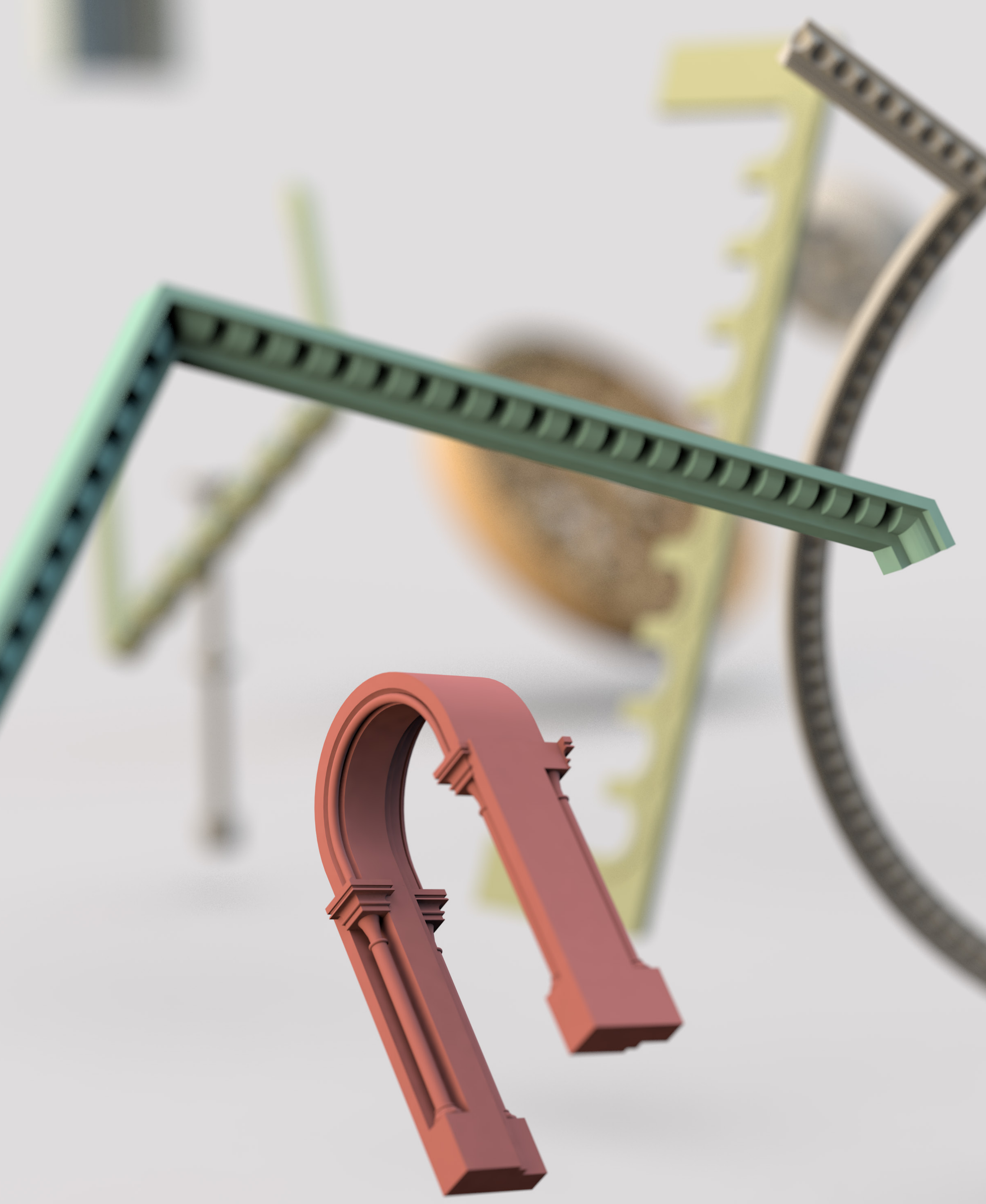


Fabrizio Apollonio

T. Conceptual modelling and cognitive process in 3D virtual reconstruction

→ 3D virtual reconstruction, 3D semantic segmentation, conceptual modeling, knowledge representation

The progresses in ICT brought, within the virtual reconstruction of cultural heritage activity, new theoretical problems related to the interpretation of the meaning (Metadata) and of construction methods (provenance and Paradata) related to information / sources in form of digital 3D data sets. The base for a scientific approach concerns the conceptual modelling and cognitive process in 3D virtual reconstruction. The paper is focused on its theoretical definition as well as on proposing a methodological approach to data modeling behind the 3D reconstructive process. A proper conceptual modeling of the process of virtual reconstruction becomes of fundamental importance in order to take into account all the aspects that come into play: subjectivity, ontic and epistemic vagueness.

The workflow and the methodology are related to the whole of the acquired and used to produce not only the 3D model, but above all the semantic characterization and enrichment of the elements that compose the model. They are based on these operational pipeline steps:

1. Subjective and temporal characterization
2. 3D virtual modeling
3. Semantic enrichment of 3D reconstructed model

The methodological approach proposed, therefore, allows many types of analysis and could introduce new and meaningful innovations to the interpretation methods and techniques concerning architecture. It defines the conceptual model of data that is the basis of the reconstruction process, as well as it provides the appropriate degree of transparency of the adopted process, allowing all researchers to re-think that process in order to qualify the outcome obtained and to propose, based on new knowledge or interpretations, new reconstructive hypotheses.

T.1 Introduction

Within the broad field concerning the hypothetical 3D virtual reconstruction process, unrealized historic artifacts and architectural projects are often considered as peculiar case studies, as well as city plans. They represent projects designed and never built and they introduce specificities, besides the typical issues common to the general digital reconstruction, documented by technical drawings or text only. [01]

Over the last decades the progresses in information technology brought, within the virtual reconstruction of cultural heritage activity, new theoretical problems related to the interpretation of the meaning (Metadata) and of construction methods (provenance and Paradata) related to information / sources in form of digital 3D data sets. This means analysis and subjective interpretation of evidences, documentation and architectural / archaeological / artistic artefacts, [01] definition of a proper and transdisciplinary methodology, [02] and the possibility to ensure transparency, comprehensibility and long-term availability of information in virtual reconstruction. [03]

