Extending the Extended Matrix with CIDOC-CRM
Paradata for Virtual Reconstruction Processes & Beyond

Elisabetta C. Giovannini[1], Emanuel Demetrescu[2]

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Developed in the archaeological field but potentially scalable with respect to the topic of VIRTUAL RECONSTRUCTIONS at large

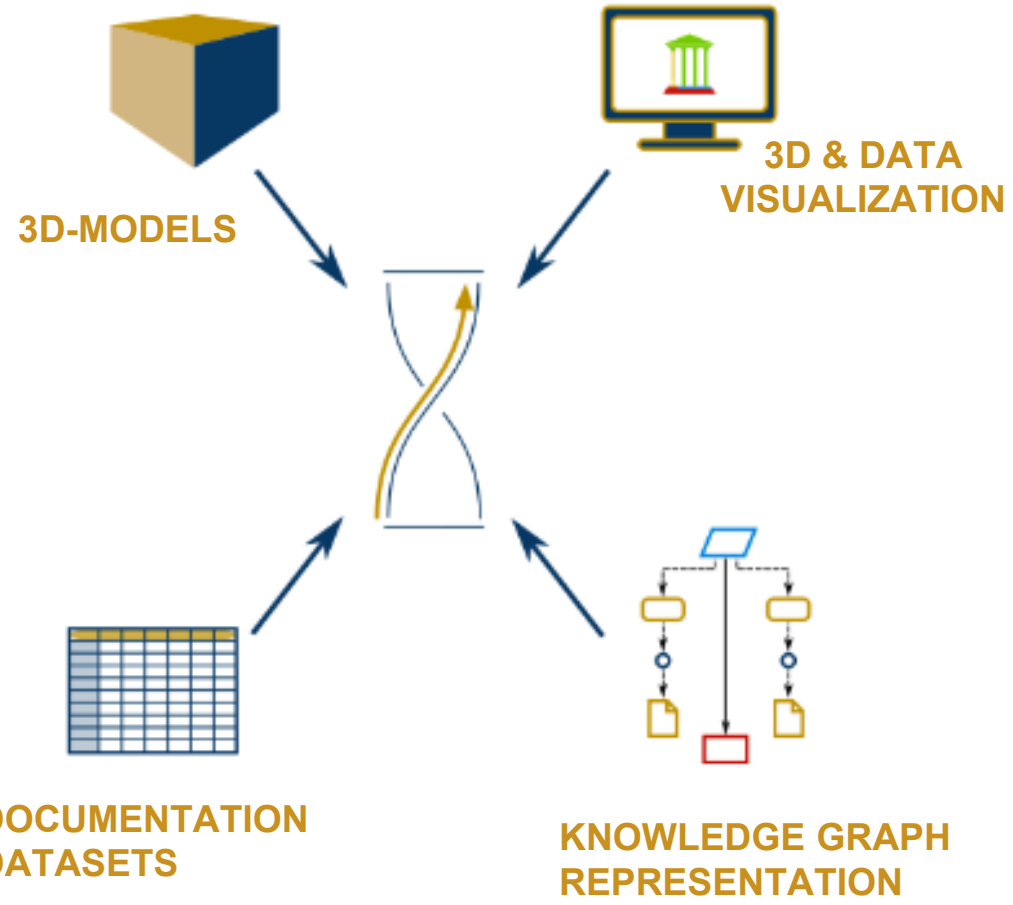
For knowledge data organization

-Facilitate the discovery of archaeological datasets and support the interpretation and reuse of data by defining a semantic structure that can describe the complexity of the built environment

-Create links to all available documentation (historical sources, archival sources, maps, images, 3D etc.

Interoperable approach

Foster data interoperability by developing an ontological model to document archaeological buildings and architectural heritage



Extended Matrix

OPENSOURCE ECOSYSTEM EXTENDED MATRIX FRAMEWORK [EMF]

EM is about scientific-driven content creation, EMF is about technological-driven solutions.

Every version of the EM has an equivalent EMF digital framework identified by the same number (at present EM 1.3 has its EMF 1.3).

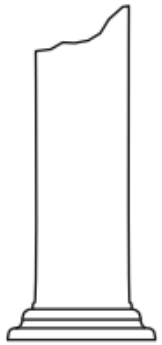
Tools available in the **EMF 1.3**:
- EMviq (3DWeb-app)
- EMtools (add-on for Blender 3D)
- 3DSC (add-on for Blender 3D)

