

What do we disseminate?

- Disseminate data we hold
- Provide integrated resource discovery across data we aggregate
- Also disseminate to other aggregators
  - OAI-PMH
  - Linked Data
  - Via Export

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Intro to the Archaeology Data Service

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ads ARCHAEOLOGY DATA SERVICE

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Intro to the Archaeology Data Service

How is archaeological data different to other SSH data?

- Archaeological research is often non-repeatable (e.g. excavation destroys the archaeological site) so the data becomes primary data.
- Digital data is also fragile and requires long-term stewardship.
  - This is why people who work with archaeological data are obsessed with preservation and data persistence.
- Archaeological data is typically very heterogeneous and difficult.
- Archaeologists will use any kind of research tool or methodology if it helps to answer their research questions, so they are digital early adopters of a huge range of data types.

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Archaeology Data Service FAIR Audit

Led by Digital Archivist Ray Moore, who undertook our Core Trust Seal accreditation process, with input from all staff

Determined we should do an audit that would result in internally and externally-facing reports

- Internal report for ADS staff to inform our strategic planning process using the RDA FAIR Data Maturity Model tool, so that our progress can be measured over time
- External report for users/depositors to show how data deposited with ADS is FAIR data

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Archaeology Data Service FAIR Audit

Internal audit was confirmed our data is FAIR, but resulted in 14 recommended actions to prioritise within ADS for specific improvement. For example:

- F1.3 Implementation of globally unique PIDs at an object level for data AND metadata
- A1 Consider a more granular expression of ‘terms of access’ at an object level within metadata (even if it is essentially the same for all digital objects)
- I2.3 Request clearer documentation from depositors where data makes use of controlled vocabularies (for example, in a database). This is not directly requested, but would mean we could highlight FAIRness of data. Active encouragement of use of controlled vocabularies within Guides to Good Practice/Guidelines for Depositors
- R1 Consider a wider use of standards registries (e.g. the RDA-endorsed FAIRsharing) and the inclusion of our own standards

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Archaeology Data Service FAIR Audit

External audit was meant to provide transparency for users and depositors

- Most archaeologists are not familiar with the FAIR Principles
- Helps depositors understand the value of FAIR data and convey it in **funding applications** and as **impact indicators**
- Helps to promote best practice, both for data creators and data users
- Will continue to be updated as ADS works to make its data more FAIR

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Archaeology Data Service FAIR Audit

Findable

F1. (Meta)data are assigned a globally unique and persistent identifier.

For a fuller discussion of the ADS metadata and the use of persistent identifiers see our Metadata Overview page.

- The ADS uses Digital Object Identifier (DOIs) persistent identifiers for all collections.
- The ADS supports the use of ORCID IDs.
- The ADS supports the use of WikiData Q Codes.

F2. Data are described with rich metadata (defined by R1 below).

- All ADS resources are documented using the Dublin Core Metadata Element Set (DCMES) plus DCMI recommended qualifiers.
- The ADS also provides rich qualitative and technical metadata for all digital objects. These are repository specific metadata requirements, derived from domain-specific community standards (i.e. Guides to Good Practice, see also R1.3 below).
- All metadata is displayed alongside data, with technical metadata downloadable in open formats.

F3. Metadata clearly and explicitly include the identifier of the data they describe.

- All persistent identifiers for ADS collections are clearly displayed, alongside data, within each archive interface.
- The ADS supports the use of additional or supplemental identifiers relating to the dataset that link to external repositories, agencies or resources. This includes identifiers for physical, as well as digital, collections.

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Archaeology Data Service FAIR Audit

F4. (Meta)data are registered or indexed in a searchable resource.

- ADS datasets are findable through the repositories own indexes and catalogues.
  - ArchSearch
  - Archives
  - ADS Library
- ADS collections are also available through external catalogues and resources, including:
  - Heritage Gateway
  - DataCite
  - the Keepers Registry
  - Natural Environment Research Council (NERC) data discovery portal
  - ARIADNEPlus Portal
  - Marine Environmental Data and Information Network (MEDIN) data portal
  - Europeana
- ADS catalogues and indexes are searchable and harvestable through a series of OAI-PMH targets, and as linked open data using a SPARQL query web interface.

