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Quantification of the Average Uncertainty in Hypothetical 3D Reconstruction

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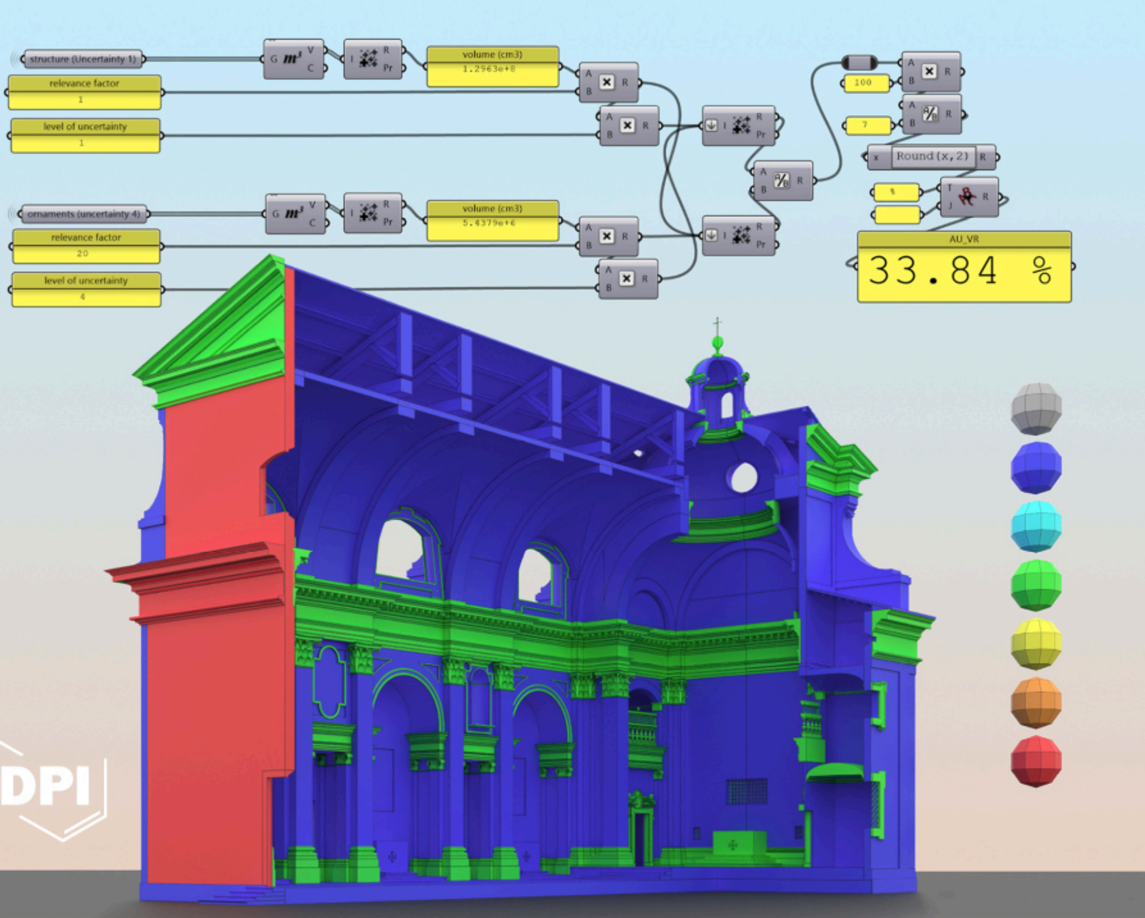

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Terminological Study for Scientific Hypothetical 3D Reconstruction

Federico Fallavollita [1,*], Riccardo Foschi [1,*], Fabrizio Ivan Apollonio [1] and Irene Cazzaro [1,2]

1 Department of Architecture, University of Bologna, 40136 Bologna, Italy; fabrizio.apollonio@unibo.it (F.I.A.); irene.cazzaro2@unibo.it (I.C.)
2 Iuav di Venezia, 30135 Venezia, Italy
* Correspondence: federico.fallavollita@unibo.it (F.F.); riccardo.foschi2@unibo.it (R.F.)

Abstract: This paper presents preliminary findings from the ongoing Erasmus+ European project CoVHer, which focuses on the hypothetical virtual reconstructions of lost or unbuilt architecture. This contribution provides a critical assessment of the terminology specific to this field. A significant challenge lies in the absence of standardised terminology for many foundational aspects, which can lead to misconceptions and misunderstandings. The research begins with a comprehensive review of the relevant literature in the field, aiming to identify which terms are most widely accepted and appropriate to use and which are ambiguous or should be avoided. For concepts that lack a clear definition, new terminology is proposed. This paper analyses six key terms: reconstruction, uncertainty, raw model, informative model, digital representation methods, and 3D modelling techniques.