GitHub

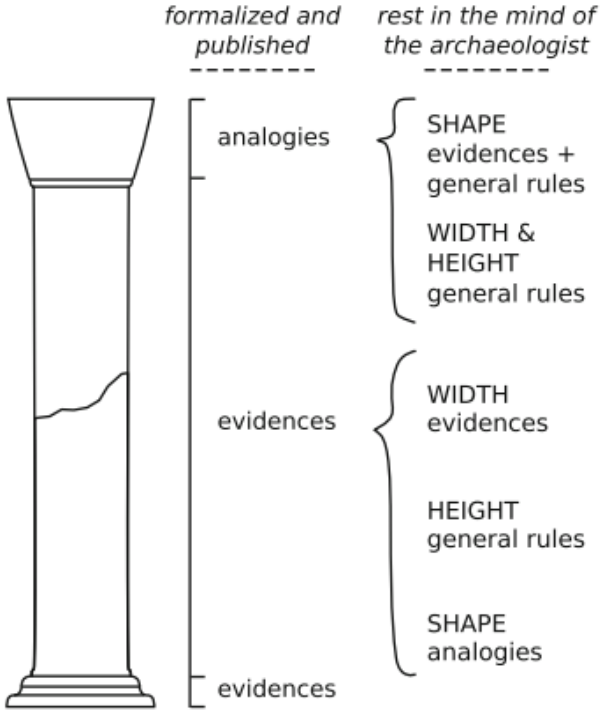
extendedmatrix.org

Extended Matrix

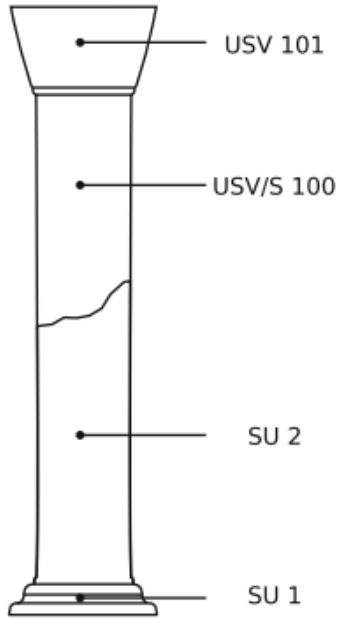
EXAMPLE



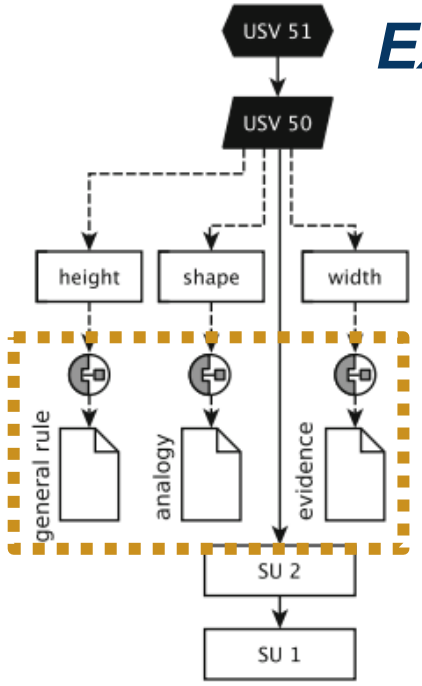
(a) Survey



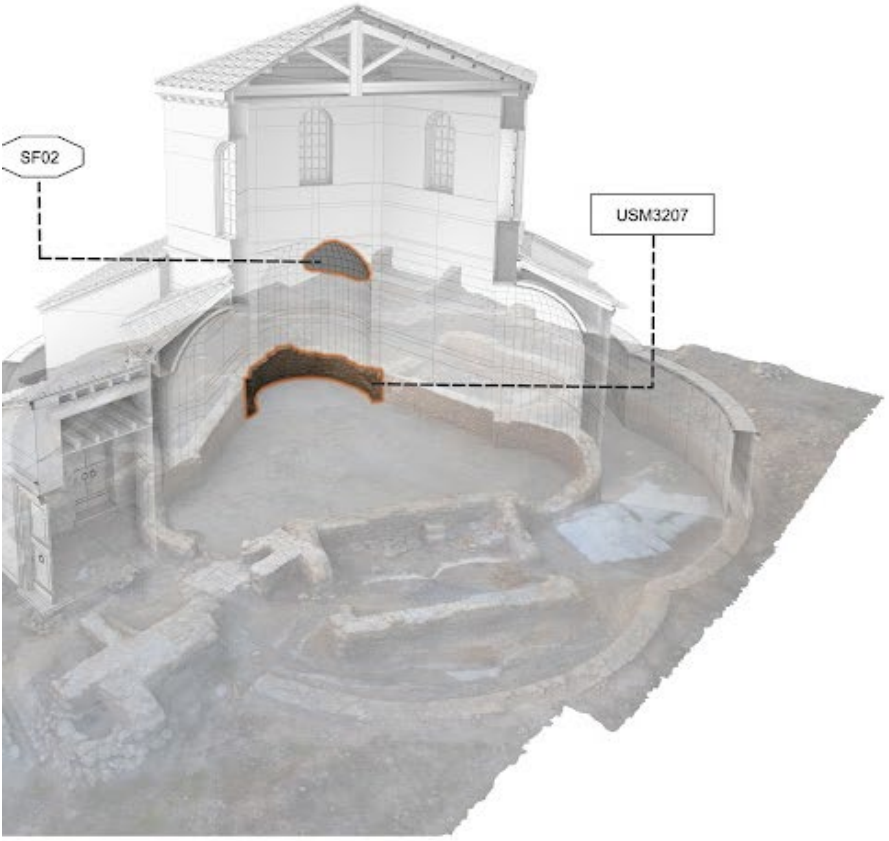
(b) Actual granularity

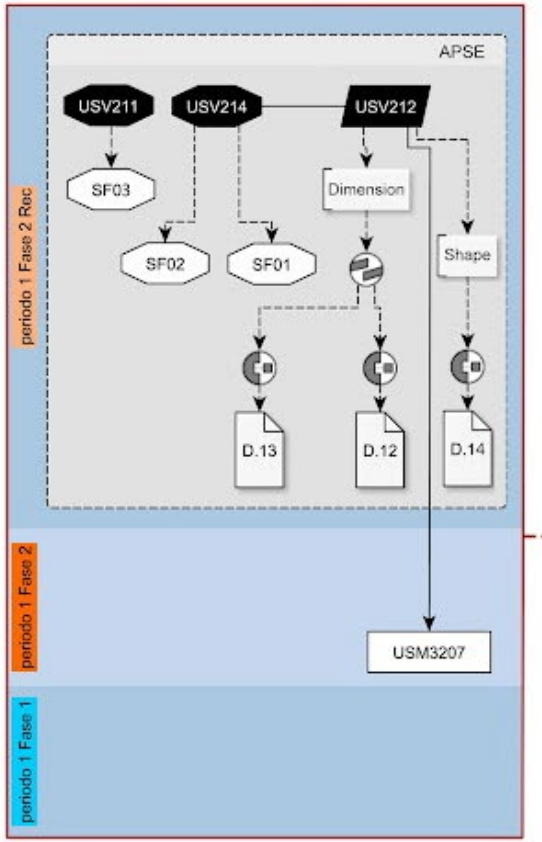


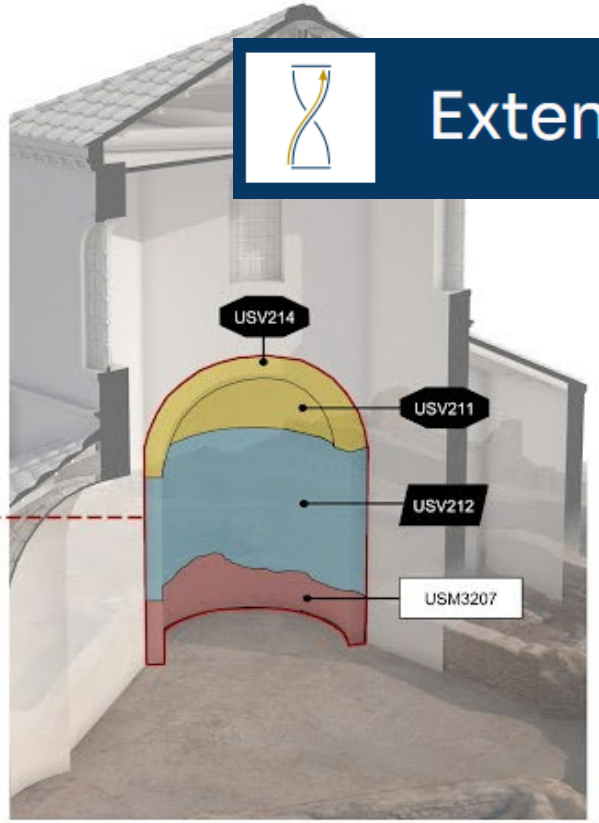
(c) EM granularity



(d) EM







Extended Matrix

EXAMPLE

APSE	PROPERTIES	INFOS	INTERPRETATION	SOURCES
USV 212	EXISTENCE:	CERTAIN	EVIDENCES	USM 3207
	SHAPE:	APSE	COMPARISONS	LATE ROMAN BUILDING (D.14)
	DIMENSION:	DIAM. 16 Ft	3D SURVEY	3D MODEL (D.12)
		HEIGHT. 24 Ft	DEDUCTION	THEORY OF PROPORTION (D. 13)
	MATERIAL:	LIMESTONE + WHITE PLASTER	EVIDENCES	USM 3207 (*IN-SITU*) – EA 01 ; EA 2 (*NON-IN-SITU*)

Extended Matrix

INTEROPERABILITY

Ability of computer systems or software to exchange and make use of information

CIDOC CRM | CONCEPTUAL REFERENCE MODEL

ISO 21127:2006 > ISO 21127:2014 > ISO 21127:2023

The CIDOC Conceptual Reference Model (CRM) is a theoretical and practical tool for information integration in the field of Cultural Heritage.

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Friday 17th May 2024. 12:00-16:00 UCT. Online MS Teams