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Accessible

A1. (Meta)data are retrievable by their identifier using a standardised communications protocol.

- All ADS datasets utilise the HTTPS protocol to ensure free and open access to resources and to facilitate data retrieval.
- In rare instances, where discrete data objects are too large to support easy exchange using HTTPS, the ADS makes data available 'on request' using free and open exchange services (e.g. University of York DropOff Service, etc.).

A1.1 The protocol is open, free, and universally implementable.

- The ADS uses the HTTPS protocol for the sharing of resources and transfer of datasets. This is widely supported, open, and freely available.
- The repository utilises open and free file-sharing services where files or datasets are too large for easy exchange using HTTPS. Typically the ADS utilises the open and free University of York DropOff Service to share data when this is necessary.

A1.2 The protocol allows for an authentication and authorisation procedure, where necessary.

- The use of HTTPS provides authentication of the ADS website, and ensures the protection of the privacy and integrity of disseminated data. The repository ensures that all server-side digital certificates are current and up to date.

A2. Metadata are accessible, even when the data are no longer available.

- Yes. As an accredited digital repository the ADS supports long-term preservation and access of its holdings, consequently all datasets and metadata are maintained in perpetuity.
- The ADS maintains a clear Appraisal and Deaccession Policy which outlines current practice for datasets removed from the archives holdings. In such instances the ADS is committed to suporting identifiers (DOIs), maintaining resource discovery metadata, and updating current information on resources.

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Interoperable

I1. (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation. ⓘ

- Yes, all resource discovery metadata is made available using a qualified Dublin Core in RDF/XML through the ADS Linked Data repository
- External services also consume and disseminate metadata (see above, and Metadata Services for a more detailed discussion

I2. (Meta)data use vocabularies that follow FAIR principles. ⓘ

For a wider discussion on the vocabularies used in ADS metadata see our Strategy and Standards page.

- The ADS uses a variety of sustainable, open vocabularies to qualitatively classify and identify resources and datasets, including:
  - Heritage Data vocabularies, including those provided by the Forum on Information Standards in Heritage (FISH), Historic England (HE), Historic Environment Scotland (HES), and the Royal Commission on Ancient & Historical Monuments of Wales (RCAHMW)
  - Library of Congress Subject Headings (LCSH)
  - Marine Environmental Data and Information Network (MEDIN)
  - Getty Thesaurus of Geographic Names (TGN)
- The ADS also utilises recognised technical vocabularies to denote and categorise preservation activities
  - PREservation Metadata: Implementation Strategies (PREMIS)
  - Getty metadata types (Baca 2016)

I3. (Meta)data include qualified references to other (meta)data. ⓘ

- The ADS supports the qualified referencing with and between publications, datasets and resources. Where available the repository uses sustainable referencing, e.g. DOIs.

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Archaeology Data Service FAIR Audit

Reusable

R1. Meta(data) are richly described with a plurality of accurate and relevant attributes.

R1.1. (Meta)data are released with a clear and accessible data usage license.

- All ADS resources have clearly defined terms of access and reuse within each collection interface, and within metadata records distributed by the ADS or externally. Typically, data is disseminated under the terms of Attribution 4.0 International (CC BY 4.0), but data may also be disseminated under other forms of Creative Commons (see also the ADS Terms of Use and Access to Data).

R1.2. (Meta)data are associated with detailed provenance.

- The ADS provides detailed provenance metadata for all data. At a collection level this is clearly expressed in the archive interface and discovery metadata, but also at a file level within the technical metadata disseminated alongside the data.

R1.3. (Meta)data meet domain-relevant community standards.

- Yes, the ADS utilises a qualified Dublin Core metadata standard for all collection level metadata (noted above). The repository also uses standardised templates to ensure metadata consistency. All data must be accompanied by appropriate, file specific 'technical' metadata, this is derived from recognised community standards (Guides to Good Practice) to ensure consistency. All (meta)data is accepted, preserved and disseminated in sustainable, open formats. These are expressed in the 'Guidelines for Depositors' and the ADS' Data Procedures. The repository employs appropriate vocabularies to qualitatively describe datasets (noted above) and document preservation actions.