Keywords: standardization; uncertainty; raw model; informative model; digital representation methods; 3D modelling techniques; definitions

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1. Introduction

This study is part of the Erasmus+ CoVHer research project (Computer-based Visualization of Architectural Heritage, 2021-1-IT02-KA220-HED-000031190) [1]. One of the main objectives of the project is the drafting of a shared glossary that collects the significant concepts and terms that deal with the topic of virtual reconstructions of architecture from the past. The research group currently includes five universities and two private companies from five different European countries: Italy, Spain, Portugal, Germany, and Poland. The CoVHer Erasmus+ project is coordinated by the University of Bologna (principal coordinator Federico Fallavollita). The principal partners are Hochschule Mainz University of Applied Sciences (DE), Politechnika Warszawska (PL), Universitat Autònoma de Barcelona (ES), Faculdade de Arquitectura Universidade do Porto (PT), Interessengemeinschaft für Semantische Datenverarbeitung E.V. (DE), and La Tempesta: City, culture & technology (ES) [1]. The search for shared terms and concepts is a fundamental part of the project because the lack of a common language can mystify or slow down the exchange of ideas considering the definition of shared standards for the construction and validation of architectural 3D models related to our past. Further reading about standards of reference or shared guidelines in the field of hypothetical reconstruction are the following: the London Charter [2], the Principles of Seville [3], and the DFG handbook [4] by the DFG German network [5].

This paper presents and analyses six fundamental terms: *reconstruction*, *uncertainty*, *raw model*, *informative model*, *digital representation methods*, and *3D modelling techniques*. The first two terms, *reconstruction* and *uncertainty*, are words commonly used in the field of digital Cultural Heritage (CH), both in the academic and popular fields. The latter two, *digital representation methods* and *3D modelling techniques*, are terms often used in other fields but sometimes not used properly in the hypothetical reconstruction field. The two remaining terms, *raw model* and *informative model*, are instead original terms that aspire to better sort and classify some characteristics of the 3D models of virtual reconstructions. Bibliographic research concerning the frequency of use and the definition of these terms was conducted in order to understand how various scholars use them in the reference literature and which of them are favoured over the others. This research extends the bibliographic study on terminology started by Irene Cazzaro in her doctoral thesis in 2023 [6], which dealt with the wide topic of source-based digital 3D reconstruction, visualisation, and documentation in the domain of archaeology, art, and architecture history. This research applies the consistent methodology adopted in the cited studies but extends it to further terms and contexts. The analysis methodology consists of gathering as many relevant papers as manageable in the reference field of hypothetical architectural reconstructions. The target terms were not only analysed in terms of the frequency of appearance, as shown in Figure 1, because this approach would have not highlighted how these terms were used. Thus, before the preliminary quantitative assessment, the reference papers were read carefully to exclude eventual instances of the terms that might have biased the results. Definitions and relevant sentences were highlighted and gathered, some of which are cited in this text. In this way, both the frequency of use and the meaning of the target terms were assessed. For each term, the definitions from scientific bibliographic references and the ones developed and proposed in the CoVHer forthcoming glossary will be provided and discussed.

