



## **CASE STUDY 2: The 3D model of the Civil Forum of Pompeii in Europeana**

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### **Abstract**

Through the CARARE project, the Scuola Normale Superiore (SNS) is delivering to Europeana a collection of 3D models and related content representing the Civil Forum of Pompeii. The SNS collection of 3D models is composed of 13 models of complex architectural structures and 322 smaller finds, covering an area of approximately 150x80 m corresponding to the area of the Forum of Pompeii. The 3D models are the result of a multi-resolution survey of the Pompeii Civil Forum, carried out in 2008 by a staff of the Politecnico of Milan with the objective of documenting the present status of the buildings, hence mainly for documentation and conservation purposes.

In agreement with the Superintendence of Pompeii (the owner of the 3D models), SNS decided to re-use this collection of 3D models for creating new digital resources and to make them available online, directed to a broader public. In fact, for the CARARE project, SNS created twenty 3D PDF files. Each document is composed of a number of 3D models, explanatory text and images with the aim of creating learning resources to illustrate the monuments and finds of the Forum of Pompeii, the history of their discovery, their interpretation and to explain how they were perceived during past time by the scholars, by the visitors and by other figures.

This case study provides a brief overview about the selected monuments and the related 3D models. It then illustrates how the pre-existing 3D models have been selected, prepared and re-elaborated, how descriptive data has been created, how 3D PDF documents have been prepared, assembled and published on the web and how the related metadata has been created and delivered to Europeana through the CARARE repository.

**Keywords:** Pompeii, Roman Forum, 3D models, digital collections, interoperability.

## 1. The Civil Forum of Pompeii: a brief historical introduction

The Civil Forum was the main square of the ancient city of Pompeii. It was the centre of political, commercial and religious life. Located in the middle of the so-called “Altstadt”, the oldest part of the city placed in the South-Western quadrant of the plan, it is also the key for the interpretation of the town-planning evolution from the VII century B.C. to the final destruction of the city, due to the eruption of Vesuvius in 79 A.D. The interpretation of the various building phases and the examination of the relationships between the walls of the monuments that nowadays are visible in the Forum are, therefore, important topics to the archaeological investigation in to the urban history of Pompeii.



Figure 1. The Civil Forum of Pompeii taken from the South side

In its first configuration during the Samnitic period, the Forum had a trapezoidal shape and was oriented following the North-West/South-East axis, the same axis preserved by the Temple of Apollo, dated from the VI century B.C. This orientation was maintained at least until the second half of the II century B.C. when the Forum was transformed into a rectangular square with a North/South axis, including the Capitolium (Temple of Zeus) on the shorter side which points at Mount Vesuvius (the cult of Zeus Vesuvius is attested to in the area). The Archaic Forum comprises the main square, that was paved with pressed volcanic ashes, the Temple of Apollo and some commercial buildings (*tabernae*) found under the East Porticus.



Figure 2. The Civil Forum of Pompeii taken from the North side

During the Late-Samnitic period (II century B.C.), the Forum changed completely in appearance; the square was paved, the Temple of Apollo was restored and the *Macellum* was built. Other important buildings were built up during the second half of the century: the *Basilica*, the Temple of Zeus and the *Comitium*, together with the so-called *Porticus of Popidius* along the East and South sides, defining the new orientation of the square. This ensemble of monuments has been interpreted by John Dobbins as a whole and named “Popidian Ensemble”.

During the Early Imperial Age, in the Roman period, the Forum changed again its aspect; the square was paved with travertine stone. Travertine was also used for rebuilding the Porch. New monuments were built along the East side of the Forum that was completely transformed with a new ensemble of buildings dedicated to the Imperial cult: the Sanctuaries of *Lares Publici* (also called of the Imperial Cult) and of the *Genius of Augustus* (or Temple of Vespasianus), and the *Eumachia* Building. The square was completed with two monumental Arches placed on both sides of the *Capitolium*.