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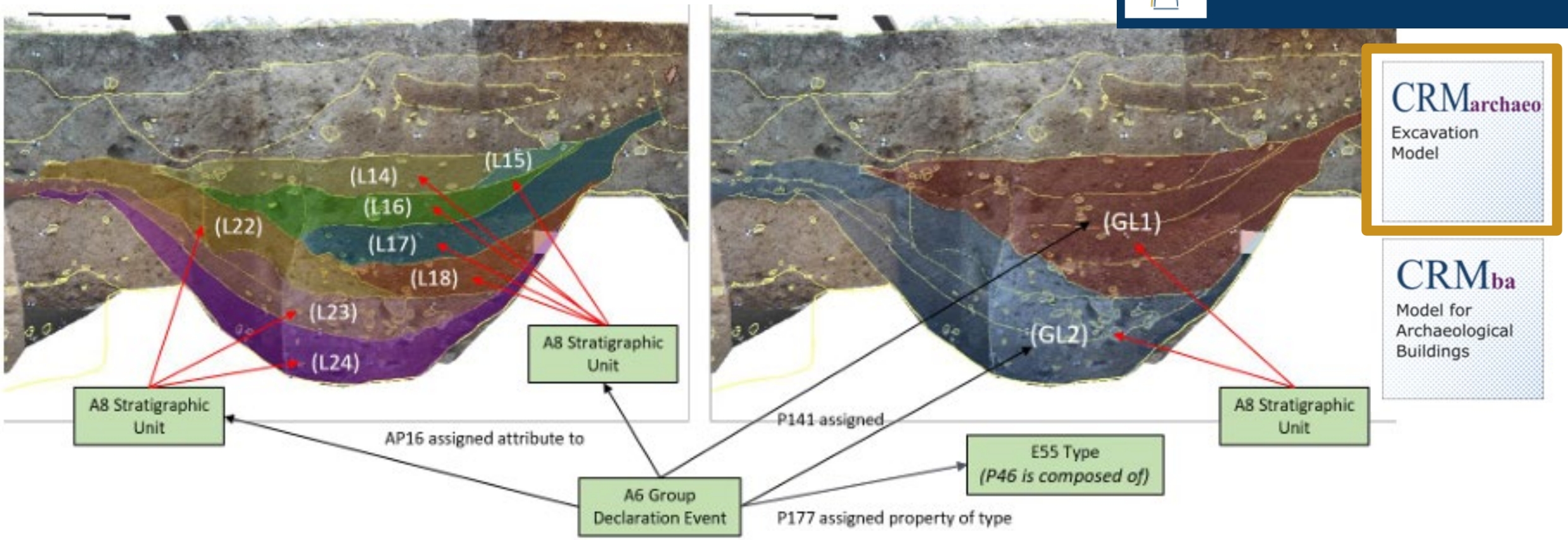
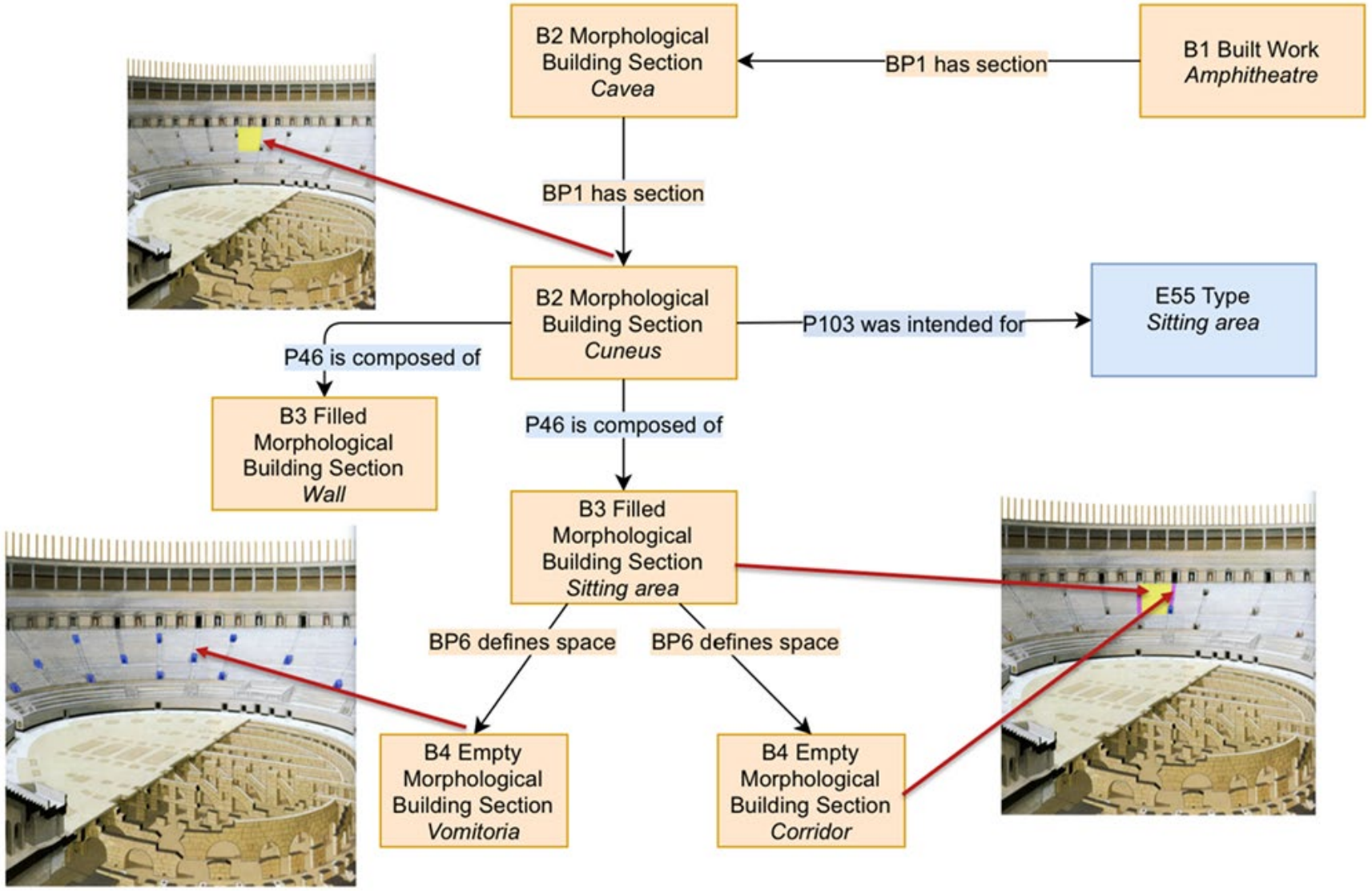
Extended Matrix



Definition of the CRMarchaeo - An Extension of CRMbase to support the archaeological excavation process, Approved by CIDOC CRM - SIG
Editorial Status: Stable Version 2.1.1 April 2024



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CRMarchaeo
Excavation Model

CRMba
Model for Archaeological Buildings

Paola Ronzino, Anna Toth, and Bianca Falcidieno. 2022. Documenting the Structure and Adaptive Reuse of Roman Amphitheatres through the CIDOC CRMba Model. J. Comput. Cult. Herit. 15, 2, Article 36 (June 2022), 23 pages. https://doi.org/10.1145/3485466