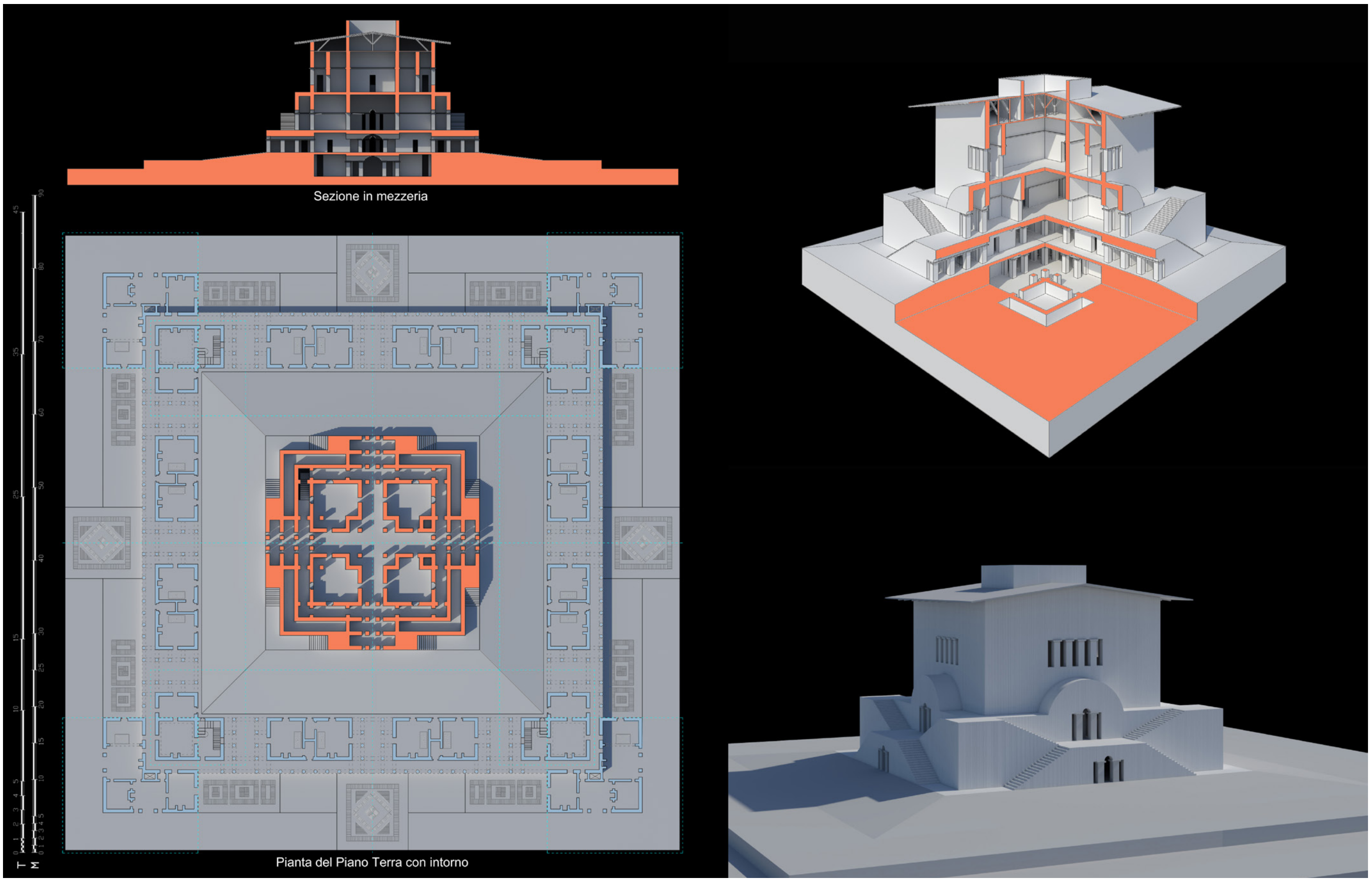
The base for a scientific reconstruction concerns the conceptual modelling and cognitive process in 3D virtual reconstruction. The paper is focused on definition of theoretical approach to virtual reconstruction activity for no longer existing or partially documented cultural heritage artefact, as well as proposing a methodological approach to data modeling behind the 3D reconstructive process. [04]

■ 01
Fabrizio I. Apollonio, Classification Schemes for Visualization of Uncertainty in Digital Hypothetical Reconstruction, in: Sander Münster et al., 3D Research Challenges in Cultural Heritage II: How to Manage Data and Knowledge Related to Interpretative Digital 3D Reconstructions of Cultural Heritage, Cham 2016, pp. 173–197; Nicolò Dell'Unto et al., Digital reconstruction and visualization in archaeology: Case-study drawn from the work of the Swedish Pompeii Project, in: 2013 Digital Heritage International Congress, Marseille 2013, pp. 621–628.

■ 02
Fabrizio I. Apollonio, Elisabetta C. Giovannini, A paradata documentation methodology for the uncertainty visualization in digital reconstruction of CH artifacts, in: SCIRES-IT, 5 (1) 2015, pp. 1–24.

■ 03
Piotr Kuroczyński et al., Virtual Museum of destroyed Cultural Heritage, in: Proceedings of the 2nd International Conference on Virtual Archeology, The State Hermitage, St. Petersburg Russia 2015, pp. 54–61; Sorin Hermon et al., The London Charter and its Applicability, in: Future Technologies to Empower Heritage Professionals, VAST 2007, Geneva 2007, pp. 11–14.

■ 04
Fabrizio I. Apollonio et al., 3D Modeling and Data Enrichment, in: XXIV Int. CIPA Symp. ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences, ISPRS XL-5/W2, 2013(a), pp. 43–48, 2016.



☐ 01
C.-N. Ledoux: Maison de campagne — Planche 21 — 3D virtual reconstruction based on text and drawings (Fabrizio Apollonio)

The sources-based reconstructive process is a reverse process 05 that begins from the documentary sources, it defines a semantic structure for the case study, then interprets its shapes (dimensional, geometric and morphological consistency), and finally produces a 3D digital model, semantically enriched. This sources-based reconstruction process is developed according to three steps:

1. the analysis and subjective interpretation of available documentary sources with different level of uncertainty and different level of the geometrical accuracy 06,
2. the production of 3D model — semantically structured — with different Level of Definition and characterized by different digital consistency, fidelity and quality concerning geometry, surface, constructive and temporal features,
3. use of documentary sources and knowledge concerning this process in order to semantically enrich the 3D digital model produced.

The reconstruction process is essentially driven by decisions based on several input datasets that are basically interpreted and integrated. If not correctly addressed, this subjectivity, compromises the validity of a whole virtual reconstruction or, eventually, makes it less understandable.

In response to this problem **The London Charter for the computer based visualization of Cultural Heritage** and **Valencia Charter** define the principles for the use, in research and communication of cultural heritage, of computer-based visualisation in relation to intellectual integrity, reliability, documentation, sustainability and access of heritage artefacts (London Charter, Preamble). According to the Principle 4 of the London Charter 07 a proper methodology has to define a correct approach, on one side to Paradata Documentation creating a conceptual scheme able to clarify the relationship between research sources, the implicit knowledge, the explicit reasoning, and the visualisation-based outcomes, and on the other side to Semantic structure of 3D digital model. As it is happening to a large extent in the field of humanities and social science, conceptual modelling is an absolutely useful technique for shaping, exploring, documenting, understanding and communicating artefacts of many kinds.

A proper conceptual modeling of the process of virtual reconstruction has indeed to take into account the subjectivity of the operator throughout the production of the model, to consider both ontic vagueness (i. e. imprecision or inaccuracy) and epistemic vagueness (i. e. reliability or uncertainty), to incorporate intricate and fuzzy temporality issues, to allow the possibility to explore, document and let understandable any data available, incorporating vagueness and subjectivity as much as necessary, and in creating conceptual models for documentation and communication purposes.

From a methodological point of view, therefore, the reconstruction process adopted becomes of fundamental importance. The workflow and the methodology are related to the whole of the data that is acquired and subsequently used to produce not only the 3D model, but above all the semantic characterization and enrichment of the elements that compose the model.