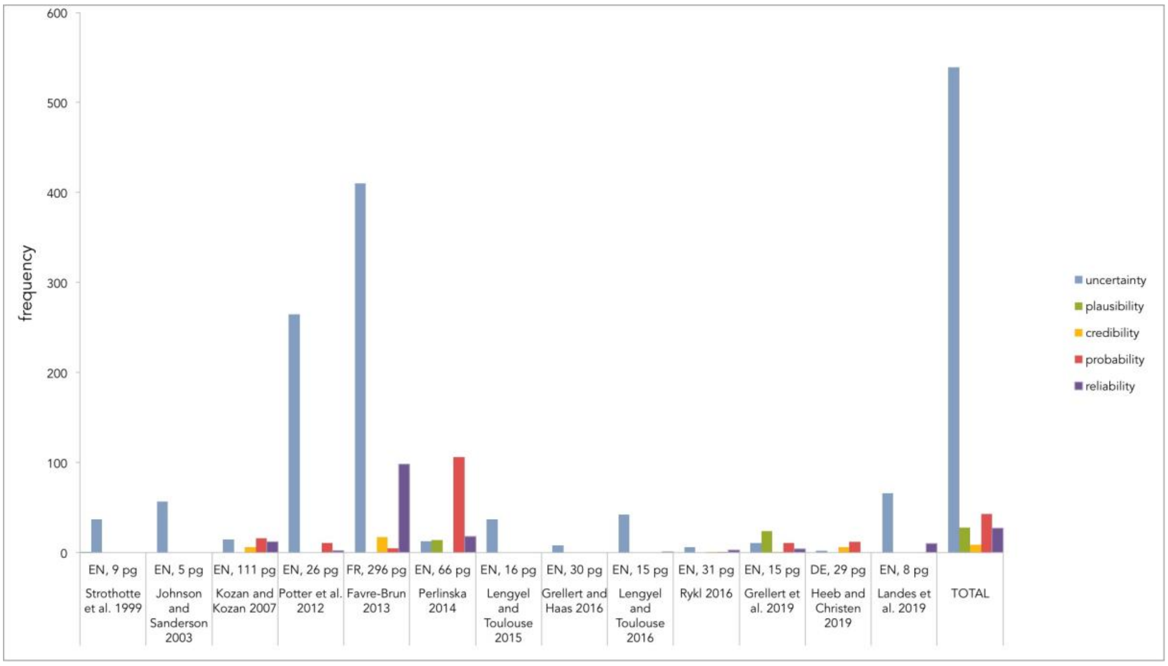

Figure 1. The frequency of use of the terms cited in the analysed papers [19, 23, 24, 26, 27, 28, 48, 49, 50, 51, 52, 53, 54]. This image is based on an image published in Irene Cazzaro's PhD thesis in 2023 [6] and further elaborated.

2. Commonly Used Terms: Reconstruction

The first two analysed terms, *reconstruction* and *uncertainty*, are normally used in the academic context of virtual reconstructions. This research investigates if the terms adequately express the concept to which they refer, if they are already used and shared by the scientific community and if there are alternative words in use.

In the draft of the CoVHer glossary (The CoVHer glossary has not been released yet to the public, so its final published form might be subject to modifications. Please refer to the CoVHer website for updates [1]), the term *reconstruction* appears in the following definition: "Virtual hypothetical 3D reconstruction refers to the process of digitally recreating or constructing a three-dimensional representation of an object, structure, or environment that may no longer exist or is inaccessible in its original form. It involves using available data, such as historical sources, photographs, archaeological findings, or physical remnants, to create a virtual representation of the object […]".

Some scholars dispute the very use of the term *reconstruction* and suggest the use of alternative terms such as *construction*. Clark in 2010 [7] already highlighted that using the term *reconstruction* in the field of archaeology might lead to misconceptions because the 3D model that we construct today, based on sources, "is never a statement of reality but rather a tool for understanding," which does not imply being perfectly consistent to the original. So, he proposes the use of the word *construction* instead.

A similar point of view is shared by Ataman in 2002 [8] and Vitali et al. in 2021 [9], who sometimes add a hyphen or parenthesis to the first two letters of the term *reconstruction* (i.e., *re-construction* or *(re)construction*). This approach does not change the term itself but would help raise awareness of the terminological ambiguity without diverging from the standard terminology already widely used in the academic field.

(Re)construction with parenthesis is also sometimes used in the field of BIM and HBIM. Two examples are the works by Rossi and Palmieri in 2020 [10] and Gonizzi Barsanti et al. in 2023 [11]. The same naming was adopted in some recent works by the authors of this paper concerning the 3D modelling and visualisation of never-built architecture from the past in 2021 [12].

The word *reconstruction*, in the archaeological field, is also used to indicate the actual *physical reconstruction* of architectural remains. The field is the same, but the meaning is different. The definition by ICOMOS (International Committee on Archaeological Heritage Management, 1990) [13] of the term *reconstruction* given in 2020 [14] (pp. 4–5) reads as follows: "Reconstructions serve two important functions: experimental research and interpretation. They should, however, be carried out with great caution, so as to avoid disturbing any surviving archaeological evidence, and they should take account of evidence from all sources in order to achieve authenticity. Where possible and appropriate, reconstructions should not be built immediately on the archaeological remains and should be identifiable as such". In this case, it is evident that the term *reconstruction* refers only to *physical reconstructions* and not digital ones.

To sum up, the term *reconstruction* is the most used one, even though for some cases it might be inappropriate (e.g., when the building was never built or never finished in the first place) or ambiguous (e.g., it can be confused with the *physical reconstruction* defined by ICOMOS). Therefore, in order to continue using a term already widely adopted by the scientific community while reducing ambiguities, the following best practices are suggested:

- Prefer the form with parenthesis or hyphen (*re-construction* or *(re)construction*) when specifically referring to never-built architecture;
- Always specify which type of *reconstruction* it is with one or more adjectives (e.g., digital, 3D, hypothetical, virtual, source-based, reality-based, etc.). This would help distinguish the term from the one defined by ICOMOS which refers only to *physical reconstructions*.

3. Commonly Used Terms: Uncertainty

The concept of *uncertainty* refers to the field of *hypothetical source-based reconstruction* and it is commonly used in the context of the *scale of uncertainty* [15]. Sometimes *reliability*, *probability*, *plausibility*, and other terms are used as synonymous or antonymous of *uncertainty*. These terms are analysed and discussed below.

In the draft of the CoVHer Glossary, the term *uncertainty* can be found in the definition of the *scale of uncertainty* which reads as follows: "The uncertainty scale (sometimes it is called reliability scale which is opposite to uncertainty) is an analysis and visualisation strategy for hypothetical source-based reconstructions aimed at evaluating the level of accuracy and consistency of interpretation and historical plausibility based on some related data (e.g., historical documental sources). Different scales could exist based on the different objectives of the reconstruction […]".