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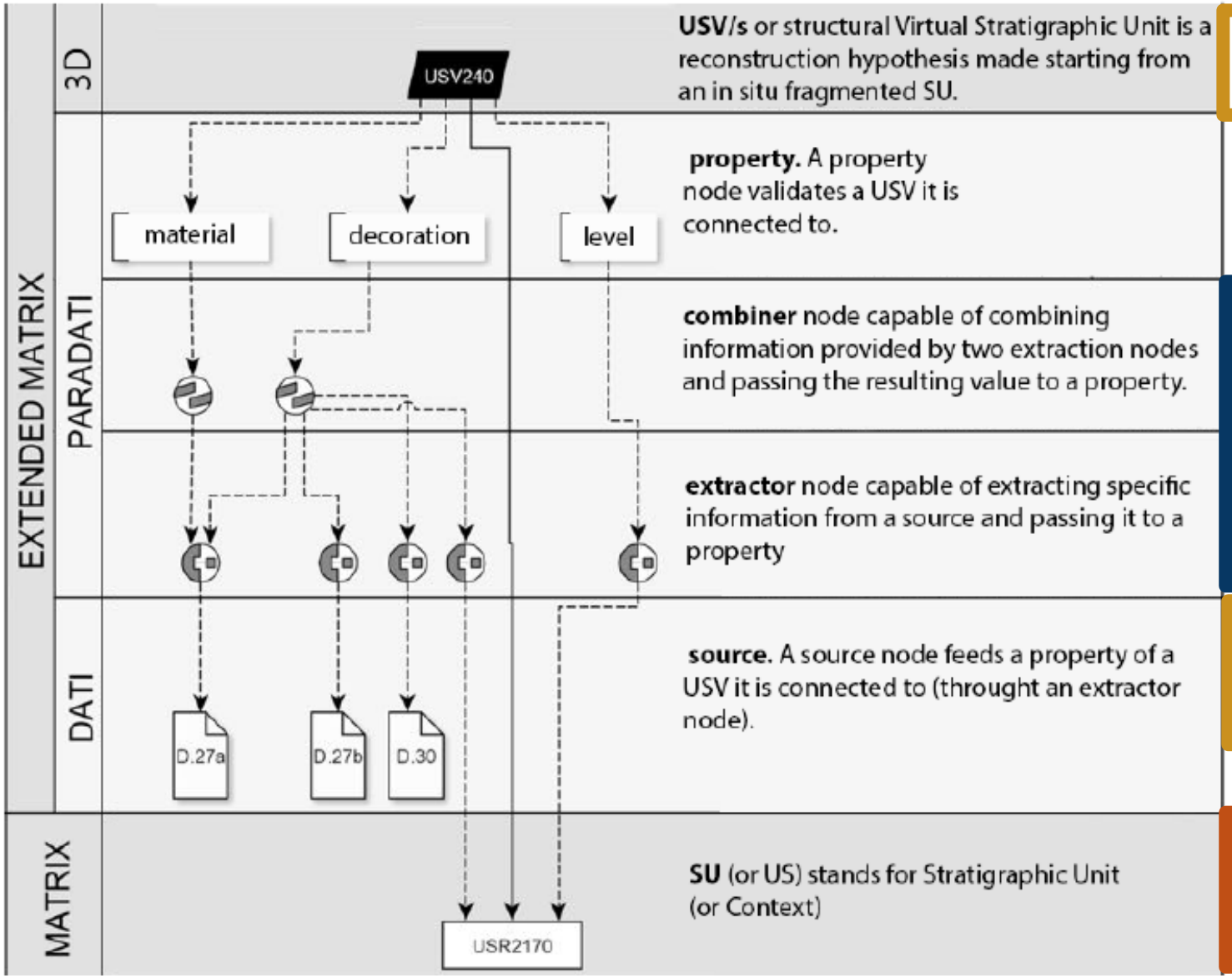
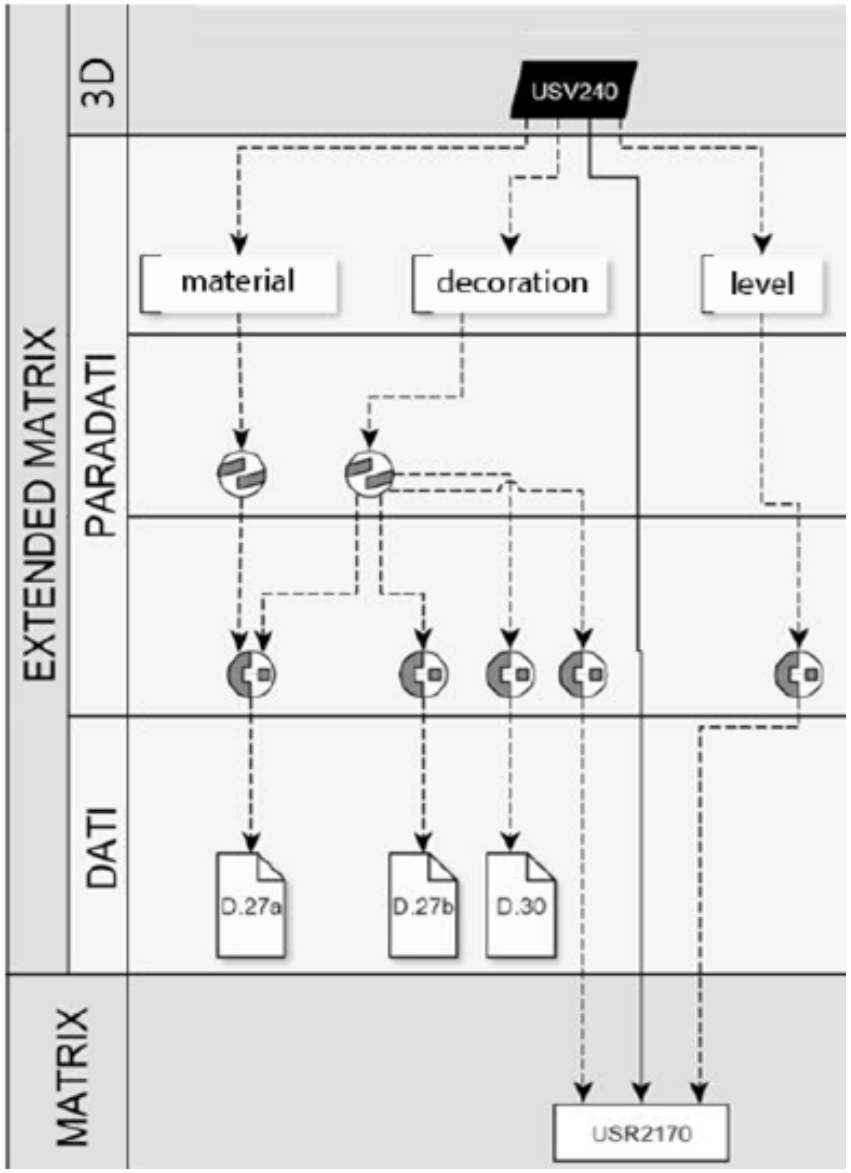