■ 05
Mieke Pfarr-Harfst, Typical Workflows, Documentation Approaches and Principles of 3D Digital Reconstruction of Cultural Heritage, in: Sander Münster, et al., 3D Research Challenges in Cultural Heritage II. LNCS 10025, Cham 2016, pp. 32–46.

■ 06
Apollonio 2016; Kuroczyński et al., 2015.

■ 07
London Charter, Principle 4, http://www.londoncharter.org/principles/documentation.html.

This process can be developed according to three steps operational pipeline:

Subjective and temporal characterization

→ Collection of documentary sources-based data concerning the case study.
→ Analysis of documentary sources and extrapolation of information on the consistency of the artifact (geometrical shape, surface appearance, physical characteristics), through a process of analysis / interpretation inductive / deductive / analogical decision assumed to extract the data based on the evidence, the relationship between information, deduction or conjecture.

3D virtual modeling

→ Definition of a semantic structure of the artifact to be modelled.
→ Reconstructive modeling 3D

Semantic enrichment of 3D reconstructed model

→ Linkage between data available and used in the process of reconstruction and the level of vagueness that characterizes each constitutive element.
→ Validation of the reconstructive hypothesis obtained through the data enrichment of each constitutive element and its displaying.

T.2 Subjective and temporal characterization

The first part deals with the collection and elaboration of available information concerning the case study. Analysing, evaluating, understanding and interpreting the history of an historic (architectural, archaeological, artistic) artefact requires a cross-reference-examination of several kind of evidences, spanning from specific data information concerning the artefact to generic pieces of knowledge concerning its historical-cultural context, theoretical-stylistic references, etc. As we know, any single artefact may be documented by numerous heterogeneous data sources that may vary in type / dimension (1D / textual, 2D / graphical, 3D / solid, etc.), relevance / vagueness or spatial granularity (concerning the artefact and its environment or isolated pieces of it), and in different scales / accuracy (from a single details to the whole artefact). Besides, a single piece of documentation — i. e. a sketch or a manuscript — may refer, at the same time, to various artefacts as well as various level of relevance or granularities. Throughout a hypothetical reconstruction process of the analysis and interpretation of such kind of documentation should produce a **probable reconstructed whole** of some point in the past, based on retrievable evidence and argumentation. [08] The subjective analysis and interpretation of data sources available helps to put in relation artefact elements with primary and secondary evidence, trying to develop the most appropriate possible complex chain of reasoning, able to manage the problems concerned to the heterogeneous nature of documentation: i. e. ambiguity of the textual descriptions, accuracy and exactitude of artistic representations, subjective ability to read / understand / interpret documentation, due to the experience, knowledge and intuition of the analysts.

In parallel the result of this process changes over time, due to the progress of knowledge, the increase of experience, and the evolution of the tools able to intercept the available data.

Among these tools, Information System document and store the different steps of the reasoning, decision and procedures chain adopted throughout the virtual reconstruction process, linking them in the end to the reconstruction output.

Thus, a documentation model in which the clues for the reconstructed elements, and the elaborated arguments around them, became explicit, available and queryable, as well as they can be updated, extended and reused by other researchers in future work.

Within this field Bruseker. Guillem and Carboni, [09] considering the reconstruction of an archaeological site as a case study, propose a high level, generic process model — based on CIDOC-CRM ontology — aimed at documenting the reasoning behind a virtual reconstruction process linked both to its digital outcome and to elements part of an information system storing data regarding the site or monument under reconstruction. Gonzalez-Perez, Martín-Rodilla and Blanco-Rotea [10] — based on ConML provided with the necessary extensions — propose a simple, affordable solution, through a collection of techniques, to capture time and subjectivity in conceptual models of the archaeological record. Even before, Dudek and Blaise [11] worked on the topic concerning analysis and understand the evolution of historic artefacts,

■ 08
Daniel Pletinckx, An EPOCH Common Infrastructure Tool for Interpretation Management, in: EPOCH report, 3.3, 2008.

■ 09
George Bruseker et al., Semantically documenting virtual reconstruction: building a path to knowledge provenance, in: 25th International CIPA Symposium 2015, Taipei, ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences, ISPRS, II-5/W3, 2015, pp. 33–40.

■ 10
Cesar Gonzalez-Perez et al., Expressing Temporal and Subjective Information about Archaeological Entities, in: 41st Annual Conference on Computer Applications and Quantitative Methods in Archaeology (CAA 2013), 2013, pp. 326–335.

■ 11
Iwona Dudek, Jean-Yves Blaise, Visualizing alternative scenarios of evolution in heritage architecture, in: Stefanie N. Lindstaedt, Michael Granitzer (Eds.), i-KNOW ,11–11th International Conference on Knowledge Management and Knowledge Technologie, ACM International Conference Proceeding Series ACM, New York, 2011, Article No. 45.

which requires the cross-examination of indications ranging from specific pieces of data, to generic pieces of knowledge, proposing that the same artefact could act as a media to integrate heterogeneous indications, enabling information visualisation and retrieval through 2D / 3D dynamic graphics.

Such experiences highlight the importance of this issue, providing at the same time an important disciplinary / scientific contribution. Without going into considerations of the specific techniques adopted (CIDOC-CRM or ConML), the solution proposed by Bruseker et al. [12] can be traced back to a generic process model but, despite being an high level approach, it could be dissuasive for operators [13] (modelers or archeologists) involved in the virtual reconstruction process, since they usually have limited skills due to their different former education to digital tools. Given the valuable contribution of Blaise and Dudeck [14] to he knowledge extraction, elicitation and representation, as well as the operational practices suggested by Gonzalez-Perez et al., [15] but above all on the epistemological difficulty in translating a typical subjective practice into an operational objectivity, we argues that a semantic characterization (see next section) on the characteristics that define / qualify the outcome of subjective and temporal data interpretation process can be more effective and better communicative.

■ 12
Bruseker et al. 2015.

■ 13
See Gonzalez-Perez et al. 2013.

■ 14
Jean-Yves Blaise, Iwona Dudek, What comes before a digital output? Eliciting and documenting Cultural Heritage research processes, in: International Journal of Culture and History, 3 (1) 2017, pp. 86–97.

■ 15
See Gonzalez-Perez et al. 2013.

T.3 3D semantic segmentation

Considering the peculiarities of any CH artefact, an acquiring knowledge process that is able to note and make understandable and reusable the analysis of preliminary data and interpretation criteria used to validate the entire process can be developed through the segmentation of digital models, [16] The segmentation, in fact, is the basic principle for a semantic representation of an artifact and its information-technological storage in an Information / Cognitive System. According to the largely shared principles concerning the Information / Cognitive System peculiarities, [17] a proper cognitive modeling helps discerning different segments of information (including raw data, as well as documentation strategies, documentation results and process of documentation) and re-assemble them together in a structured semantic way to let new information derived or linked to 3D model. [18] As just stated in Apollonio et al. [19], De Luca, Busarayat, Stefani, Véron, Florenzano [20], Blaise, Dudeck [21] the semantic structuring visually assess the related level of knowledge, with its flaws and lacunae, and it carry out comparative operations on the set of data and information held, allowing the compatibility of the digital model with alternative modes of representation. As we can see infra M. Gaiani **The history of Palladian digital 3D models from the spatial grammar to the semantic construction**, [22] the semantic structure applied to 3D digital modeling can be usefully used to re-construct the hypothetical model, to identify the characters, limitations and in-consistencies of those sources, to display the reconstructive conjectures adopted and not documented in the same documentation, and the reconstructive solutions more likely, giving back self-representation to the same instrument.