In 62 A.D. a strong earthquake seriously damaged Pompeii and its monuments. Looking at the ruins of the Forum, we can still see the evidence of the restoration made by the ancient citizens. In 79 A.D., when the Vesuvius erupted, the restoration had still to be completed in some buildings. Many research studies continue to investigate and to refine the history of Pompeii Forum and, through this, the evolution of the entire city.

## 2. The 3D digital collection provided by SNS: the 3D model of the Forum of Pompeii

The 3D model of the Civil Forum of Pompeii is the result of an archaeological survey of the area and its monuments that documents its present status through a very precise and realistic technical plastic model with photographic textures.

The area covered by this model is approximately 150 x 80 m. It is composed of thirteen big models reproducing large architectural structures and three hundred and twenty two smaller models representing architectural elements and other finds.

The survey and the creation of the 3D model was carried out in 2008-2009 by the staff of Gabriele Guidi (Politecnico of Milan) for the Pompeii project, in agreement with SNS, the Superintendence of Pompeii and ARCUS (funding institution).

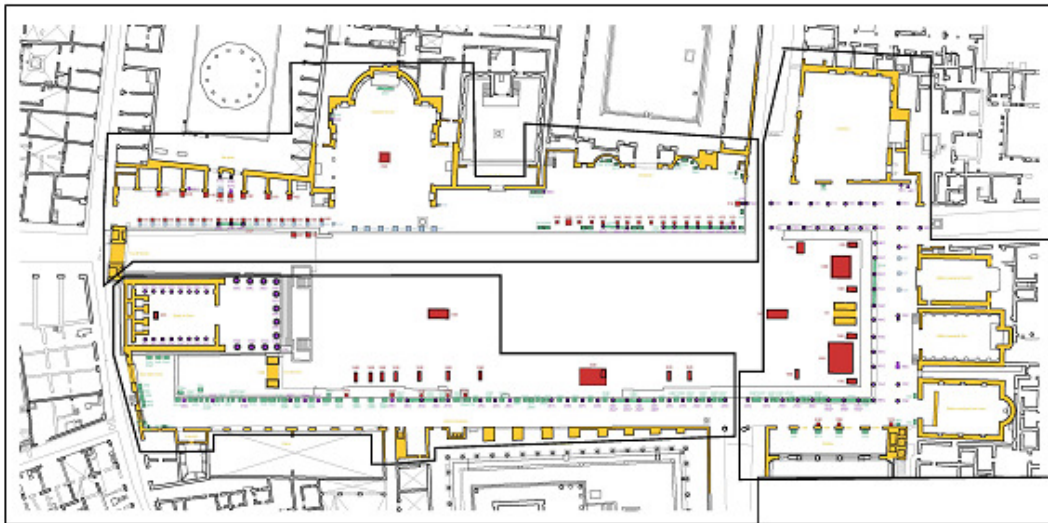


Figure 3. Plan of the Civil Forum.

The structures reproduced in the 3D model are evidenced in different colours. Yellow: walls and large buildings. Violet: columns. Red: bases and pedestals. Green: architectural elements and other small finds

A multi resolution approach was chosen for the modeling, using:

- classical aerial images acquired for a typical mapping project;
- oblique aerial views for texturing purposes;
- range-data acquired from the ground with a ToF sensor;
- terrestrial images to fill the gaps and to document small finds in higher resolution by means of dense image matching.

The geometric resolution of data spans from 25 cm to few mm in geometry, and from 15 cm down to few mm in the texture. The resulting 3D models were delivered in 2009 in VRML format, both separately and combined together on the basis of a DTM (Digital Terrain Model) derived from aerial images.



Figure 4. Some of the sensors and devices used for the survey of the Pompeii Forum

This first release was prepared for the visualization of the whole 3D model in a virtual theatre and was mainly to be used for scientific purposes, such as for documentation, conservation, study of the architectural structures, and to build up a 3D GIS to be used as a geographic basis for accessing various types of documents and data related to the represented buildings and structures.