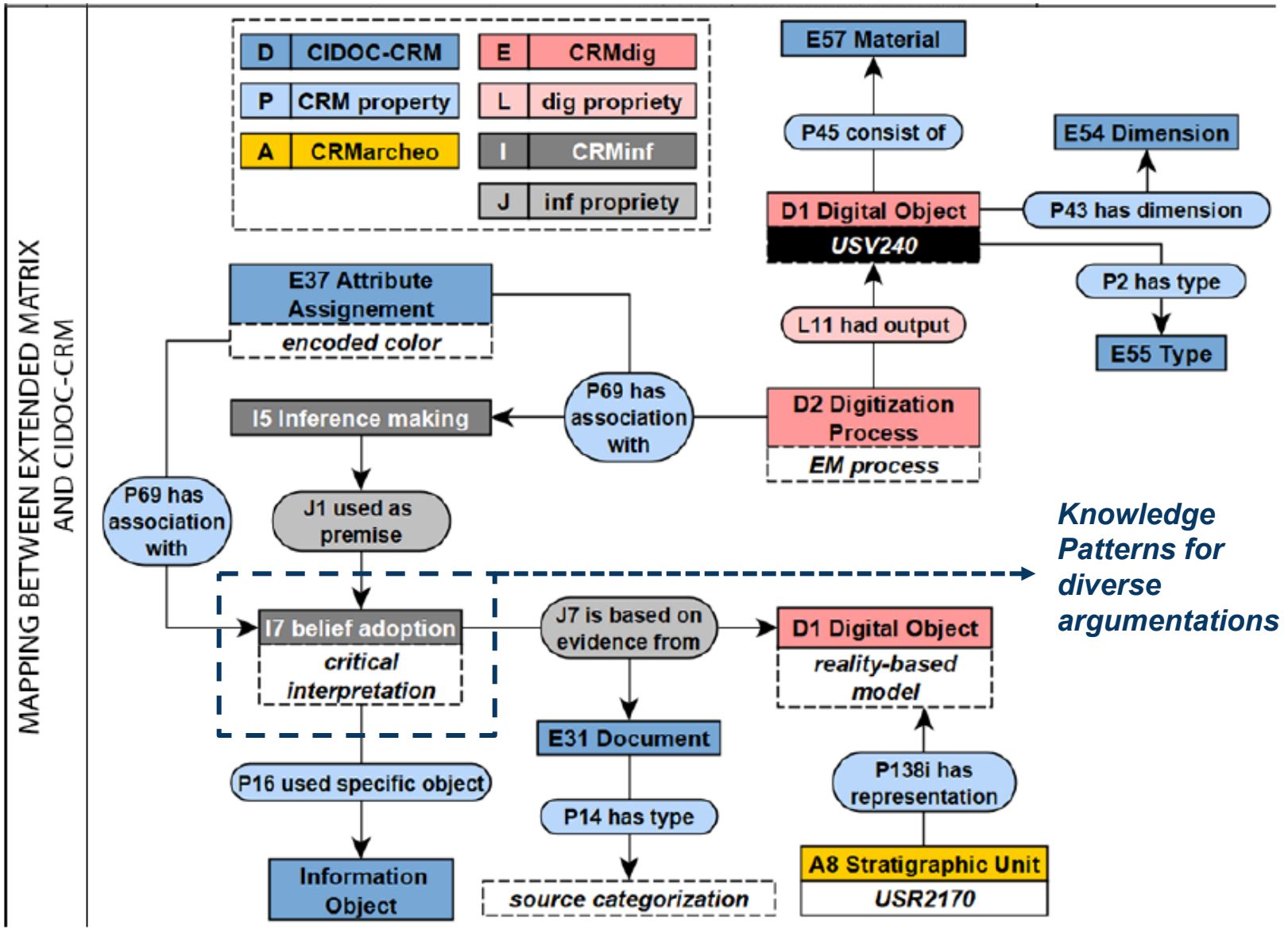
Extended Matrix

CRMinf
Argumentation model

CRMarchaeo
Excavation Model

CRMdig
Model for provenance metadata





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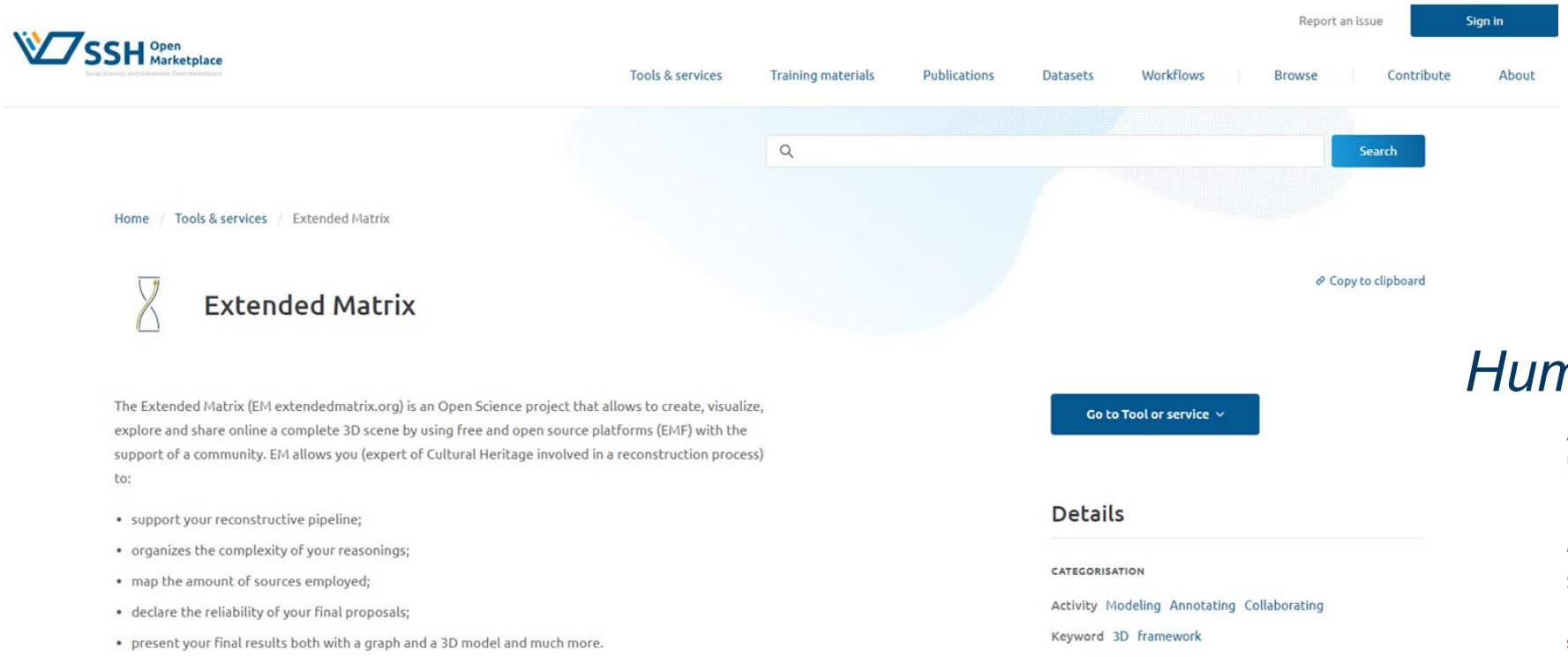

SSH Open Marketplace
Social Sciences and Humanities Open Marketplace

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EM SERVICE

On Social Sciences and Humanities Open Marketplace

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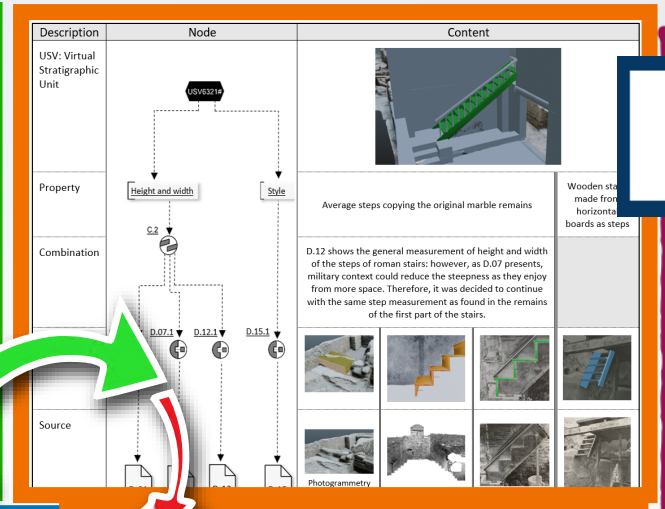
merging tangible and intangible datatables, graphs and 3D

Sources

Name	Description	Url	Property that can validate	
D.01	Photogrammetric model		Geometry, material	
D.02	St. Peter's Church in an engraving by E. Dodwell (1834)	F.M. CIFARELLI - M.J. STRAZZULLA (a cura di): Il Museo Archeologico di Segni. Il percorso espositivo. 2. Il suburbio, il territorio, la città medievale, Segni 2004 e ristampa 2014 (con versione in inglese). P.26	Shape and extent of the temple foundation; preservation of the cistern; three rows of blocks left cell	
D.03	Reconstructive hypothesis of the Castrum	F.M. CIFARELLI - F. COLAIACOMO - M. J. STRAZZULLA; Il Museo archeologico di Segni - Il percorso espositivo - 2. Il suburbio e il territorio, la città medievale, Segni 2004, pag. 25	Site morphology	Perspective drawing
D.04	Medieval spolia incorporated in St. Peter's Church	F.M. CIFARELLI - F. COLAIACOMO - M. J. STRAZZULLA; Il Museo archeologico di Segni - Il percorso espositivo - 2. Il suburbio e il territorio, la città medievale, Segni 2004, pp. 27-28	Architectural details	Photo
D.05	Castrum area in the early Middle Ages	F.M. CIFARELLI - F. COLAIACOMO - M. J. STRAZZULLA; Il Museo archeologico di Segni - Il percorso espositivo - 2. Il suburbio e il territorio, la città medievale, Segni 2004	Site morphology	Perspective drawing
D.06	Survey of	F.M. CIFARELLI - F. COLAIACOMO - M. J.	Planimetric survey	Planimetry