The method used to organize and structure 3D models is Object-Oriented (see next section) and based on well-established agreement about artifact analysis in which buildings, archaeological finds, artistic artifacts are described through a series of structured elements according to their related disciplinary vocabulary. [23] [02] [03]

■ 16
Patricia Lulof et al., The art of reconstruction documenting the process of 3D modeling: some preliminary results, in: Proceedings of International Conference on Digital Heritage, Marseille 2013, pp. 333–336.

■ 17
Iwona Dudek, Jean-Yves Blaise, Using Abstraction Levels in the Visual Exploitation of a Knowledge Acquisition Process, in: i-KNOW '05 Proceedings of the 5th International Conference on Knowledge Management and Knowledge Technologies, Graz 2005, pp. 543–552; Fabrizio I. Apollonio et al., A semantic and parametric method for 3D models used in 3D cognitive-information system, in: Future cities, 28th eCAADe 2010 Conference, Zurich 2010, pp. 717–726.

■ 18
Fabrizio I. Apollonio et al., 3D reality-based artefact models for the management of archaeological sites using 3D Gis: a framework starting from the case study of the Pompeii Archaeological area, in: Journal of Archaeological Science, vol. 39, 2012, pp. 1271–1287; Giorgio Agugiaro et al., Queryarch3D: Querying and Visualising 3DModels of a Maya Archaeological Site in a Web-based Interface, in: Geoinformatics FCE CTU Journal, 6, 2011, pp. 10–17.

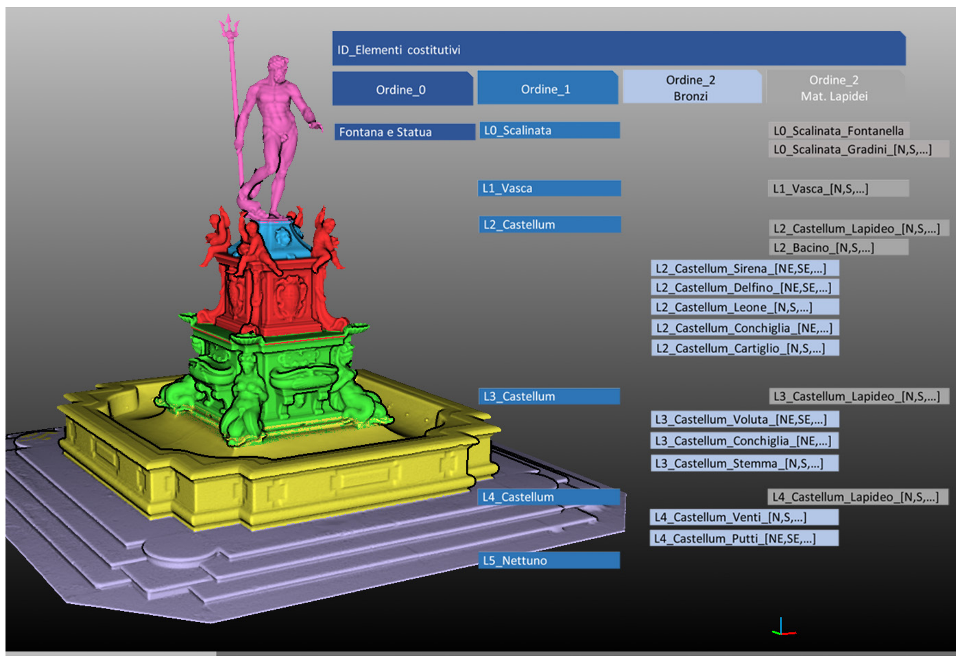
■ 19
Fabrizio I. Apollonio et al. 2013.

■ 20
Livio De Luca et al., A semantic-based platform for the digital analysis of the architectural heritage, in: Computers & Graphics, 35 (2) 2011, pp. 227–241.

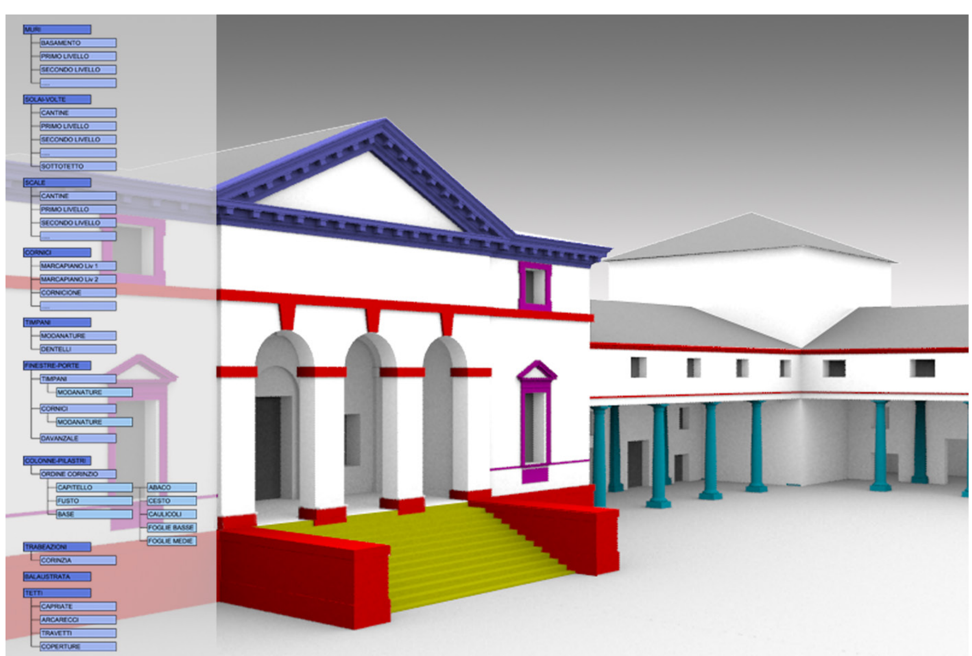
■ 21
Jean-Yves Blaise, Iwona Dudek, Visual tools decipher historic artefacts documentation, in: Journal of Universal Computer Science, 7th International Conference on Knowledge Management, Salamanca 2007, pp. 456–463.

■ **22**
See Marco Gaiani The history of Palladian digital 3D models from the spatial grammar to the semantic construction, infra.

■ **23**
George Stiny, Introduction to shape and shape grammars, in: Environment and Planning B: Planning and Design, 7, 1980, pp. 343–351; Livio De Luca et al., A generic formalism for the semantic modeling and representation of architectural elements, in: Visual Computer, 23 (3) 2007, pp. 181–205; Livio De Luca et al., An Iconography-Based Modeling Approach for the Spatio-Temporal Analysis of Architectural Heritage, in: Shape Modeling International Conference (SMI ,10), Washington 2010, pp. 78–89.