	Sensors	Use	Quantity	Geometric resolution	Texture resolution
<b>Aerial images</b>	Zeiss RMK A 30/23	DSM of the site at low resolution	3 (image scale 1:3500)	25 cm	5 cm
	Pictometry	Texturing	4	-	15 cm
<b>Range sensors</b>	Leica HDS3000	Modeling of entire Forum at middle resolution	21 scans (400 Mil pts)	10-50 mm	-
	Leica HDS6000		45 scans (800 Mil pts)	5-10 mm	-
<b>Terrestrial images</b>	Canon 10D (24 mm lens, 6 Mpixel)  Canon 20D (20 mm lens, 8 Mpixel)  Kodak DCS Pro (50 mm lens, 12 Mpixel)	Modeling of small finds, mural architectural structures, ornaments	3200	0.5-10 mm	0.2-5 mm

Figure 5. Table: data employed for the multi-resolution 3D modeling of the Forum of Pompeii

### 3. Preparation of the 3D models: selection, grouping, modification

The involvement of axis in the CARARE project offered the possibility to re-think and re-purpose this already existing collection of 3D models for its diffusion via the Web to a broader public.

The CARARE 3D Working Group identified 3D PDF as a format suitable for the dissemination on the web of 3D models and related information that also met with Europeana's requirements (i.e. no need for installation of additional plug-ins or specialist software). The creation of these documents from previously existing content required a phase of preparation of the content itself.

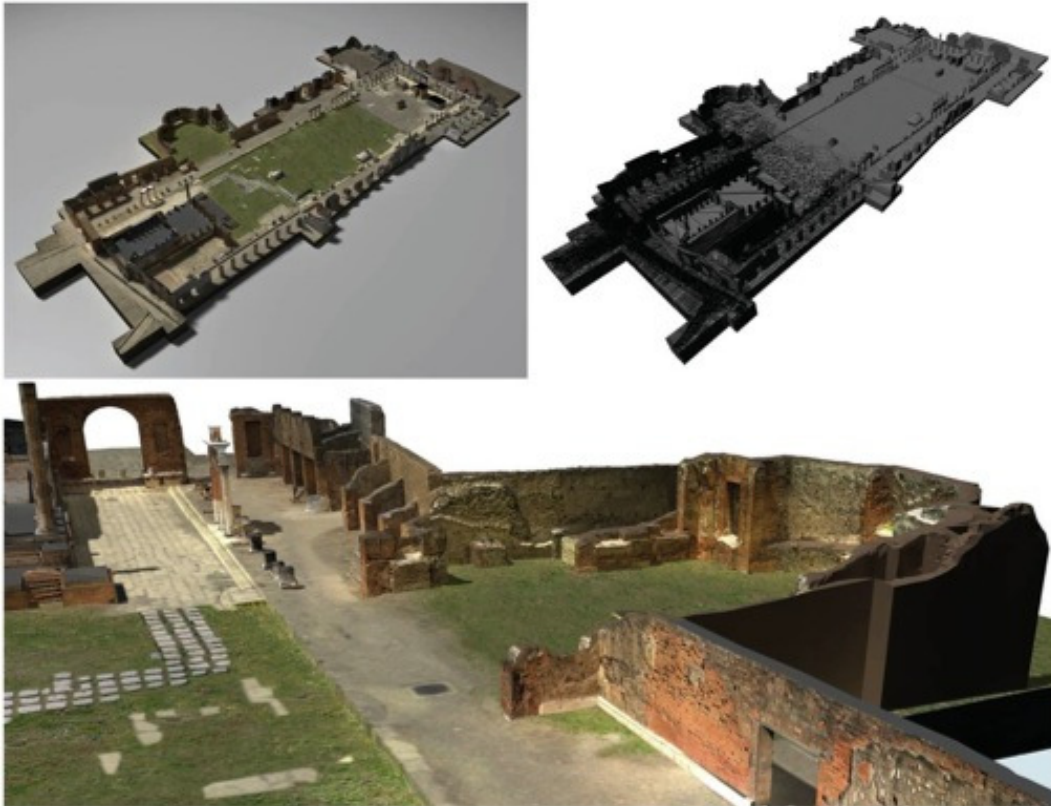


Figure 6. Some views of the 3D model of the Pompeii Civil Forum

#### 3.1 Selection and grouping of 3D models into medium-sized larger models

The pre-existing VRML files corresponding to 13 larger models of buildings and 322 smaller models of architectural elements and other finds (such as columns, capitals, etc) were grouped into the following 35 medium-sized 3D models (and corresponding files), each of which comprises one main building and various finds located in the same area, or many smaller models located in the same portion of the Forum and/or with the same function:

1. Building: Macellum. Smaller finds: 001B, 003B, 005B, 006B, 008B, 010B, 012B, 014B, 016B, 017B, 022B, 023B, 025B, 027B, 034B, 035B, 037B, 038B, 040B, 042B, 043B, 019C, 020C, 002-004F, 007-009F, 013-015F, 018F, 021C, 024C-031B, 036F-039F, 041-044F, 046B, 047-051F.
2. Building: Sanctuary of Public Lares. Smaller finds: 058B, 052-062F.
3. Building: Temple of Vespasianus.
4. Building: Eumachia building. Smaller finds: 069B, 070B, 071B, 073B, 082B, 084B, 086B, 090B, 092B, 097B, 099B, 101B, 103B, 105B, 107B, 112B, 117B, 083-088A, 098-110A, 118-119C.
5. Building: Comitium. Smaller finds: 130A, 123-126C, 127-129C, 131C, 132-134C, 135-138C, 139-144C, 141C, 142C.
6. Building: Tabularium (3 administrative buildings in the South side), Smaller finds: 145-146C, 151-155A, 160-165C, 166-174C, 159C, 156F, 157F, 158F.
7. Building: Basilica. Smaller finds: 188-195C.
8. Building: Temple of Apollo. Smaller finds: 243-246C, 249-252C, 284-286C, 247-248.
9. Buildings: Forum Holitorium, Latrine, Aerarium.
10. Building: Temple of Jupiter (Capitolium). Smaller finds: 383S.
11. Building: Arch of Nero.
12. Building: Arch of Drusus.
13. Smaller finds: 147B, 149B, 150B, 161, 163, 168B, 170, 148B, 169B, 162B (bases in the South side).
14. Smaller finds: 360B (Suggestum).
15. Smaller finds: 362B, 361B, 359B, 356B, 352B, 350B, 349B, 348B (bases in the East side).
16. Smaller finds: 358B, 357B, 354B, 351B, 347B (bases with inscriptions).
17. Smaller finds: 353 (altar).
18. Smaller finds: 119C, 123-126C, 127-129C, 131C, 132-134C, 135-138C, 139-144C, 145-146C, 151C-155A, 156F, 157F, 160-165C, 166-174C (Popidian portico).
19. Smaller finds: 188-195C (West Portico)
20. Smaller finds: 024C-031B (North-East Portico)
21. Smaller finds: 083C-088A (South-East Portico)

- 22. Find: 057A
- 23. Find: 065A
- 24. Finds: 067-068A
- 25. Finds: 072-074A
- 26. Finds: 089-091A
- 27. Find: 114C
- 28. Find: 115A
- 29. Find: 116A
- 30. Find: 173A
- 31. Find: 185A
- 32. Finds: 222-224A
- 33. Finds: 305-306A
- 34. Find: 326A
- 35. Finds: 315-316



Figure 7. Medium-sized model of the North-East portico assembling various smaller models

### 3.2 Modification and preparation of 35 medium-sized 3D models

The 35 medium-sized 3D models and related VRML files obtained from the previously illustrated grouping operation were further modified and elaborated, following the steps below:

- Modification of orientation.
- Application of small corrections and simplifications to the geometry and textures of the 3D models.
- Assembling of more than one model into one file.
- Cropping of the large DTM in many portions corresponding to the areas covered by the models joined into each group, and assembling of each portion of the terrain model to the related 3D model.
- Conversion of the file format from VRML to U3D, required to embed 3D objects within a 3D PDF file.

Such modifications were assigned to, and carried out by, the same staff of the Politecnico of Milan that originally created the 3D models of the Pompeii Civil Forum.



