

**Hertziana Studies**  
in Art History



**BIBLIOTHECA HERTZIANA**  
MAX PLANCK INSTITUTE  
FOR ART HISTORY

# Visualizing Complexities

Practices and Heuristics of Digital Models in Art History

Edited by Nicola Camerlenghi, Tanja Michalsky & Elisabetta Scirocco



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*Editors*

Tanja Michalsky & Tristan Weddigen

*Managing Editor*

Elisa Bastianello

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# Contents

7

*Tanja Michalsky, Nicola Camerlenghi & Elisabetta Scirocco (eds.)*

Introduction

13

*Giacomo Landeschi*

What is a 3D Model and Why Do We Model?  
Some Reflections Built Upon Archaeological  
Case Studies

19

*Lex Bosman*

The Fourth-Century San Giovanni in  
Laterano in the Twenty-First Century: Digital  
Approaches and Reconstruction

29

*Angelica Federici*

Visualizing Medieval Rome. The Basilica of  
Sant'Agnese fuori le mura

37

*Giulia Bordi*

Visualizing Medieval Rome. Digital Storytelling  
about the City and its Churches

47

*Nicola Camerlenghi*

Virtual St. Paul's Basilica 2.0. Developing an  
Open Educational Resource

55

*Fabrizio Nevola, Donal Cooper, Chiara Capulli,  
Luca Brunke*

Bringing Together Geospatial Information, 3D  
Modeling, Experiential Learning, and Research  
Data. The Ospedale degli Innocenti: A Case  
Study of the Florence 4D Project

63

*Andrea Giordano, Paolo Borin*

Visualizzare la complessità: Fondamenti BIM  
per il progetto *Visualizing Cities*

71

*Ruggero Longo*

Digitizing Cultural Heritage. Methodology,  
Potential, and Limits of the Palermo Royal  
Palace Project

83

*Piotr Kuroczyński*

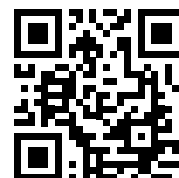
Serious 3D in Art and Architectural History

# Abstract

Tanja Michalsky, Nicola Camerlenghi  
& Elisabetta Scirocco

## Introduction

keywords – 3D Models, History of Art, History of  
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*Digital models help to visualize complexities heretofore unapproachable through more conventional methods of art history. The seductive qualities of these models—which tend to transcend those of words—are increasingly untempered by their digital and thus potentially alien nature. Modeling technologies—including, but not limited to, Gis, photogrammetry, laser scanning, vr, ar, or BIM—can assist not only in visualizing, but also in measuring, reconstructing and, thus, analyzing works of art and architecture. With the use of these tools come both challenges and opportunities. Furthermore, the interdisciplinarity of digital approaches invites diverse conventions, and as the media used for digital visualizations are adopted across disciplines and their hermeneutics contested, the resulting epistemes are naturally hybrid. This introduction presents the contributions contained in the volume and poses some of the most pressing questions about the process of visualizing artistic complexities.*

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## Introduction

*Tanja Michalsky  
Nicola Camerlenghi  
Elisabetta Scirocco*

These are exciting and promising times for scholars in the disciplines of Art History, Architectural History, Archaeology, and Heritage Conservation, who can choose to avail themselves of increasingly sophisticated digital models to expand their respective fields. The shared usage of digital models fosters new connections between these disciplines as well as with the field of Computer Science. The digital models that help scholars to visualize and analyze complexities heretofore inaccessible with more conventional approaches are the subject of this publication and of the conference from which it originated.<sup>1</sup>