☐ 02
A typical semantic segmentation of CH artifacts: Monumental fountain: Fontana del Nettuno, Bologna (u.). (Fabrizio Apollonio



☐ 03
A typical semantic segmentation of CH artifacts: Architectural building: A. Palladio, villa Saraceno (b.). (Fabrizio Apollonio)

This structure — expandable if necessary over several hierarchical levels — allows to manage 3D models, in the subsequent semantic enrichment phase too, in a consistent manner and according with a hierarchically related subsets system.

The criteria for its production need to proceed on three levels:

1. identification of individual artifact parts and thus their linkage among themselves or with further information;
2. definition of mutual and hierarchical relationships among different constitutive elements;
3. attribute management, concerning geometrical (shape, size, spatial position, topological relationship), constructive / surface (physical form, stratification of building / manufacturing systems) and temporal (evolution / transformation over life cycle) features, and related sources of information.

The conceptual modelling starts, therefore, with the abstraction process aimed at identifying the artifact as it is analyzed and understood and the classification of the elements / objects it is composed of and allowing an intuitive orientation within the structure.

The granularity of the segmentation, depends on the level of detail of the available information and the goals of the virtual reconstruction process. [24] The finer the segmentation is the higher the number of identified segments and, clearly, the authoring of the representation becomes more complex. In return, a very fine segmentation allows detailed assignment of information about the building too.

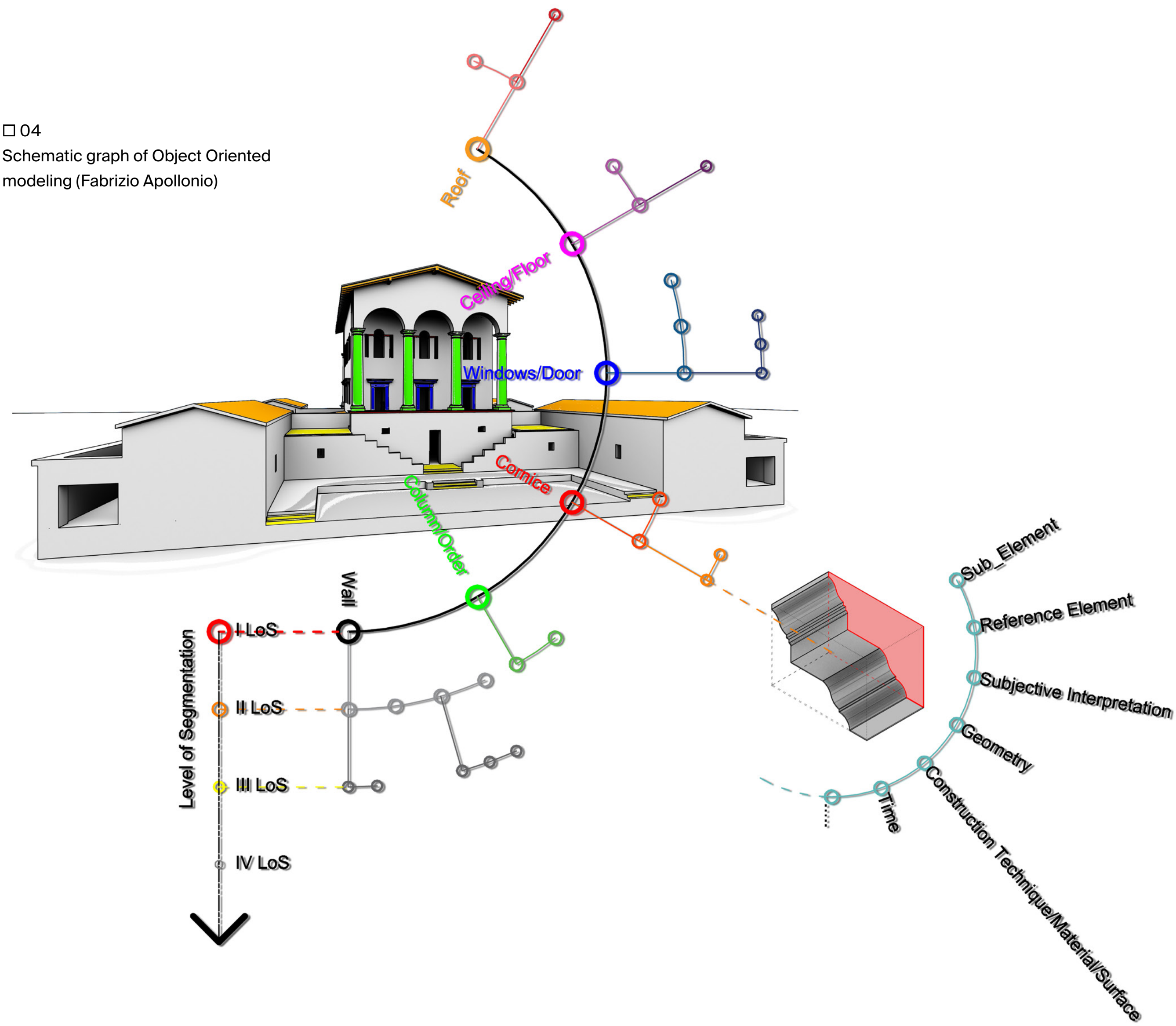
■ 24
Kuroczyński et al. 2015.

T.4 Object-Oriented Approach

Similarly to basic assumption of BIM (Object-Oriented approach), any artifact is composed of elementary parts, which allows a semantic 3D representation of an artifact from different point of view, following these characteristics: 04

- → 3D semantic models ensure that individual elementary parts are identifiable and thus can later serve as an anchor for information.
- → The graphical, radiometric, as well as the constructive representation is created by composing the different information available and thus makes it easier to represent the artifact appropriately.

☐ 04
Schematic graph of Object Oriented modeling (Fabrizio Apollonio)



The Object-Oriented (OO) modelling approach is, therefore, adopted in order to define — according to UML-classes, their attributes, and relations (associations) among the classes. The process of classification involves systematic assigning similar objects to the classes. As classes are identified, meaningful names (see encoding methodology in Apollonio [25] and Apollonio, Govannini [26]) to them are assigned by the user. Another step is the identification of the way objects and classes are mutually connected through links for setting particular hierarchies, relationships and assigning different associations.

Adopting the Object-Oriented modelling approach there is no need to divide / segment the artifact into exterior and interior sub-component and to segment and re-organize the artifact following its functional organization.

Segmenting artifact according to its physical organization (Object-Oriented) allow, in fact, jointly to the topological attributes and association which characterized each single element, to define / get the information concerning the function of a hollow space (i. e. in a building) bordered by floor, walls, ceilings, door, etc.

Any articfact, in fact, exists through the solid features which is composed of, and on a secondary level, by the interclused space as the hollow ones, which allow some function. The former component will be modelled by a mathematical / geometrical construction of physical characteristics that are defined by morphologic rules. The latter derives from the topological relationships among the former (physical component), and has explicit limits created by them: the interclused spaces are identifiable as different hollow volumes that one can interpret following a cognitive process, starting from the analysis of physical solid geometries.

■ 25
Apollonio 2016.

■ 26
Apollonio, Giovannini 2015.