The Cambridge Dictionary [16] defines the following alternative terms as follows:

- *Uncertainty*: "Is something that is not known or certain."
- *Reliability*: "Is the quality of being trusted because it works or behaves well."
- *Probability*: "The level of possibility of something happening or being true."
- *Plausibility*: "The quality of seeming likely to be true, or possible to believe."

All of them are similar in everyday use, however, some of them might assume very specific meanings in various scientific contexts.

Pang et al. in 1997 [17] refer to *uncertainty* as the statistical variation or spread, the errors and differences, the minimum–maximum range, the noise in the data, or the missing data. This definition was developed for the broader context of computer graphics in general, but it is also applicable to the architectural CH field. Also, Gershon in 1998 [18] gives a similar definition of *uncertainty* in the broad field of visualization, but, in addition, he relates it to the quality of the sources.

Strothotte et al. in 1999 [19] define the term *uncertainty* as the "absence of information due to some reason," which they relate to imprecisions and incompleteness. Kensek et al. in 2004 [20] propose to exploit the *uncertainty* assessment to evaluate which 3D reconstruction is better documented and thus is more reliable.

Blaise and Dudek in 2008 [21] assert that a 3D *hypothetical source-based reconstruction*, which is provided without the *uncertainty* assessment and visualization, is less credible. They not only use the term similarly to the previous cases, but they also highlight the importance of the *uncertainty assessment* for 3D reconstructions. Also, Rocheleau in 2011 [22] had a similar approach. He asserts that the process of keeping track and reporting *uncertainty* is an important step that fosters transparency and intellectual honesty. Favre-Brun in 2013 [23] tried to find subclasses of *uncertainty*: *uncertainty of quality*, *uncertainty of coherence,* and *uncertainty of objectivity*.

Perlinska in 2014 [24] compares the use of some commonly used words in the field of archaeology: *probability*, *uncertainty*, *confidence*, and *plausibility*. She says that *probability* should not be used because it assumes that the number of all possible cases is known, which is not possible in our field; and she says that *plausibility* could be more suitable for a humanistic field. Also, Nicolucci and Hermon in 2004 [25] and Landes et al. in 2019 [26] warn about the dangers of using the term *probability* as synonymous with *reliability* in the archaeological field because it refers to a specific mathematical concept that has a formulation that is not suitable to evaluate the level of *reliability* in this context. In particular, Nicolucci and Hermon assert the following: "[…] a probabilistic approach leads to nowhere because of the normalisation property of probability, which is the basis for the multiplicative law we were forced to adopt. In other words, probability is very unreliable as a measure of reliability" [16] (p. 30).

In three further examples by Potter et al. in 2012 [27], Lengyel and Toulouse in 2015 [28], and Chandler and Polkinghorne in 2016 [29], the authors propose their definitions of the term *uncertainty* in the field of 3D *hypothetical source-based reconstructions*, which are similar to the previous ones.

In particular, the contribution by Potter et al. reads as follows: "*Epistemic* uncertainty describes uncertainties due to lack of knowledge and limited data which could, in principle, be known, but in practice are not. Such uncertainties are introduced through deficient measurements, poor models, or missing data […]. *Aleatoric* uncertainty is defined as uncertainties that arise from, for example, running an experiment and getting slightly different results each time. This type of uncertainty is the random uncertainty inherent to the problem […]" [27] (p. 227).

Lengyel and Toulouse assert the following: "There is a common understanding of the meaning of uncertainty, knowledge and hypotheses whereas uncertain knowledge seems to be contradictory at first […]. Uncertain knowledge takes into account incomplete knowledge, e.g., if some parts of a structure are known while other parts are unknown, but also contradictory knowledge, that is if the stringent deduction of prerequisites allow(s) contradictory yet equivalent conclusions. Incomplete and contradictory knowledge is then summarized as uncertain knowledge" [28] (pp. 1–3).

Lastly, Chandler and Polkinghorne, in accordance with previous definitions, state the following: "Missing data therefore generates uncertainty about visions of the past" [29] (p. 163).

In the plot in Figure 1, the frequency of usage of these terms is compared in 13 reference papers dealing with 3D *virtual hypothetical source-based reconstructions*. In the reference sample, the term *uncertainty* is the most used by far.

To assess the subjectivity of the *hypothetical source-based reconstruction*, the terms *uncertainty*, *reliability*, *probability*, *credibility*, and *plausibility* are used in the reference scientific bibliography. Based on the gathered and assessed data, the term *probability* should be avoided because *mathematical probability* is not a suitable formulation for assessing *uncertainty* that might cause misconceptions and ambiguities. On the contrary, the term *uncertainty* is the most used in the considered reference bibliography. It is unambiguous and should be adopted systematically. *Reliability* and *plausibility* are valid alternatives, but it must be clarified that they are opposite to *uncertainty* (60% *uncertainty* = 40% *reliability/plausibility* and vice versa), thus their definition is unambiguous but less popular in this field.