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Future Work

Take the lessons learned from the ADS FAIR audit and undertake a similar audit for the ARIADNE metadata aggregation infrastructure for archaeological data

- ADS data is FAIR, but ADS also aggregates it's data within the ARIADNE portal, **making it even more FAIR** (e.g. mapped to CIDOC CRM)
- Undertaking a similar FAIR audit for the ARIADNEplus workflow, both internal and external (with DANS)
- Supplemented with existing work on archaeological science data undertaken as part of the E-RIHS PP.

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The EMviq tool

Bruno Fanini, ISPC

SSHOC Archaeological Case Study Workshop
25 May 2021

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Bruno Fanini

Fellow Researcher @ CNR ISPC

Computer Scientist, R&D on real-time 3D

PhD in Computer Science - focuses his **research** & **development activities on real-time 3D graphics**, **Virtual Reality, interaction design and 3D user interfaces** at the Institute for Heritage Sciences of the National Research Council (CNR ISPC) in Italy.

He developed several software tools, serious games, online virtual museums, web-applications and web services within national and international projects.

He is responsible for different projects dealing with interactive 3D visualization, WebXR applications, interaction models and immersive VR through head-mounted displays. He is responsible for unit #14 under SHINE (Strengthening the Italian Nodes of E-RIHS)

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EMviq

(Extended Matrix Visual Inspector & Querier)

Bruno Fanini - CNR ISPC
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A cross-device, online, interactive 4D tool for *Extended Matrices*

This project is funded from the EU Horizon 2020 Research and Innovation Programme (2014-2020) under Grant Agreement No. 823782

Bruno Fanini CNR ISPC - bruno.fanini@ispc.cnr.it

EMviq tool - Origins

- **Goals**
- **First prototype** (2016 - 2018)
  Desktop tool
- **Research playground**
  - Runtime data extraction from EM
  - Query and inspection
  - Presentation
  - Immersive VR interfaces (HMD)

Fanini, B., & Demetrescu, E. (2018, July). *Carving Time and Space: A Mutual Stimulation of IT and Archaeology to Craft Multidimensional VR Data-Inspection*. In International and Interdisciplinary Conference on Digital Environments for Education, Arts and Heritage (pp. 553-565). Springer, Cham.

Demetrescu, E., & Fanini, B. (2017). A white-box framework to oversee archaeological virtual reconstructions in space and time: methods and tools. Journal of Archaeological Science: Reports, 14, 500-514.

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EMviq tool - Origins

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EMviq tool - Online

- Development of ***online*** version of EMviq (as *web-app*)
  Goal: cross-device tool, without installation

  http://osiris.itabc.cnr.it/scenebaker/index.php/projects/emviq/

- Based on the *open-source* framework "**ATON**" (CNR ISPC)
  http://osiris.itabc.cnr.it/aton/
- Why
  - Embracement of modern web standards
  - Cross-device presentation features
  - 3D/4D query performance at runtime
  - Scalable deployment

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EMviq - Extraction from EM

- **Extraction step**
  GraphML → runtime data

  a. Timeline
  b. Proxy-graph
  c. Source-graphs

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EMviq - Multi-temporal VE

- Different **representation models** per *period*

  $(\tau, \tau', \tau'', \ldots)$

- We exploit *scene-graphs*:
  - Periods can share portions
  - Reuse/caching of 3D resources
  - Specific hierarchies

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EMviq web-app

Explore | Query | Search

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EMviq - Explore

- **Navigation** of *virtual environment*
  - Navigation modes offered by ATON
  - Allow to move through ***space***
- **Timeline**
  - extracted from EM (GraphML)
  - allow to move through ***time***

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EMviq - Query

- Runtime **inspection** of *proxies* (3D shapes)
- Focus
- Options
  - Proxies visibility
  - Occlusion (wrt representation model)
  - Show whole proxy-graph

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EMviq - Search

- Runtime search/filter (proxies)
  - by proxy ID
  - by term
- *Semantic* navigation (viewpoints)

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EMviq - development

- **Parser (extraction step)**
  GraphML (XML) → runtime data (graphs)

- **ATON** features exploited
  - ***Semantic 3D shapes*** → proxies
  - ***Layers (JSON scene)*** → different 3D representations (scene-graphs)
  - ***Viewpoints*** → smart search, proxy focus
  - ***BVH trees**** → efficient 4D queries

* **Fanini, B., Ferdani, D., & Demetrescu, E. (2021)**. *Temporal Lensing: An Interactive and Scalable Technique for Web3D/WebXR Applications in Cultural Heritage*. Heritage, 4(2), 710-724.