#### **4. Design of 3D PDF documents and preparation of content**

Following the preparation of 3D models to be ingested into the 3D PDF documents, SNS staff designed the 3D PDF documents according to the steps listed below:

- General planning and design of a template: quantity of 3D PDF documents to be created, object/s and theme/s to be treated within each document. General scheme for a 3D PDF document.
- Selection of the medium-sized 3D model/s (U3D file/s) and of 2D images (photographs, digitized prints and drawings, etc.) to be included within each 3D PDF document.
- Creation, review and delivery of texts to be added to each 3D PDF document.

##### **4.1 General planning and design of a template for 3D PDF documents**

On the basis of the 35 medium-sized 3D models previously prepared, SNS staff planned the following number of 3D PDF documents to be created and related titles, on the basis of the objects (monuments) and themes to be treated:

1. Arch of Drusus
2. Arch of Nero
3. Basilica
4. Comitium
5. Eumachia building
6. Forum Holitorium Latrine Aerarium
7. Macellum
8. Sanctuary of Public Lares
9. Tabularium
10. Temple of Apollo
11. Temple of Jupiter
12. Temple of Vespasianus
13. Architectural elements (fragments of architrave)
14. Architectural elements (fragments of cornice)
15. Architectural elements (fragments of frieze)
16. Bases in the Forum (South side)



17. Bases in the Forum (West side)
18. Forum Portico (North-East)
19. Forum Portico (Popidian)
20. Forum Portico (South-East)
21. Forum Portico (West)

After establishing the quantity and themes of the 3D PDF documents to be created, a general model for a 3D PDF document was drawn up.

A typical 3D PDF document representing one or more monuments of the Pompeii Civil Forum will be in A4 format, oriented horizontally and formed by a variable number of pages. It will include:

- A main title referring the name of the monument/s (1<sup>st</sup> page, on the left).
- The logo of the “Fortuna Visiva of Pompeii” Project (1<sup>st</sup> page: in the heading, on the right; following pages: on the right side).
- A text divided into chapters distributed on 4 columns in the 1<sup>st</sup> page; on 3 columns in the other pages and on 1 column in the final page. This text will include links both to external resources and to resources internal to the PDF (such as predefined views of the 3D model). The text will also include a list of Bibliographic references on the last page. Text can be lacking for 3D PDF assembling some minor models (architectural decoration and small finds).
- One main window in the 1<sup>st</sup> page or many windows distributed in the 1<sup>st</sup> and 2<sup>nd</sup> pages, hosting the 3D model/s.
- One or more figures to be included in the internal pages.
- A frame in the last page, where to include information on Credits and Rights.

A template was finally designed following the points listed above.

#### **4.2 Selection of the iconographic material (3D models and 2D images)**

On the basis of the general planning illustrated above, for each of the 21 3D PDF documents foreseen in the list, there was selected one or more of the previously prepared 35 U3D files to be ingested in the PDF, and various bi-dimensional images of different types: recent and/or ancient photographs, digitized prints, drawings and other iconographic material representing the monument illustrated in the PDF document.

#### **4.3 Creation, review and delivery of Texts for 3D PDF documents**

Other important work carried out by SNS staff was the preparation of descriptive and explicative texts on the monuments represented in the 3D models, regarding their meaning (use and context),

their history and discovery, in order to illustrate the edifices of the Forum in depth to the general public. Texts have been prepared following this general schema:

- Physical description of the monument/s.
- Interpretation and ancient function of the monument/s.
- Dating of the monument and its historical-archaeological meaning.
- History of the discovery of the monument/s; history of its knowledge; history of related studies.
- Bibliographic References.

Texts have been enriched with various links to external web-resources regarding the illustrated monument/s, in particular:

- Links to records of various type (monuments, iconographic sources, physical persons) published in the website of “The Visual Fortune of Pompeii” at: <http://pompei.sns.it>
- Links to digitized iconographic resources published on the web in various websites (digital libraries, web-portals, databases, etc.)
- Links to other on-line resources such as biographies, encyclopaedias, wikipedia, etc.