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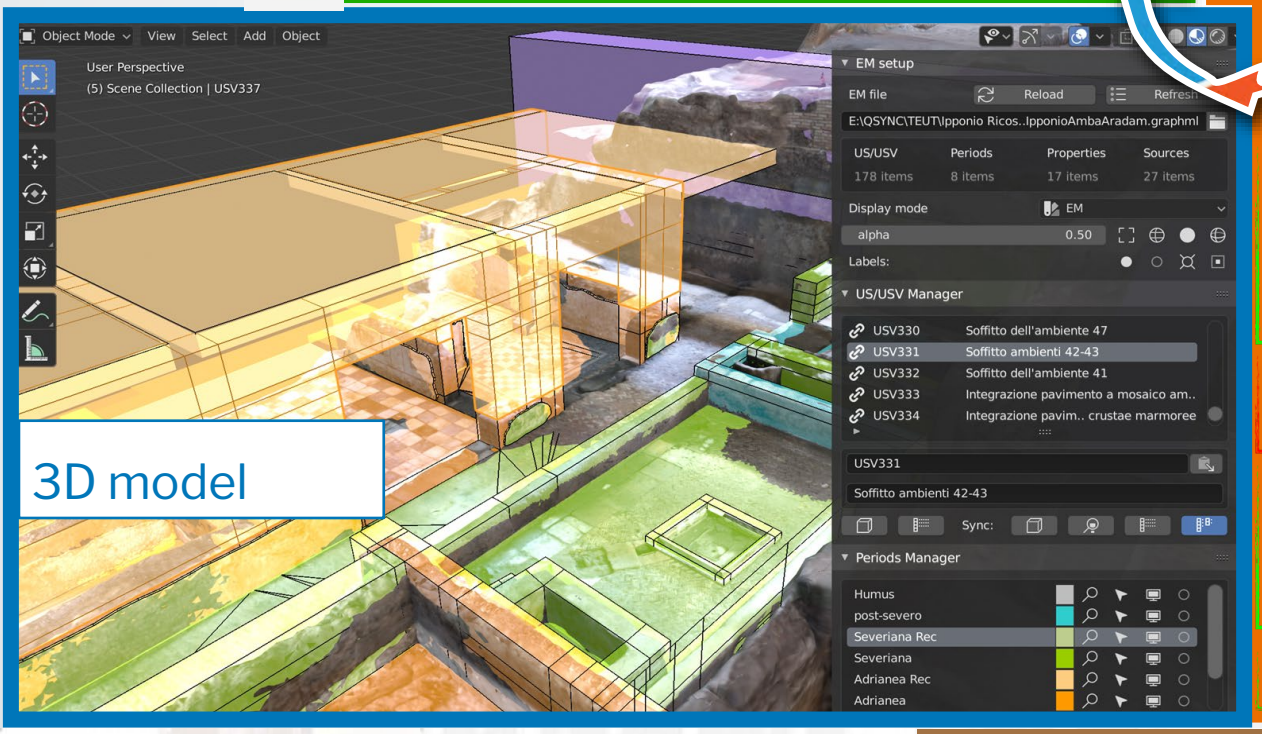
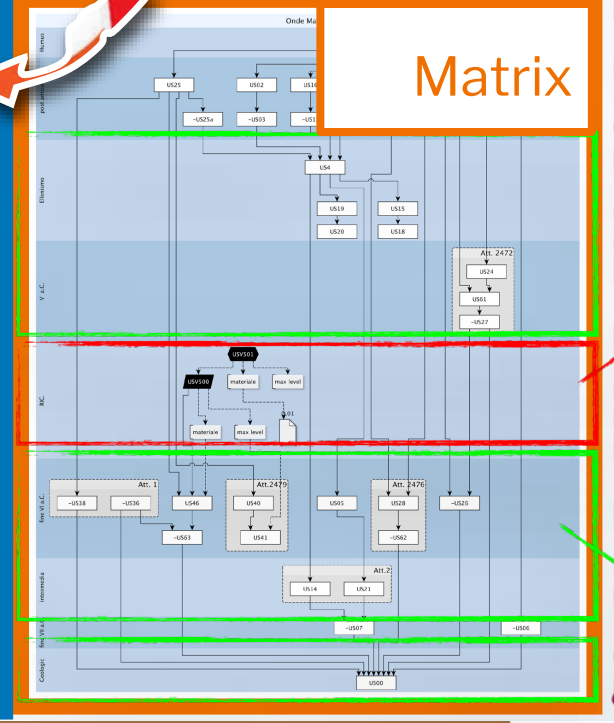


3D model

Matrix



Visualization

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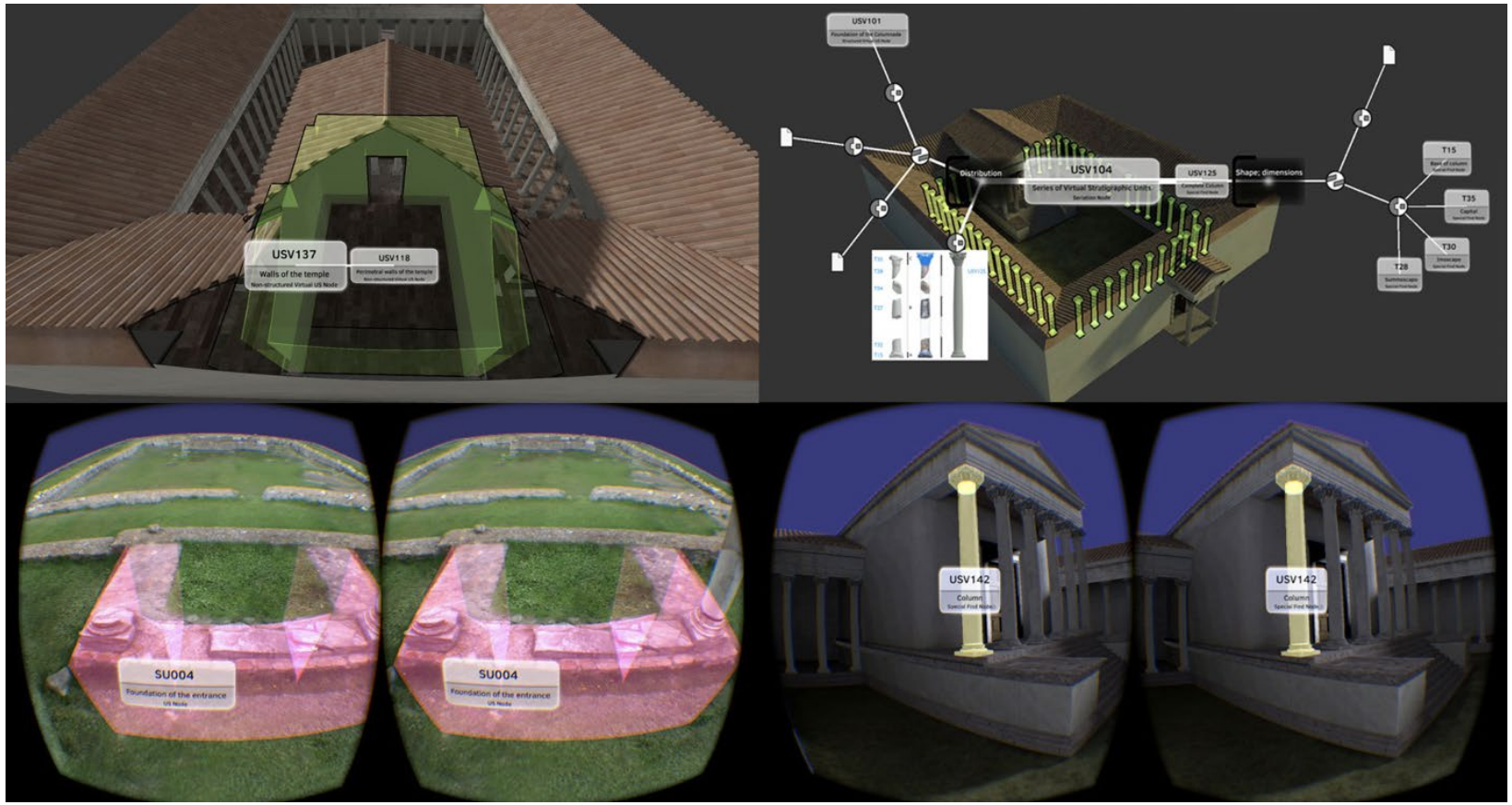
Extended Matrix

EMviq tool



EMviq

web-app, based on ATON,
allowing to visualise, explore,
share 3D models and 3D scenes

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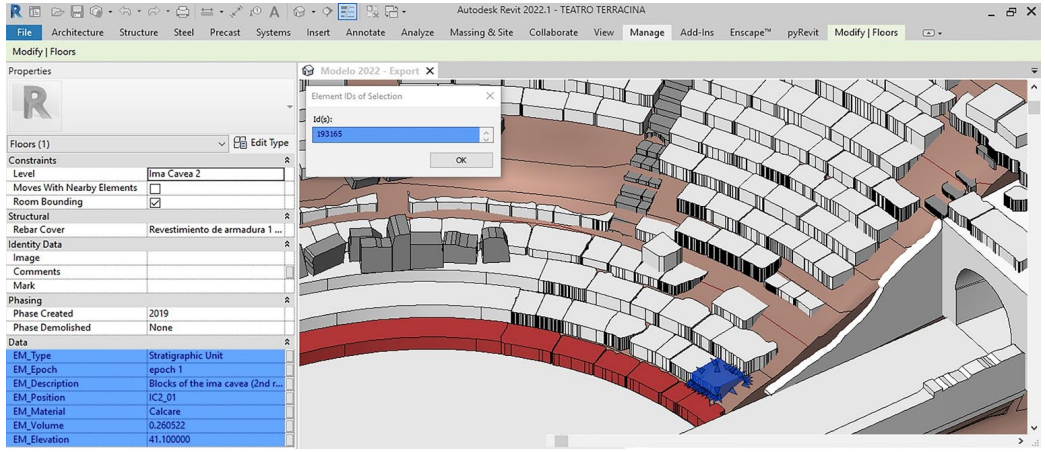