Specific modeling technologies include, but are not limited to, databases, digital maps, GIS, photogrammetry, laser scanning, virtual reality, augmented reality, architectural modeling, and Building Information Modeling (BIM and HBIM). Several, but not all these approaches are addressed in this volume. The emphasis is on three-dimensional, spatial models, which have benefitted from increasing sophistication. Much of their power derives from the intermediality they enable. To wit, a GIS project can collect and interpret not only points, lines, and polygons with geographic co-ordinates, but also a variety of textual or visual metadata associated with the mapped features. Similarly, a building scanned by photogrammetry and by laser can become a BIM model that carries all sorts of structured data used to justify the components of a model and to verify its scientific value. The variety of digital techniques used to generate models explains the challenges of achieving a common grammar and the lack of shared

conventions. Additionally, each modeling technology has its own set of demands regarding the model's afterlife, its interoperability, and re-usability. Perhaps the varying standards that we find in traditional publications, might serve as inspiration for scholars to recognize serious modeling work and learn to adjudicate variance in quality.

Why this turn to 3D models in our disciplines? Models can assist a scholar not only in visualizing, but also in plotting, organizing, reconstructing, measuring, and, therefore, analyzing a work. Of course, the same could be said for models in the sciences, but for the benefit of our argument we restrict ourselves to treating works of art and architecture. Particularly in the case of sculpture and architecture, given their inherent spatial nature, it is indispensable to do research and to think in 3D; indeed, one might feel obliged to explain and demonstrate such research in inherently spatial terms.

The use of more conventional media, such as fixed viewpoint drawings or even textual descriptions, to examine an object or space offers greater opportunities to leave uncertainties unaddressed. That which is unknown can remain undrawn or unwritten. In contrast, many of the 3D models addressed here (not only because they are interactive) "force" scholars to consider every possible aspect of an object or of a space. Moreover, they invite scholars to show as well as to test their hypotheses. This approach fosters a more holistic interpretation of the thing being studied than conventional media, behind which uncertainties can hide. All

<sup>1</sup> <https://www.biblhertz.it/3051429/visualizing-complexities-practices-and-heuristics-of-digital-models-in-art-history>.

told, interactive 3D models are a more demanding and powerful heuristic with which to tackle a work of art or architecture.

The practice of virtual anastylosis answers the need to (re)compose forms from fragments and fill lacunae, all the while balancing the desire for aesthetic appeal against scholarly demands for ‘unembellished’ truth. Given the allure of realism—particularly among a broader audience—it is crucial to devise digital models that disclose both fact and uncertainty, lest a proposal initiated as hypothetical become accepted as truth outside its original context or over the course of time. The seductive qualities of a virtual model—which tend to transcend those of words—are increasingly unhindered by technical shortcomings. Uncanny verisimilitude is achievable, if desired. But as more and more scholars adopt, develop, and apply this tool, challenges arise.

We must learn to harness 3D models to display levels of interpretative complexity and argumentation required of historic research. Because we live in a world where images are a principal vehicle by which we convey content, they are fetishized and ascribed inordinate power, instead of acknowledged for their ambivalence and ambiguity. We would do better to consider 3D models as a visualization of a hypothesis or idea. Along these lines, some scholars propose abandoning the term “reconstruction,” which is often synonymous with 3D models.<sup>2</sup> Some prefer the form “(re)construction” to signify “the theoretical nature of the research being undertaken, reinforcing the hypothetical nature of the models created.”<sup>3</sup> Some others prefer to emphasize the hypothetical, interlocutory and provocative value of models as an invitation for discussion among equals.<sup>4</sup> What is a model, but a creative synthesis based on interpretation and intuition? Indeed,

3D models are a scientific argument expressed through this specific medium. As with textual arguments or the drawings and plans often used by scholars, 3D models are based on research carried forth through specific methods.

Because, in our opinion, 3D models are explorative research tools and not the final aim, they deserve the same skepticism we apply to every scientific argument. This is an alternative to placing them on a pedestal on account of their seductive—and thus unquestioned—imagery. Without diminishing the importance of documentation and demonstrating the method for an argument, nor the fundamental importance of the findability, accessibility, interoperability, and reuse of the digital assets,<sup>5</sup> our workshop roundtable also raised the question if it is necessary to feed the “obsession” for paradata and the “sense of guilt” of those who produce models for which the display of paradata is not given the same time, attention (and thus money), as the model itself.<sup>6</sup> After all, a similar level of scientific rigor and assumption of due diligence granted a scholar communicating through traditional media should be accorded to the scholar creating (and explaining the reasons underlying) a 3D model.