## 5. Assembling and delivering of 3D PDF documents

Using the template already defined, 21 PDF documents were created after assembling content described in the previous chapter (texts and images).

Finally, one or more of the previously selected U3D files were ingested into each PDF document, using the software Adobe Acrobat Professional 9.0, thus creating a 3D PDF document.

Further refinements and modification were applied using the same software, before delivering the final version of the 3D PDF documents, in particular:

- Creation of named views (main view and additional views) of the 3D models, modification of background colours and personalized light.
- Personalization of the 3D model miniature (2D image printed on the PDF before activating the 3D model).
- Creation of cross sections of the 3D models integrated in the named views, when required for better illustrating the monument.
- Use of 3D measurements integrated in the named views, when useful for explaining the shape and geometries of the monument.

- Entry of comments within the named views, when a label is needed for better explanation of particulars that are visible in the view.
- Creation of links internal to the PDF: 1) between one or more words on the text and one named view of the 3D model; 2) between one or more words in the text and one 2D image.

## 6. Publication of 3D PDF documents on the web

The 21 3D PDF documents have been then published in the website of the “Fortuna Visiva of Pompeii” SNS Project. They are available for download at the following links, each one corresponding to a record describing a monument of the Pompeii Civil Forum, at the end of the record, under the label “Attachments:”

Arch of Drusus: [http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=8994&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=8994&lang=en)

Arch of Nero: [http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=8993&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=8993&lang=en)

Basilica: [http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6043&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6043&lang=en)

Comitium: [http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6042&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6042&lang=en)

Eumachia building: [http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6063&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6063&lang=en)

Forum holitorium - latrine - aerarium:

[http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6536&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6536&lang=en)

Macellum: [http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6259&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6259&lang=en)

Sanctuary of public Lares:

[http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6333&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6333&lang=en)

Tabularium: [http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6264&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6264&lang=en)

Temple of Apollo: [http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6252&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6252&lang=en)

Temple of Vespasianus:

[http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6257&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6257&lang=en)

Temple of Jupiter or Capitolium:

[http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=6254&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=6254&lang=en)

Architectural elements found within the Forum (3 attached 3D PDF files):

[http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=9185&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=9185&lang=en)

Bases of honorary monuments in the Forum (2 attached 3D PDF files):

[http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=9184&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=9184&lang=en)

Porticos of the Forum (4 attached 3D PDF files):

[http://pompei.sns.it/prado\\_front\\_end/index.php?page=Home&id=9183&lang=en](http://pompei.sns.it/prado_front_end/index.php?page=Home&id=9183&lang=en)

## 7. Metadata mapping and creation of CARARE records

The high level mapping of SNS content into CARARE metadata schema leads to a sample record composed by the following elements wrapped within a CARARE wrapper:

- `<car:collectionInformation>` (0-to-1): describes the physical or conceptual collection to which the monument/archaeological object and the related resources are pertaining. In this case, a conceptual collection is described, corresponding to the “Fortuna Visiva of Pompeii” collection and related 3D models.
- `<car:heritageAssetIdentification>` (1): describes the heritage asset, that is the archaeological monument or object to which the described digital resources and activities are related. In this case, a monument of Pompeii is described. Metadata is mapped here from the Monument record of the Digital Archive (Fortuna Visiva database).
- `<car:digitalResource>` (1-to-N): describes the digital resource/s related to the above-described monument. Digital resources can be of various types (2D images, texts, audio files, videos, 3D models, etc.) and formats. In this case, Digital resource is used to describe: 3D PDF documents including a 3D model and/or 2D images representing the monument described in the Heritage Asset Identification element. Metadata mapped within this element derives from the record describing Iconographic sources and from metadata on the 3D PDF documents. 2D images or 3D PDF documents described in this element are directly linked through their URL, entered as value within the element `<car:link>`.
- `<car:activity>` describes one activity that can be related both to the heritage asset and to the digital resource. In this case, the survey activity and the creation process of the 3D model is described. Within this element is mapped metadata from the 3D Model record of the Digital Archive.