T.5 Semantic enrichment

While geometric patterns related to cultural heritage are the primary information structures to be archived in 3D repositories aimed to be indexed, the purpose of qualification and authentication of products of scientific research requires that these models have to be implemented with the corresponding textual Metadata (cataloging, comment and bibliographic notes) and Paradata (information about human processes of understanding and interpretation of data objects) which permit the transparency of information to users in a manner similar to what occurs with notes, comments and references in the traditional publications.

This level defines the set of information that semantically characterizes and enriches the model obtained during the virtual reconstruction process. It is, in turn, the core of information that can provide / guarantee the full transparency of the adopted process and the characteristics that qualify the product obtained.

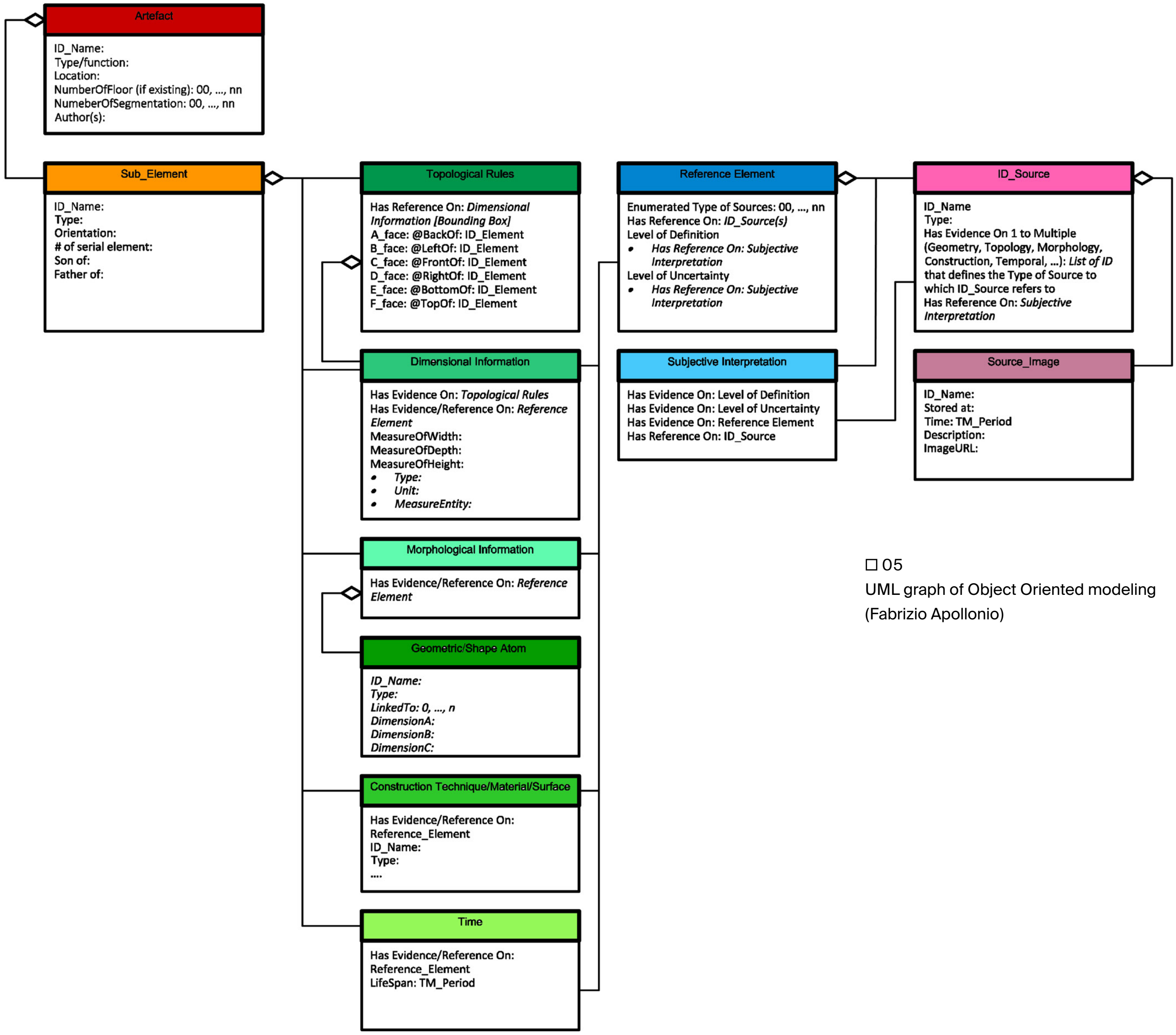
Semantic enrichment is realized at the granularity level of the basic element defined in the semantic segmentation 05 06, and consists of a set of **clusters** of suitable data models that define the characteristics that qualify / define the product model as fully as possible.

These **clusters** are:

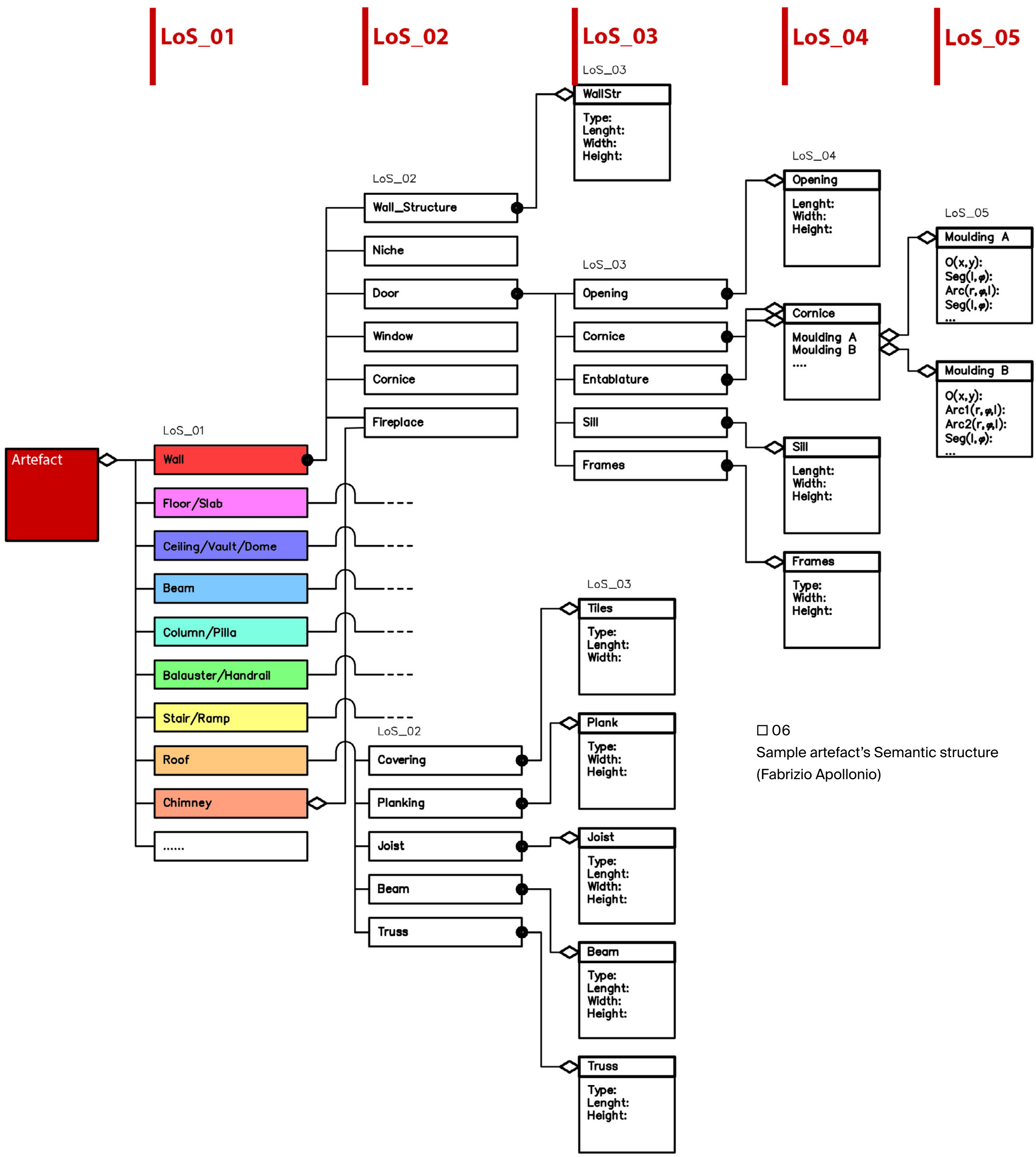
→ Base element identifier
→ Geometric characteristics
→ Topological characteristics
→ Construction / Surface / Surface Features
→ Time identifier
→ Interpretative characteristics of data sources (Subjective Interpretation)