4. Novel Terms: Raw Model and Informative Model

Digital reconstructive architectural 3D models, in the field of *hypothetical virtual reconstruction*, can be divided into two broad categories: *raw models* and *informative models*. The forthcoming CoVHer glossary, on the one hand, gives the following definition of the *raw model*: "The Raw Model (RM) is a digital 3D model obtained through quasi-automatic procedures starting from raw data captured from physical sources with minimal subjective interpretations by the operator (e.g., digital photogrammetry, laser scanning). For example, possible sources may be archaeological remains (e.g., the ruins of a Roman theatre) and in this case, the RM could be a point cloud or a textured mesh model […]. RM represents only dimensional data (and sometimes also colourimetric data) acquired from physical objects".

On the other hand, the glossary defines the *informative model* as follows: "The Informative Model (IM) is a digital information-enriched 3D model where the relevant information is available and accessible […]. An example of IM is any architectural source-based virtual hypothetical 3D reconstruction […] the IM, represents the complex interpretation process of various sources. The IM is a model obtained through a reverse engineering operation".

The glossary also states that the *raw model* is generally a quasi-automatically generated discrete 3D model (e.g., mesh model), while the *informative model* can be represented with different digital representation methods (continuous or discrete) and built with various modelling techniques (e.g., parametric modelling, direct handmade modelling, polygonal modelling, etc.).

Some previously existing terms that might relate to the concept of the *raw model* are *raw data* and *reality-based model*; however, they have slightly different meanings. The definition that Wikipedia gives about raw data [30] states that: "Raw data, also known as primary data, are data (e.g., numbers, instrument readings, figures, etc.) collected from a source […]. A distinction is made between data and information, to the effect that information is the end product of data processing".

Concerning the term *reality-based model*, the Extended Matrix (EM) glossary defines it as "[…] equal to a digital replica of an existing object or context" [31]. A *raw model* always comes from *raw data*; however, *raw data* does not always represent a 3D model, thus it is not strictly synonymous with a *raw model*. For example, in a photogrammetric survey, the set of unprocessed pictures is *raw data*, the sparse and dense point cloud and the consequent automatically generated mesh model (which are generated after the processing of the pictures through a photogrammetric software) are the *raw models*, and the documented and rectified reverse engineered 3D model redesigned with a CAD software, and thus enriched with additional interpretative information, is the *informative model*.

Concerning the term *informative model*, it is not a widely used term in the reference literature of the field. Other terms express similar concepts, such as *information model* (from BIM: Building Information Modelling), *semantic model* [32] (p. 8), and *source-based model* [31]. The *information model*, in the BIM literature, means that the model embeds additional information which is key for decision-making tasks and project management. The *semantic model* in the Extended Matrix framework refers to models that are semantically segmented and enriched with paradata and metadata and these data are accessible and readable. The *source-based model* is defined as "a 3D model which is realized starting from sources. Within the EM methodology Proxy models and Representation models are Source Based models" [31]. All these terms have one aspect in common, which is the fact that the model is based on, or enriched with, additional information that is not exclusively dimensional data (as in the *raw model*) but embeds additional data, for example, data gathered from historical documentary sources.

Kuroczyński et al. in 2023 relate some of these terms to each other: "For example, if the 'reality-based' models are digital models obtained through quasi-automatic procedures starting from raw data acquired from physical sources (point clouds and/or meshes), the 'source-based' models are digital models that, in some cases alongside the raw data, collect and contain historical information of a textual and graphic nature and documentary resources" [33] (p. 895).

In some cases, the terms *source-based model*, *semantic model*, *information model*, *informed model*, and *informative model*, are used interchangeably. However, the term *informative model* puts the accent on the fact that the model is not only enriched with information but also provides access to information. In this sense, the *informative model* could be considered a more specific and descriptive type of *information-enriched model* (or *informed models*, which contain information but do not necessarily make it available or readable). Figure 2 provides a schematic view of the relationship between *raw data*, *raw model*, *informative model*, and other types of models, and Figure 3 visually compares a *raw model* with an *informative model* derived from it. In contrast, while the term "source-based model" is commonly used to describe a model that incorporates historical information from textual, graphic, and documentary sources, it can potentially be ambiguous, as physical remains are also a type of source. Therefore, to avoid misunderstandings when referring to a model enriched with information not only derived from *reality-based sources* but also from *documental historical sources*, it is better to use the term *documental source-based model*, and when it is important to put the accent on the fact that the added information is made available and readable it is preferable to use the term *informative model* instead.