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EMviq - data

Cloud-based workflow

- **Distributed** pipeline among professionals
- Fine-grained **access policies***
- Live **update** of EM inside the tool

*

Fanini, B., Pescarin, S., & Palombini, A. (2019). *A cloud-based architecture for processing and dissemination of 3D landscapes online*. Digital Applications in Archaeology and Cultural Heritage, 14, e00100.

Meghini, C., Scopigno, R., Richards, J., Wright, H., Geser, G., Cuy, S., Fanini, B.... & Vlachidis, A. (2017). *ARIADNE: A research infrastructure for archaeology*. Journal on Computing and Cultural Heritage (JOCCH), 10(3), 1-27.

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EMviq - immersive VR

- **Immersive (HMD)** *6-DoF* or *3-DoF* inspection through web browser
- **Spatial UI** (via ATON)

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EMviq - final considerations

- Flexible **online 4D tool** for EM as *web-app*
  - 4D exploration
  - Query
  - Search
- SSHOC case study (*Catania Theatre*)
- Powerful for **validation** of EM by remote professionals
- **Cloud-based** workflow
- Based on ATON framework
  cross-device presentation
  open standards
  responsive UIs
  inherits tools/features
  …

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EMviq links

- **GitHub:** https://github.com/phoenixbf/emviq
- **Web site:** http://osiris.itabc.cnr.it/scenebaker/index.php/projects/emviq/

ATON framework

- **Web site:** http://osiris.itabc.cnr.it/aton/

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Where do we go from here

(Wolfgang Schmidle DAI, Alberto Bucciero, Emanuel Demetrescu, ISPC)

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Chronology in the EM

PERIOD 1	Phase 1	Activity 1	Action
	Phase 2		Action
PERIOD 2	Phase 1	Activity 2	Action
	Phase 2		Action
			Action
Augustus epoch	1st construction of the new theatre	Building the scene	Making the plynth USM 99
	2nd construction of the new theatre	Building the cavea	Making the column USM 100

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Place and time data in the LOD scenario

interoperability: align vocabularies:

- epoch: Augustus epoch
- phase: first construction of the theatre
- activity: build of the scene, clusters of different actions
- action is the making of the plynth = stratigraphic unit, action to create something

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Evolution of the virtual reconstruction process towards a shared online service

- Today: process well defined but divided in heterogeneous working steps (from the point of view of tools involved):
  - 01 – Documentation
  - 02 – Survey
  - 03 – Data Processing
  - 04 – Virtual Reconstruction

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Where do we go from here: the DIGILAB nodes of E-RIHS Italian network

E-RIHS
EUROPEAN RESEARCH INFRASTRUCTURE FOR HERITAGE SCIENCE

DIGILAB: Data center

DIGILAB: Robotized data tape library

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Where do we go from here

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E-RIHS
EUROPEAN RESEARCH INFRASTRUCTURE FOR HERITAGE SCIENCE

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Roadmap Extended Matrix

Development during real case scenarios of survey and reconstruction

Version	
1.0	Base node of EM and scientific publication
1.1	Full support to 3D realtime exploration through EMviq
1.2	Spatialisation of sources – SSHOC EU project horizon –
1.3	DTC for complex sources based on survey data
1.4	support for landscape reconstruction level of detail
1.5	support to alternative reconstructions
2.0	full support to CIDOC-CRM and CHARM for I/O

Development on a public Trello board (soon)

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EM and CHARM

- Mapping on CHARM
- need to map to CIDOC-CRM

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Open Extended Matrix Initiative

1. Registration form eligibility

Student
Independent researcher,
Institution (University/Research inst.)

2. Use it in your project

Use it independently (with support)
Your data is your data
Free hosting on our server

3. Give visibility to your project

A subset of your dataset in EM gallery

-> Be part of it

Provide feedback
Contribute to coding
Participate in EM dev. (white-paper, etc)

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