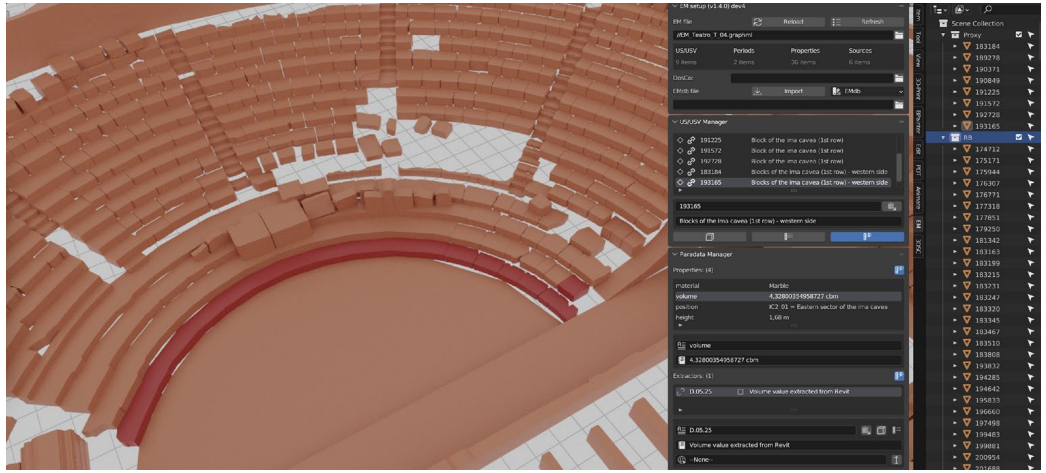

EM – BIM work in progress

- **VPL scripts** (data export and import) need further testing.
- **HBIM and EM can be linked**
- It is possible to exchange geometries and paradata from Revit to Blender and vice versa.
- The approach enables collaborative teamwork
- HBIM and EM can be linked using standards (e.g. IFC)
- Future implementation: automatic or semi-automatic procedure in Dynamo or standalone software

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MINISTERO DELLA CULTURA

ALES arte lavoro e servizi

Consiglio Nazionale delle Ricerche | ISPC ISTITUTO di SCIENZE del PATRIMONIO CULTURALE

Extended Matrix

e-Archeo

Home Chi siamo Il progetto Output Credits Change language

Funded project

Sapienza Università di Roma
Dipartimento di Storia, Disegno e Restauro dell'Architettura

Università degli Studi di Bari Aldo Moro
Dipartimento di Ricerca e Innovazione Umanistica

Università di Bologna
Dipartimento di Storia Culture Civiltà

Università della Campania L. Vanvitelli
Dipartimento di Lettere e Beni Culturali

Università degli Studi di Foggia
Dipartimento di studi umanistici

Università degli Studi di Napoli Federico II
Dipartimento di Studi Umanistici

Università degli Studi di Padova
Dipartimento dei Beni Culturali: archeologia, storia dell'arte, del cinema e della musica

Università degli Studi della Tuscia
Dipartimento di Scienze Umanistiche, della Comunicazione e del Turismo

Università di Verona
Dipartimento Culture e Civiltà

Scuola Archeologica Italiana di Atene

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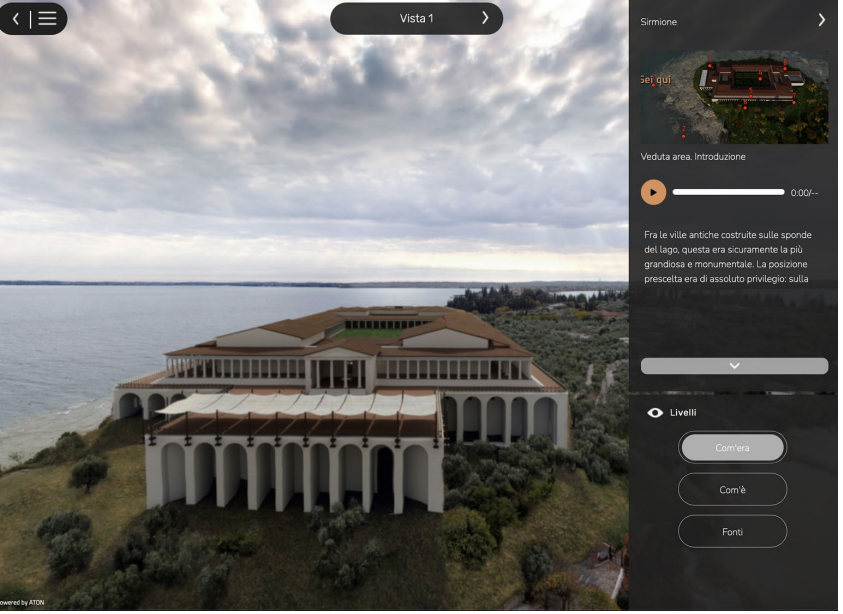
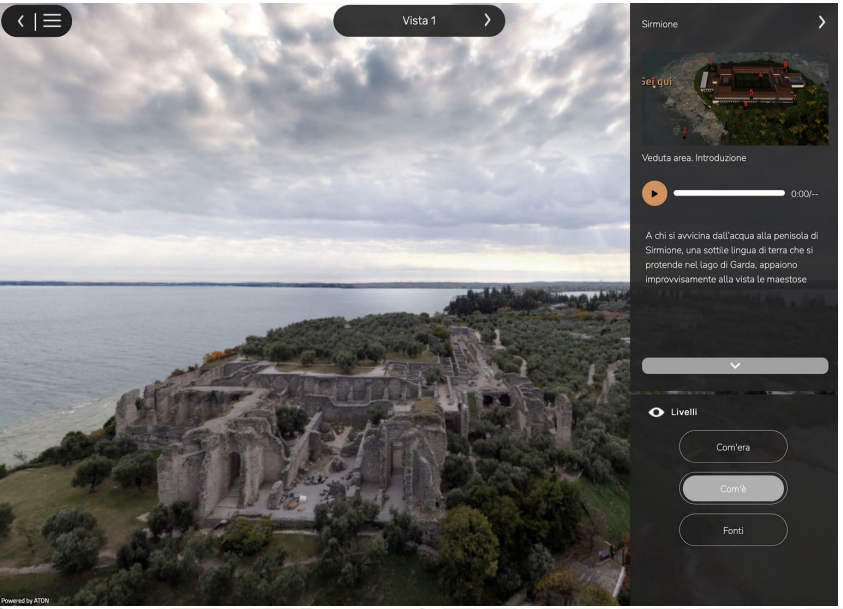
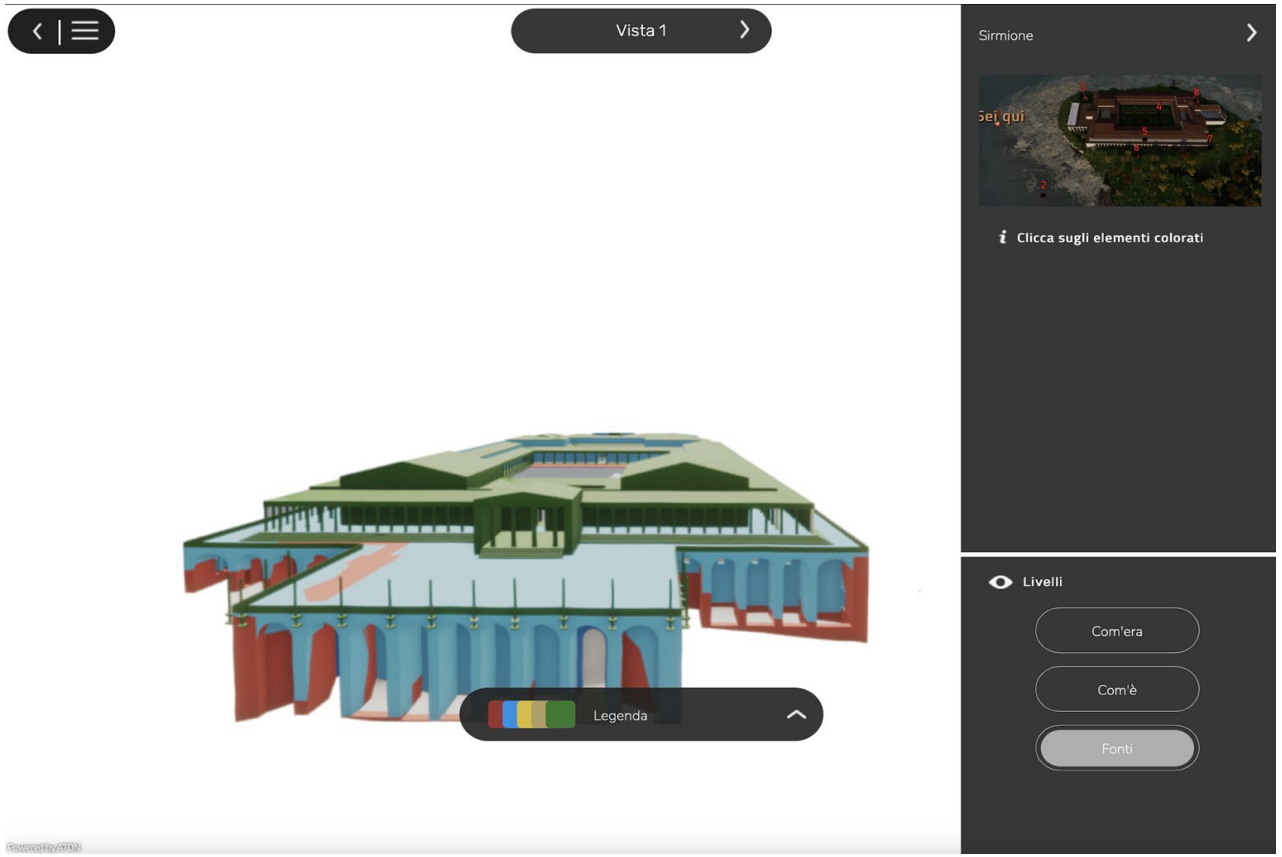
Storytelling & Narratives