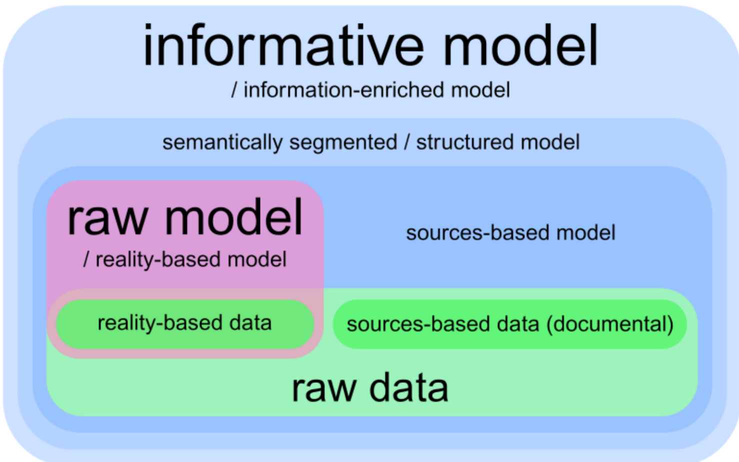

Figure 2. The schematisation of the raw model/raw data/informative model relationship.

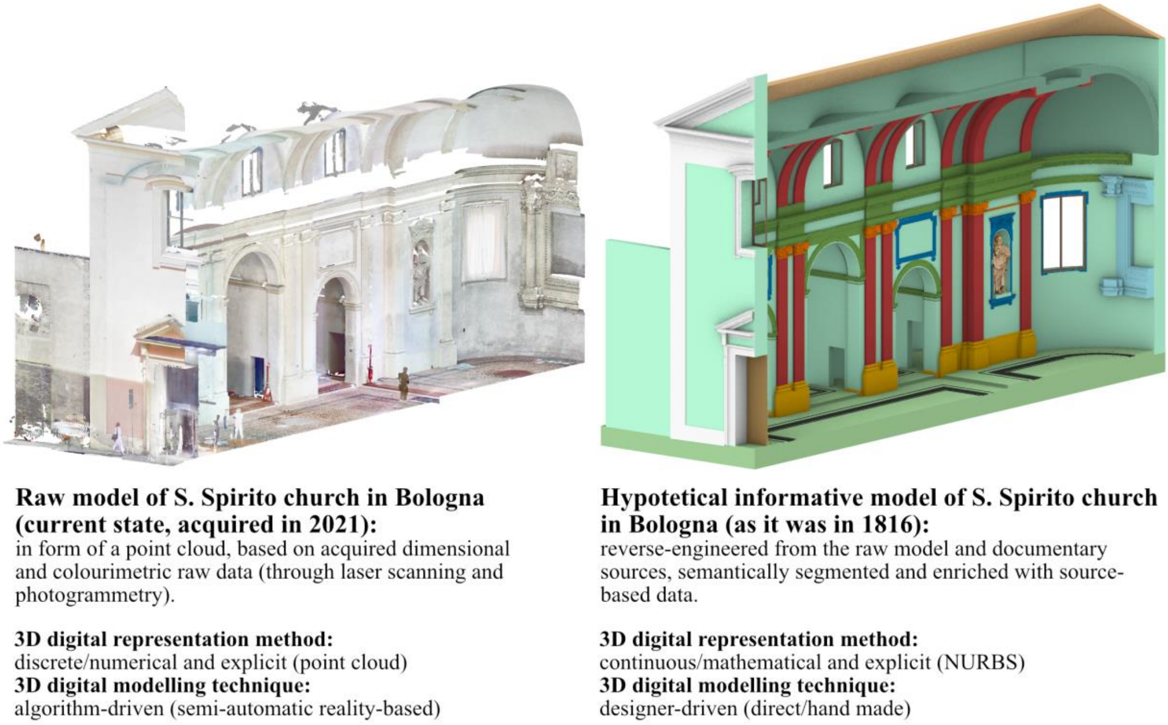

Figure 3. An example of the hypothetical virtual reconstruction of the S. Spirito Church in Bologna as it was in 1816. **Left**: Raw model. **Right**: Informative Model.

5. Refocused Terms: Digital Representation Methods and 3D Modelling Techniques

The last two terms analysed are *digital representation methods* and *3D modelling techniques*. To explain the difference between the former and the latter the typical classification of descriptive geometry can be used as the starting reference point. In fact, for some authors [34], the digital representation methods that are used today by computer applications to represent three-dimensional shapes in a three-dimensional virtual space are a direct addition to the *traditional representation methods* of descriptive geometry which were used to represent three-dimensional shapes into bidimensional media (e.g., paper). The traditional representation methods were as follows:

- *Double orthogonal projection*;
- *Axonometric projection*;
- *Perspective projection*;
- *Topographic terrain projection*.

The *digital* and *traditional representation methods* are defined in the CoVHer forthcoming glossary as follows: "Digital and traditional methods are sets of mathematical/geometrical rules developed to represent shapes, the former in 3D space, and the latter in 2D space".