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The editors of this volume hail from the discipline of art history—as also most of the authors. Those engaged in that discipline recognize that the technologies we are writing about have been the purview, for some time now, of heritage experts, archaeologists, architects, and preservationists. Indeed, the interdisciplinarity of digital approaches invites diverse conventions, and as the media used for digital visualizations are adopted and their hermeneutics contested by art historians, archeologists,

2 The most common usage implies that every reconstruction is a working hypothesis. See, for instance, Rodríguez-Gonzálvez *et al.* 2017.

3 Schreibman/Papadopoulos 2019.

4 The research group *Rome Transformed* has proposed thinking of these models as provocations: “We term our visualisations ‘provocations’, because while they are digitally rebuilt with software that ensures that they are structurally viable and represent the team members’ best

efforts to understand the data, we stress that visualisations of ancient buildings and landscapes can never be absolutely accurate. The models are generated to provoke a response, to facilitate challenge from colleagues on any point of detail or underpinning assumption. We believe that the discipline of producing the best models we can helps us to test interpretations. Accordingly, these visualisations should not be regarded as definitive or final products,

but rather advanced visual prompts to advance the testing of hypotheses.” See: <https://rometrans.ncl.ac.uk/rtsciedoc/>.

5 The FAIR Principles: <https://www.go-fair.org/fair-principles/>.

6 By “paradata” we intend the data associated with a model including the primary and secondary sources used to generate it.

preservationists, and cultural heritage experts, the resulting epistemes are naturally hybrid.

This is evident by the variety of authors and approaches collected here. The contributions in this volume at once offer case studies, celebrate, problematize, and call into question the adoption of digital models across various humanistic disciplines. The article by Giacomo Landeschi<sup>7</sup> combines 3D models and Geographical Information Systems (GIS) to evaluate the symbolic values connected to an architectural space from ancient Pompeii. In collaboration with the *Lateran Project*, Lex Bosman<sup>8</sup> employs laser scans and Ground Penetrating Radar (GPR) research to generate a 3D reconstruction of Rome's Basilica of St. John at the Lateran, which, in turn, encourages new hypotheses and prompts discussion about colors, materials, lighting, and atmospheric elements. Another Roman Basilica, St. Paul's Outside the Walls, is the subject of Nicola Camerlenghi's<sup>9</sup> efforts to develop an intuitive, peer-reviewable digital reconstruction, which delivers content through embodied experiences and exploratory learning. Fabrizio Nevola, Chiara Capulli, Donal Cooper, and Luca Brunke<sup>10</sup> demonstrate how digital tools help to investigate the role of the Brunelleschi's Ospedale degli Innocenti in the social and artistic life of Renaissance Florence from the wider urban context down to individual decorative elements in the building interior. Andrea Giordano and Paolo Borin<sup>11</sup> present the *Visualizing Cities* project, a collaborative, multi-institutional effort to revolutionize research and teaching by interpreting, representing, and fostering the understanding of cities through digital technologies. After years of recontextualizing the wall paintings, mosaics, and panel paintings of medieval Rome's sacred buildings through digital technologies, Giulia Bordi<sup>12</sup> presents a new venture—EHEM (Enhancement of Heritage Experiences: The Middle Ages. Digital Layered Models of Architecture and Mural Paintings over

Time), which develops virtual reconstructions of medieval artistic heritage as an instrument for researchers, restorers, heritage curators, and tourists. Angelica Federici<sup>13</sup> focuses on yet another Roman Basilica, that of Sant'Agnese fuori le mura, in a virtual reality project that combines established tools of scholarly enquiry with photogrammetry/point cloud, CAD modeling and virtual reality to develop an open and discoverable model that is not as much a product, but a research tool. Based on the experience of the Palermo Royal Palace Project, Ruggero Longo<sup>14</sup> presents the epistemological potentials of digital models as dynamic repositories for vast amount of research and conservation data, with a critical reflection about issues of accessibility and sustainability over time. Piotr Kuriczynski's<sup>15</sup> contribution addresses reconstructive source-based 3D models as research tools, from the experience developed in the field of contemporary engineering and urban planning; he calls for the definition of shared standards and the affirmation of what he defines "serious" 3D models of historic urban spaces and architecture.