Relations internal to the CARARE record among the above-listed elements, resulting from the mapping of SNS metadata, can be exemplified as follows:

- Heritage Asset → `wasPresentAt` → Activity;
- Digital Resource → `isRepresentationOf` → Heritage Asset;
- Digital Resource → `isDerivativeOf` → Activity.

On the basis of this mapping, SNS implemented a system that automatically generates a CARARE data-stream within the Fedora repository of the Fortuna Visiva of Pompeii information system, which also includes an OAI repository that exposes those data-streams for the harvesting.

### 7.1 xml sample of a CARARE metadata record

The following example taken from the “Fortuna Visiva of Pompeii” collection is a sample record describing the Basilica of Pompeii (a monument of the Civil Forum) and related digital resources (among them, a 3D PDF document) and activities (the creation of the 3D model):



```

<?xml version="1.0" encoding="UTF-8"?>
<car:carare xmlns:car="http://www.carare.eu/carareSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.carare.eu/carareSchema http://www.carare.eu/carareSchema" id="">

  <!-- COLLECTION INFORMATION -->
  <car:collectionInformation>
    <car:title lang="it" preferred="true">La Fortuna visiva di Pompei</car:title>
    <car:title lang="en" preferred="false">The visual fortune of Pompeii</car:title>
    <car:keywords lang="it">Pompei</car:keywords>
    <car:keywords lang="en" namespace="http://sws.geonames.org/">Pompeii</car:keywords>
    <car:keywords lang="it">archeologia</car:keywords>
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      <car:role>researcher</car:role>
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      <car:address>piazza dei Cavalieri, 7 - 56026 - Pisa, IT</car:address>
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  this collection</car:grantedTo>
        <car:conditions>Metadata describing this collection are in the public domain.
  Attribution of author is required for any copy, derivative work or citation of the present metadata:
  mention "Scuola Normale Superiore" as author. The database and visual resources related to these
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  holder.</car:conditions>
        <car:statement>Author: Scuola Normale Superiore, Pisa, IT</car:statement>
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        <car:statement>Metadata describing this collection are in the public domain (CCO 1.0
  Universal Public Domain Dedication). Attribution of author is required for any copy, derivative work
  or citation of the present metadata: mention "Scuola Normale Superiore" as author. The database and
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  allowed by the rights holder.</car:statement>
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    </car:rights>
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    <car:statement>Scuola Normale Superiore, Pisa, IT</car:statement>
    <car:creation>
      <car:createdOn>2011</car:createdOn>
    </car:creation>
    <car:coverage>
      <car:temporal>
        <car:timeSpan>
          <car:startDate>1748-01-01</car:startDate>
          <car:endDate>1899-12-31</car:endDate>
        </car:timeSpan>
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        <car:periodName lang="en">XVIII and XIX centuries</car:periodName>
        <car:periodName lang="it">secoli XVIII e XIX</car:periodName>
        <car:displayDate lang="en">before 79 a.C.</car:displayDate>
        <car:displayDate lang="it">ante 79 d.C.</car:displayDate>
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Attribution of author is required for any copy, derivative work or citation of the present metadata:
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to the south-east corner of the civil forum of Pompeii, being the southern limit to Via Marina, the
road that lead from the harbor to the public square. It is an elongated hall, consisting of a huge
central space and a corridor running all around, separated by a row of Ionic brick columns. In front
of the hall there is a narrow vestibule, which is accessed from the forum through five openings
bordered by four tufa pillars. As many columns as the pillars, alligned with them, lead to the hall

```

through some basalt steps. The whole building is paved with opus signinum, whereas the perimeter walls are covered by First Style paintings and decorated with half-columns similar to those of the central colonnade. At the end of the building there is the tribunal, sort of platform with columns on the front, placed over a vaulted room, which can be reached through two lateral flights. The basilica is considered one of the oldest buildings in the forum; it was probably intended for commercial transactions and administration of justice.</car:description>

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Attribution of author is required for any copy, derivative work or citation of the present metadata:
mention "Scuola Normale Superiore" as author. The database and visual resources related to these
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## 9. Delivery process

Metadata describing the monuments of the Pompeii Civil Forum and related 3D PDF resources have been then delivered to the CARARE repository and, through this, will soon be finally delivered to Europeana following the steps listed below:

Harvesting of metadata using MINT (the CARARE Ingestion Server): metadata already shaped according to the CARARE schema have been directly harvested using MINT, after selecting the option “Import / OAI Set”, checking the box “this import conforms to” and selecting “CARARE 1.0.6.2”.