The CoVHer forthcoming glossary, when referring to the 3D digital representation methods, also asserts that they concern "[…] the intrinsic mathematical/geometrical nature of the 3D models, namely they are the languages (or set of rules) that the software uses to represent shapes in a three-dimensional space".

Despite different *3D digital representation methods* existing, the most useful categorisation in the *hypothetical architectural reconstruction* field is the one that considers geometric continuity, which differentiates *continuous representation* (e.g., NURBS, Bézier, and spline) and *discrete representation* (e.g., mesh, point clouds, and voxels). On the other hand, *3D digital modelling techniques* are defined as "[…] the step-by-step processes to create 3D models. The 3D modelling technique describes the act of constructing the shapes […]".

Most digital drawing programs implement both the above *digital representation methods* but have a specific vocation or focus. Currently, there is no drawing software that is best in class for every task related to architectural drawing (e.g., for study sketching, technical drawing, executive drawing, building site planning, rendering, animation, etc.). In the current market, there are programs that are more devoted to continuous representation (e.g., Rhinoceros and Thinkdesign) and others more devoted to discrete representation (e.g., Blender, Autodesk 3Dmax, and Cinema 4D). The former computer programs are generally chosen by scholars interested in a rigorous geometric control of architectural design. Through these software packages, it is possible to construct, for example, a ruled surface or a developable surface and investigate their mean and Gaussian curvature point by point; or it is possible to draw polycentric or elliptical curves and use them as profile curves to generate 3D shapes.

Conversely, the CAD applications focused on discrete representation are more suitable for tasks such as organic modelling, rendering, animation, and others. These types of software packages mainly adopt numerical or polygonal representation. This *digital representation method* allows the operator to have better control over freeform sculptural shapes, shading, and soft deformation.

What is important to keep in mind is that the final image of a model realised through the discrete method might be identical to the image of the same model realised by using the continuous method; however, the nature of the two models is different, it influenced the process to generate the models and will affect the subsequent uses that these models could fulfil.

This distinction is also evident in traditional representation methods within descriptive geometry. For instance, what differentiates a perspective projection from an axonometric projection or a drawing using double orthogonal projections is not primarily the appearance of the final image—which, in rare instances, may even be identical—but rather the process employed to produce the drawing[1].

The double orthogonal projections are used to control and represent the dimensions and proportions of the architecture while the perspective projection is used to control and represent the formal perception of architectural space as viewed by human eyes. The awareness of this concept has profound implications about how to read and use the drawings, how to choose the proper *traditional representation method* based on the purpose of the drawing, and, analogously, how to read and use 3D models and how to choose the proper *digital representation method* based on the purpose of the 3D model.

3D digital modelling techniques, on the other hand, are independent of the *digital representation method* adopted, and very often the same modelling technique allows for obtaining discrete or continuous 3D objects.

Both terms *digital representation methods* and *3D modelling techniques* are often used in the scientific literature (e.g., Pottman et al. in 2015 [35]; Fuchs et al. in 2022 [36]); however, there is no official taxonomy because new ones often emerge. Furthermore, sometimes boundaries that divide one *3D modelling technique* and the other are blurry, and there could be overlapping and subcategories which would make it hard to define a rigid and universally valid taxonomy. However, to help the reader orient in this field, in this research, a provisional but synthetic and structured taxonomy that relates the *3D digital representation* methods and *3D modelling techniques* was proposed. These concepts are not always properly defined and shared in some scientific fields (e.g., computer graphics, mathematics, and descriptive geometry), and, consequently, not all scholars and professionals in the field of *hypothetical virtual architectural 3D reconstruction* use them properly and know the distinction between the two. This limits their conscious and proper use and might cause misunderstandings between scholars. Figure 4 presents a synthetic taxonomic diagram that classifies *digital representation methods* and *3D modelling techniques* in the context of hypothetical 3D virtual reconstruction of architecture.