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As with any evolving practice, there remain a series of still open questions: What are the benefits of adopting an ontology that drives workflows and standardizes methods and protocols? Much effort has been made to formulate common paths (for example, the 2006–2009 London Charter for the computer visualization of cultural heritage or the 2011 Sevilla Principles of virtual archaeology),<sup>16</sup> but these are now in the remote past by digital standards, and new stakeholders are at play. Another unresolved matter is how best to combine textual and visual data with digital 3D models to enable users to better engage with the specificity of historical sources and the heuristics of the digital result—essentially what is the equivalent of a footnote or endnote for 3D models?<sup>17</sup> This is at the core,

7 Landeschi 2023.

8 Bosman 2023.

9 Camerlenghi 2023.

10 Nevola et al. 2023.

11 Giordano/Borin 2023.

12 Bordi 2023.

13 Federici 2023.

14 Longo 2023.

15 Kuroczyński 2023.

16 <https://www.londoncharter.org/index.html>; <http://sevilleprinciples.com>

17 A rather visual and spatial way of cataloging visual evidence is evident in the Urban History 4D projects, with the developed case study of Dresden: <https://4dbrowser.urbanhistory4d.org/>. For annotating

images associated with models, see the "Scientific Documentation for Decisions. The Reconstruction Argumentation Method" developed by Marc Grellert and Mieke Pfarr-Harfst at the Technische Universität, Darmstadt: <http://www.sciedoc.org/>.

not only of the pedagogic potential of these models, but also central to evaluate the validity and reliability of digital models and visualizations in a peer-reviewed fashion. We express optimism that as more scholars develop 3D models, there will be a larger community willing and able to offer constructive peer reviews and paradigmatic examples will emerge.

As a cutting-edge tool, a 3D model is often on the frontlines of teaching and popularizing our disciplines, particularly among younger generations. Indeed, we must consider the training of future scholars, without losing the richness of traditional approaches. But new generations should acquire the skills necessary to integrate the sorts of models treated here into their research and teaching. And if not teach the competences to create basic models themselves—a task that may remain a collaborative effort—we should at least convey the methodological and epistemological concepts at the heart of such digital approaches to the arts.

Finally, there is the pressing concern of our time—sustainability—and its role in the production and retention of digital models. While not quite the burning of the Library at Alexandria, the start of 2021 brought one of greatest data losses in history. It is seldom noted and lamented that when Adobe Flash plug-ins were no longer being supported by web browsers, all websites that operated with Flash lost their interactive capabilities, which for many was their lifeline—it is how they communicated data to their users and how users interacted with the data.<sup>18</sup> Without an eye toward sustainability, websites and digital publications that include 3D models risk sliding toward a similar form of digital oblivion.<sup>19</sup>

An additional challenge to future proofing is compounded by our growing awareness of the climatological impact of data creation, storage, and maintenance required of digital projects.

While art historians are generally trained in the tradition of single-authored research, digital modeling projects tend to be collaborative, transdisciplinary ventures on account of the specific expertise required for their development. It is not only a matter of agreeing on defining the output of representation and the underpinning data: before that, it also requires self-critical reflection and questioning of different disciplinary perspectives. Digital 3D models create meeting points between disciplines where shared research and technology problems are addressed so that new questions arise. Developed outside the comfort zone of one's own discipline, such models create a space for theoretical, methodological, and epistemological opportunities, perhaps more so than an actual physical space. Accordingly, we might consider the 3D model as a “dynamic and rhizomatic knowledge site”<sup>20</sup> across the disciplines involved. Hence, the inherent challenge for art historians to both explore and expand a discipline, which on account of its transdisciplinary nature has few defined boundaries.