Each **cluster** in turn is structured in identified, descriptive, associative elements that define its components and cross-relationships between elements of the same **cluster** or belonging to other **clusters.**

Concerning the **Subjective Interpretation** it represents an identification workflow for inductive / deductive / analogical / conjectural decision assumed to extract the data based on analysis and interpretation of the evidence, the relationship between information available, having **Evidence** on **Level of Definition**, on **Level of Uncertainty**, on **Reference Element**, and **Reference** on **ID_Source.**



☐ 05
UML graph of Object Oriented modeling (Fabrizio Apollonio)



☐ 06
Sample artefact's Semantic structure
(Fabrizio Apollonio)

T.6 The cognitive process for representing the semantic structure of information

Systematizing information concerning architectural, structural, geometric, and stylistic items as well as building technologies with related level of accuracy and uncertainty needs to take into account heterogeneous information, able to considering the evolution of our knowledge, producing 2D / 3D dynamic graphics, and adapting our practices to the specific manners of the AH field.

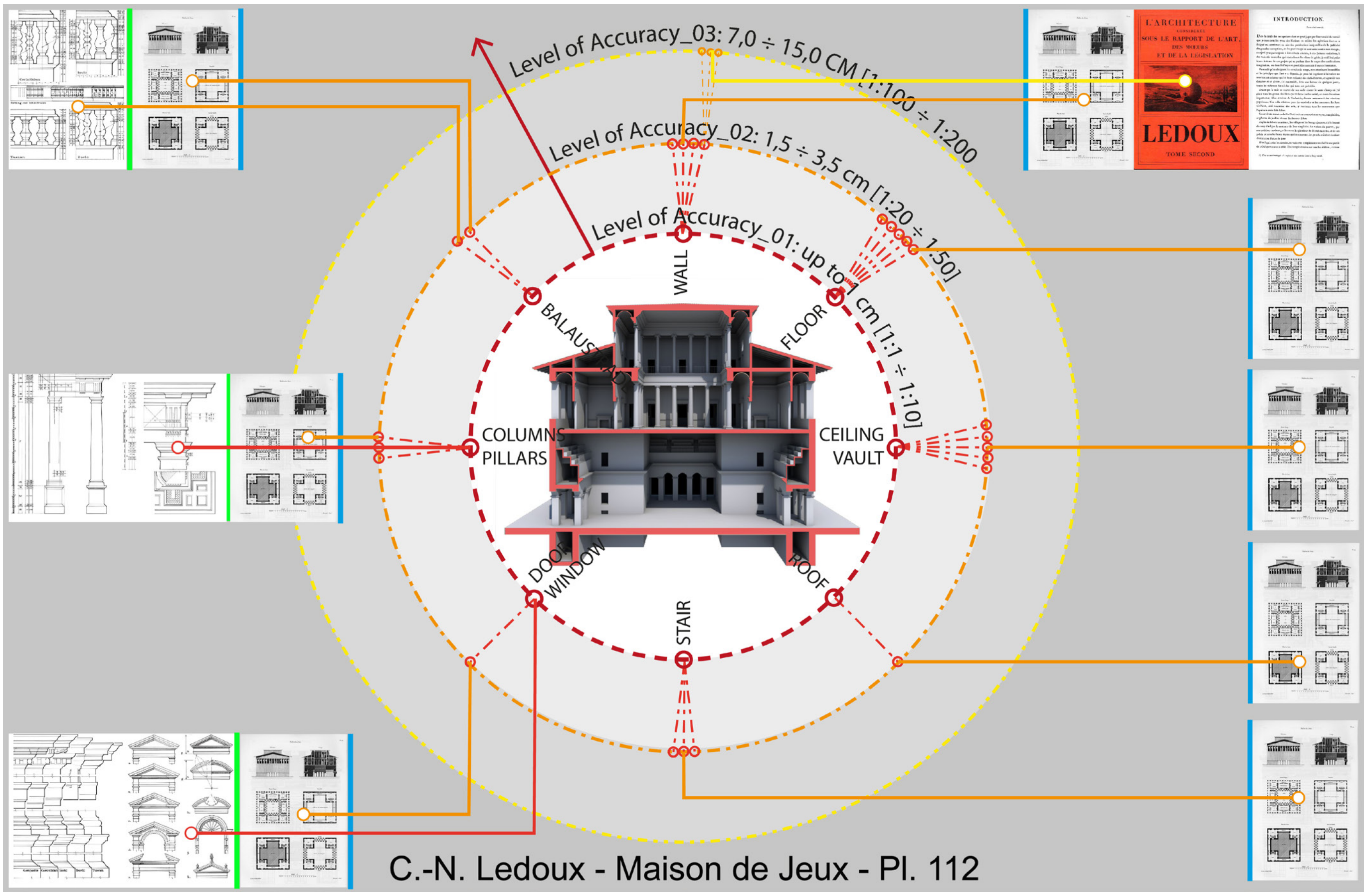
Studying, reconstructing and displaying a hypothetical state of an artifact (or ensemble of artifacts) requires introduction of temporal and documentary additional dimensions. 3D model representation becomes a metaphor of cognitive system related to architectural corpus able to show us different pieces of documentary sources related to each architectural elements. [27] The result is a cognitive graph, [28] as visual metaphor of case study, which aims to restore the hierarchical structure that drives the geometric definition of the 3D model and gives access to documents about the artifact studied.