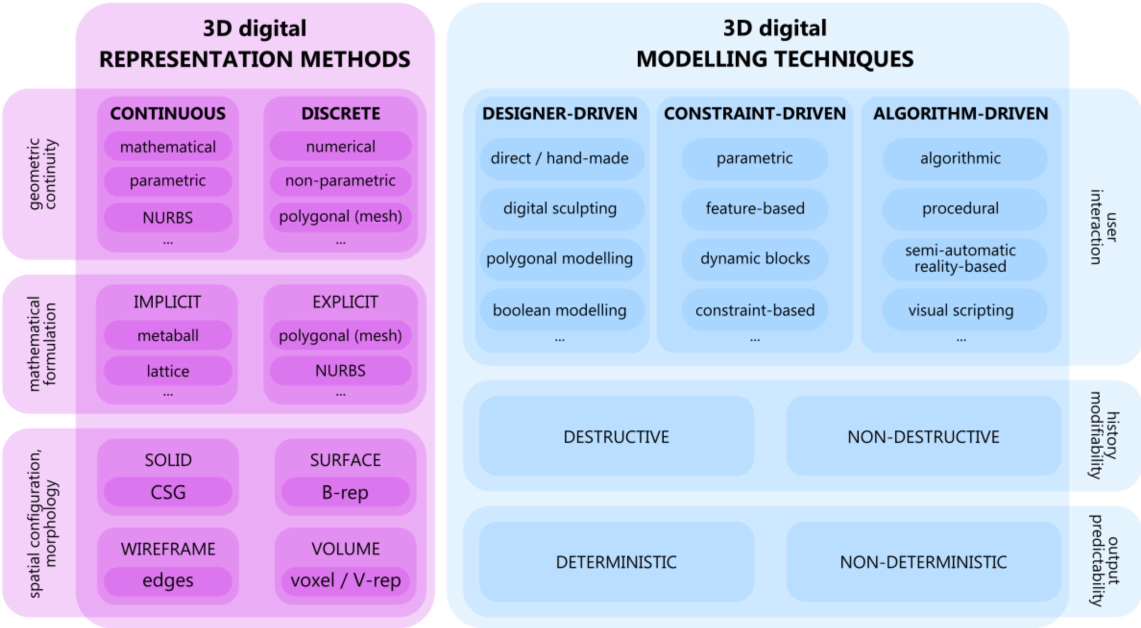

Figure 4. A simplified taxonomic scheme of the 3D Digital Representation Methods and 3D Digital Modelling Techniques.

6. Discussion and Future Work

The bibliographic references cited in this text were critically selected among a wider set of references gathered by Cazzaro in her PhD thesis [6]. Further references were consulted for this study (e.g., [37–47]) but were not discussed in detail in this paper in order to make the text smoother to read without loss of generality. The frequency of use [19,23,24,26–28,48–54] and the way the terms are used match the results already discussed in the text. While the current assessment already identifies key trends in the field and provides relevant insights into the use of terminology, the impact of the study could be improved by conducting an even more extensive investigation of a wider range of bibliographic references. As a future work, a more comprehensive but more synthetic overview of a wider set of references might be carried out.

7. Conclusions

The work presented in this paper concerns a small but significant part of the forthcoming glossary that is being developed in the context of the CoVHer project (expected date of publication: 2025), which aims to gather the most commonly used terms in the field and newly coined terms for those concepts that still miss a clear definition. In particular, in this paper, we analysed the use of the following six terms in the context of *hypothetical 3D reconstruction of architecture*: *reconstruction*, *uncertainty*, *raw model*, *informative model*, *digital representation methods*, and *3D modelling techniques*.

The term *reconstruction* refers to the process of digitally recreating or constructing a three-dimensional representation of an object, structure, or environment that may no longer exist or is inaccessible in its original form. It is the most used term among its alternative forms in the reference literature, however, it might be inaccurate or ambiguous in some contexts, thus the use of the variants *(re)construction* or *re-construction* is preferable in those cases where the object of study was never constructed in the first place (for example the design remained a project on paper and never physically built). In addition, to avoid ambiguities, it is preferable to pair the term *reconstruction* with a clarificatory adjective such as *virtual, 3D, digital, source-based, reality-based,* or *hypothetical,* when possible, to distinguish it from the *physical reconstruction* (of archaeological remains) as defined by ICOMOS.

The terms *uncertainty*, *reliability*, and *plausibility* are all suitable to be used to assess the subjectivity, inaccuracy, and incompleteness of the reconstruction. On the contrary, the term *probability* should not be used because it has a very precise mathematical meaning that does not match the meaning intended in our field.

The terms *informative model* and *raw model* are not popular terms in the field of *hypothetical 3D reconstruction*; however, these concepts need a clear naming since they are conceptually different and require different creation processes and uses. The *informative model* is an *information-enriched model* where the relevant information is made available and accessible, while the *raw model* is a discrete model that comes from *raw data* and embeds only metric and colourimetric information, and no additional interpretative information is added. The proposed definitions aim to fill the terminological and conceptual gap that was observed in the field after the assessment presented in this research.

3D digital representation methods and *3D modelling techniques* are terms used in various scientific fields (e.g., computer graphics, mathematics, descriptive geometry, etc.) but in the context of hypothetical 3D architectural reconstruction are sometimes misused. The former concerns the mathematical/geometrical nature of the models and the latter deals with the construction process. This proposed taxonomic scheme aims to help users understand their differences, to use them properly, and to avoid ambiguities.

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Note

1. For instance, when a cube is projected onto a plane parallel to one of its faces, the result is a square, regardless of whether an axonometric or perspective projection is employed. The same principle applies to perspective sections, where the sectioned area maintains its true shape. A notable example where an axonometric projection closely resembles a perspective projection occurs when the centre of projection is placed at a significant distance from the object. In this scenario, the projection rays become nearly parallel, rendering the projection visually indistinguishable from an axonometric view.

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