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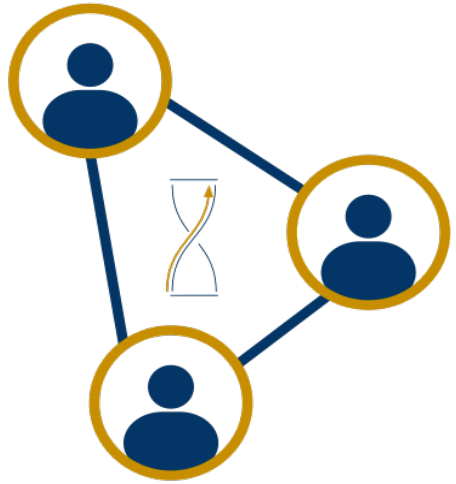
Sito internet:
www.extendedmatrix.org

Facebook:
Extended Matrix Community

Telegram channels:
- EM User Group
- 3DSC User group
- Aton Framework - Open group

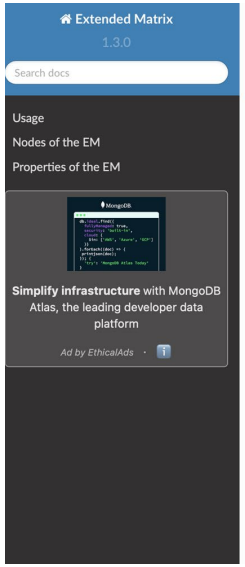


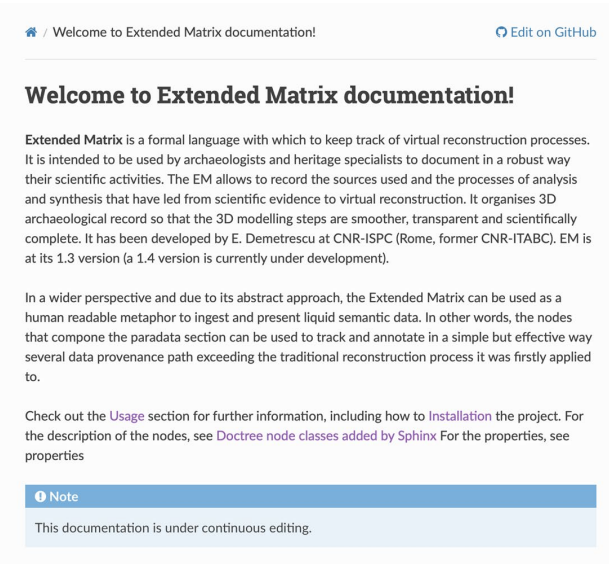
Monthly Live sessions
EM hour

1° and 3° Thursday
Every of month
14:30 CET

Extended Matrix

COMMUNITY group





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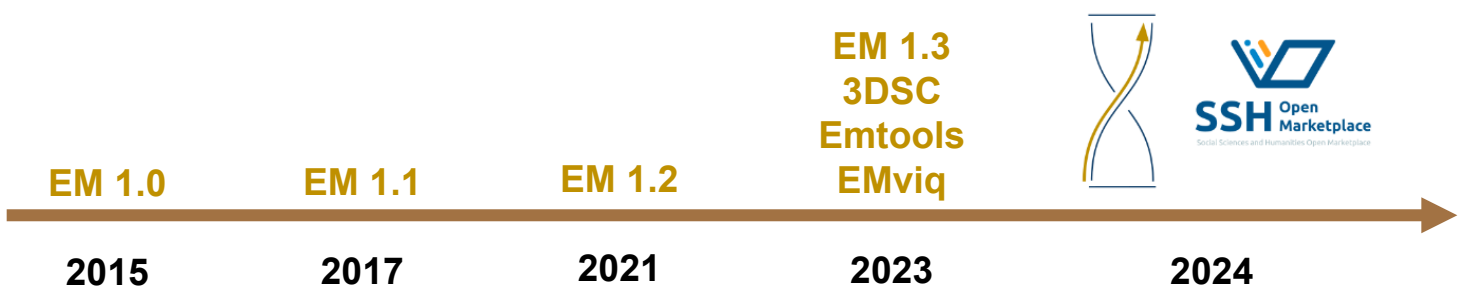

Extended Matrix

Where we are

- **Managing data provenance in heterogeneous situations:** archaeological excavations, 3D surveys, geophysical investigations, analysis of degradation surfaces, sampling for invasive and non-invasive analyses
- **Produce,** manage and publish online (ATON - EMviq) scientifically validated **reconstructive hypotheses**
- Making **interpretation processes** accessible and repeatable according to **Open Science** and **FAIR** principles
- Connecting **3D and knowledge graphs** and also heterogeneous data (tables, graphs, drawings, cards, photographs, audio, video, etc.)
- **Time extension for HBIM** and GIS platforms through stratigraphic deconstruction
- Producing **information layers for digital twins**
- **Open Source** ecosystem based on **python**, **Blender**, **Aton** and extendable to other software being adopted
- **Vibrant community** of users and developers in Italy, Spain, Macedonia, Germany, Sweden, Israel, Romania
- **10+ active PhD** on the use and implementation of EM

Extended Matrix

Where we want to go

COMMUNITY INTEREST groups

EM core

E.Demetrescu

Working on the formal language itself

EMtools

Development of the Blender add-on

EMviq

B. Fanini

Joining forces with the ATON community

EM TSU

Eleonora Scopinaro

EM, 3DGIS and HBIM

E. C. Giovannini
A. Sanseverino

Integration with other tools

Cristina Gonzalez Esteban

Including and sharing knowledge with the UR and other initiatives

EM and CIDOC-CRM

E. C. Giovannini

Creating compatibility mapping between EM and CIDOC- CRM