Due to the relationship between each document in a data set and its corresponding element of the artifact (building as a whole, parts, details, etc.) information structure could be visualized and retrieved inside a 3D model / interface that combines the metaphoric figure of cognitive system. Through this structure, exploiting the semantic graphic codes, the representation is able to:

- → display different levels of accuracy (relationship between architectural detail and accuracy of data sources)
- → display different level of uncertainty (corresponding to each level of interpretation / reliability of exploited data sources)
- → underline inconsistency in the documentation or its analysis;
- → show levels of incompleteness of the investigation;
- → provide an updated visualization of our knowledge concerning the case study.

■ **27**
Dudek, Blaise 2005; Blaise, Dudek 2007; De Luca et al., Véron 2010.

■ **28**
Apollonio, Gaiani, Sun 2013(a).

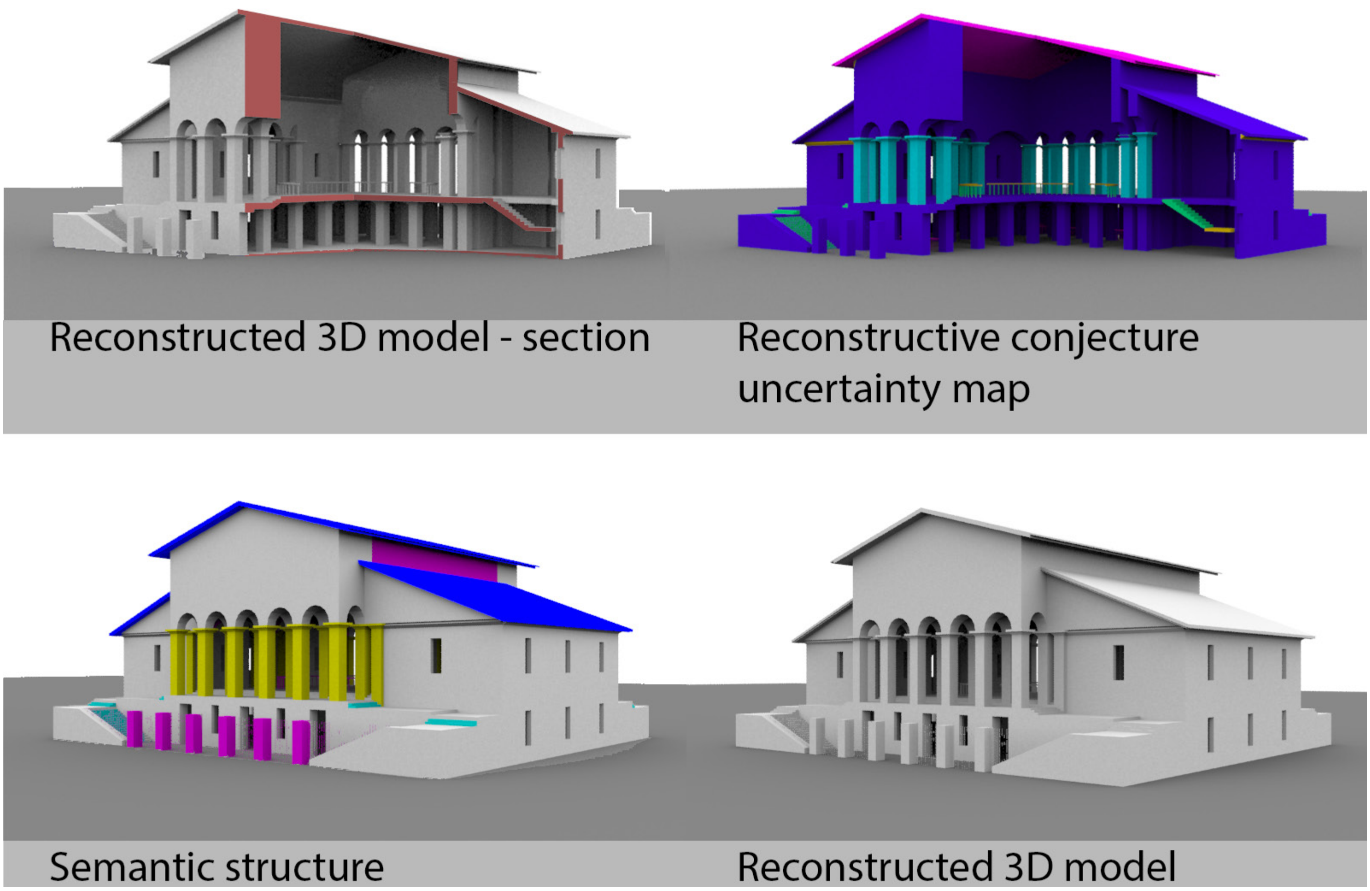


☐ 07
Cognitive graph concerning 3D virtual reconstruction of C.-N. Ledoux, Maison de Jeux – Pl. 112 (Fabrizio Apollonio)

A browsable cognitive graph 07 allow to search, retrieve and get (a) the comparison between data sources and related 3D models, (b) the analysis of the geometric characteristics of the model, through the use of patterns and diagrams that facilitate the reading of correspondence and / or anomalies identified during the analysis of the drawing, or the criteria of ratio used to design its parts, (c) a photorealistic rendering of reconstructed project within its hypothetical / original context, as well as matching any hypotheses alternative to the shaping of some of its parts, (d) the uncertainty display using a density slicing color code, that divides the rendering objects into a few color bands, corresponding to each level of uncertainty. 29 08

The graph is divided into several concentric circles. Each circle corresponds to a different hierarchical level of semantic structure. Each hierarchical level of detail corresponds to a different level of detail, progressively increasing. To an increasing level of detail it corresponds with a similar level of accuracy. Each element making up the 3D model is connected to the corresponding source from which we obtained, by deduction, induction or conjecture, useful information to the definition of its geometric-formal-material characteristics.

■ 29
Fabrizio I. Apollonio et al., Characterization of Uncertainty and Approximation in Digital Reconstruction of CH Artifacts, in: Le vie dei Mercanti. XI Forum Internazionale di Studi, Napoli 2013(b), pp. 860–869); Apollonio 2016.



☐ 08
Monument aux recreation Pl. 87: reconstructed 3D model-section (u. l.); 3D modeling reconstructive conjecture uncertainty map (u. r.); semantic structure (b. l.); reconstructed 3D model (b. r.) (Fabrizio Apollonio)

T.7 Conclusion

The methodological approach developed and applied in many case studies of virtual reconstruction allows many types of analysis and could introduce new and meaningful innovations to the interpretation methods and techniques concerning architecture.

In this paper a methodological approach has been described to define the conceptual model of data that is the basis of the reconstruction process. The objective to be achieved is the building of an adequate knowledge system that will provide the appropriate degree of transparency of the adopted process and provide all researchers with the opportunity, at any time, to rethink that process in order to qualify the outcome obtained and to propose, based on new knowledge or interpretations, new reconstructive hypotheses. The cognitive graph makes the system of knowledge accessible, since the reconstructive hypothesis are based on it, and it produces more interpretative visualizations than philological or perceptually correct. The cognitive graph makes the system of knowledge accessible, since the reconstructive hypothesis are based on it, and it produces more interpretative visualizations than philological or perceptually correct.

The case study presented in the Project Portfolio amongst the various cases of virtual reconstruction — exemplifies its application to a real case.