Imported data have been then published within MORE (the CARARE repository), where have been automatically mapped into EDM.

Mapping from CARARE records to EDM have been checked. EDM records will be finally delivered to Europeana through MORE.

## 10. Conclusions

This case study delivered by the Scuola Normale Superiore (SNS) within the CARARE project demonstrates how a collection of 3D models representing various archaeological monuments, such as the complex 3D model of the Civil Forum of Pompeii, that was mainly created for scientific purposes (documentation, research, conservation), can be re-used and re-purposed for creating learning resources targeted to a broad public.

The case study also illustrates in detail the whole process that led to the creation of those new learning resources incorporating 3D models, to their publication on the Internet and to their delivery to Europeana through CARARE.

The work carried out testifies that the choice of the 3D PDF format employed by the CARARE Working Group for 3D resources, as a suitable format for the on-line publication of 3D models, was a good choice as this format is effectively easy-to-use for the final user and easy to compose and to set-up for the provider. Moreover, work carried out demonstrates that the CARARE metadata schema and aggregation service is very useful to provide Europeana with archaeological and architectural content, even with 3D digital resources.



## Acknowledgements

This work was carried out by the staff of the research project “La Fortuna Visiva di Pompei” (website: <http://pompei.sns.it>) at the Scuola Normale Superiore, Pisa, IT. It was designed, delivered and funded within the EU project CARARE (Connecting Archaeology and Architecture in Europeana, ICT Policy Support Programme).

The 3D model of the Civil Forum of Pompeii was created in 2008 by the Politecnico of Milan within the Pompeii Project, in agreement between ARCUS (funding institution), Scuola Normale Superiore and Archaeological Superintendency of Pompeii, which is the rights holder of the 3D model itself and gave the authorization for use of this work within the CARARE Project.

## Bibliography

Masci M. E., De Santis A., Fernie K., Pletinckx D., *3D in the CARARE Project. Providing Europeana with 3D content for Archaeological and Architectural Heritage: the Pompeii case study*, in: “VSMM 2012 – 18th International Conference on Virtual Systems and Multimedia. Conference Proceedings” (Milan, Italy, 2-5 September 2012), Milan 2012, p. 227-234.

Papathodorou C., Dallas C., Ertmann-Christiansen C., Fernie K., Gavrilis D., Masci M. E., Constantopoulos P., Angelis S. (2011): *A New Architecture and Approach to Asset Representation for Europeana Aggregation: The CARARE Way*, in: E. García-Barriocanal, Z. Cebeci, M. C. Okur, A. Öztürk (edited by), “Metadata and Semantic Research. 5th International Conference, MTSR 2011 Proceedings” (Izmir, Turkey, October 12-14, 2011) Communications in Computer and Information Science, Vol. 240, 2011, p. 412-423.

Masci M. E., De Santis A. (2011): *The EU Project CARARE and the Scuola Normale Superiore contribute: Giving Access to 2D and 3D representations of Pompeii monuments through Europeana*, in: “EVA 2011 Florence – Electronic Imaging & the Visual Arts. Proceedings” (Florence, Italy, 4-6 Mai 2011), Bologna 2011, p. 34-39.

Guidi G., Remondino F., Russo M., Rizzi A., Voltolini F., Menna F., Fassi F., Ercoli S., Masci M. E., Benedetti B. (2008): *A multi-resolution methodology for archaeological survey: the Pompeii Forum*, in: “VSMM 2008 – Conference on Virtual Systems and MultiMedia dedicated to Digital Heritage. Project papers” (Limassol, Cyprus, 20-25 October 2008), p. 51-59.