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<sup>18</sup> To take examples related to Rome, the Nolli website and the Waters of Rome website, each of which used maps to convey information about the Eternal City were essentially boarded up and rendered inaccessible. Both have since had to secure thousands of dollars of funding to represent themselves in a 2.0 version. Nolli website has been recently republished (<https://web.stanford.edu/group/spatialhistory/nolli/>),

while Waters of Rome will soon be.

<sup>19</sup> The question of sustainability as well as that of shared standards and transparency of paradata were topics for discussion of the recent conference *The Future of the Virtual Past. New Directions and Shared Standards in the Reconstruction of the Medieval-Renaissance Built Environment* (Cambridge, Jesus College, 27 June 2022), organized by Donal Cooper and Morgan Ng with Tanja

Michalsky, Elisabetta Scirocco, Roberto Cipolla, and Deborah Howard <https://www.futureofthevirtualpast.com/> (WBM <https://web.archive.org/web/20220712202657/https://www.futureofthevirtualpast.com/>).

<sup>20</sup> The definition is applied by (Schreibman/Papadopoulos 2019, but with reference to Digital Scholarly Editions, which they propose as possible models for the publication of 3D (re)constructions.

## References

- Bordi 2023  
Giulia Bordi, "Visualizing Medieval Rome: Digital Storytelling About the City and its Churches", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0205>.
- Bosman 2023  
Lex Bosman, "The Fourth-Century San Giovanni in Laterano in the Twenty-first Century: Digital Approaches and Reconstruction", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0203>.
- Camerlenghi 2023  
Nicola Camerlenghi, "Virtual St. Paul's Basilica 2.0: Developing an Open Educational Resource", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0206>.
- Federici 2023  
Angelica Federici, "Visualizing Medieval Rome: The Basilica of Sant'Agnese fuori le mura", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0204>.
- Giordano/Borin 2023  
Andrea Giordano and Paolo Borin, "Visualizzare la complessità: Fondamenti BIM per il progetto Visualizing Cities", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0208>.
- Kuroczyński 2023  
Piotr Kuroczyński, "Serious 3D in Art and Architectural History", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0210>.
- Landeschi 2023  
Giacomo Landeschi, "What is a 3D Model and Why Do We Model? Some Reflections Built Upon Archaeological Case Studies", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0202>.
- Longo 2023  
Ruggero Longo "Digitizing Cultural Heritage: Methodology, Potential and Limits of the Palermo Royal Palace Project", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0209>.
- Nevola et al. 2023  
Fabrizio Nevola, Donal Cooper, Chiara Capulli and Luca Brunke, "Bringing Together Geospatial Information, 3D Modeling, Experiential Learning and Research Data: The Ospedale degli Innocenti: A Case Study of the Florence 4D Project", in *Visualizing Complexities: Practices and Heuristics of Digital Models in Art History* ed. Nicola Camerlenghi, Tanja Michalsky, Elisabetta Scirocco, 2023, Doi: <https://doi.org/10.48431/hsah.0207>.
- Rodríguez-González et al. 2017  
Pablo Rodríguez-González, Angel Luis Muñoz-Nieto, Susana Del Pozo, Luis Javier Sanchez-Aparicio, Diego Gonzalez-Aguilera, Laura Micoli, Sara Gonizzi Barsanti, Gabriele Guidi, Jon Mills, Karolina Fieber, Ian Haynes and Beata Hejmanowska, "4D Reconstruction and Visualization of Cultural Heritage: Analyzing our Legacy Through Time", *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, vol. XLII-2/W3, (2017), pp. 609–616. Doi: <https://doi.org/10.5194/isprs-archives-XLII-2-W3-609-2017>
- Schreibman/Papadopoulos 2019  
Susan Schreibman and Costas Papadopoulos, "Textuality in 3D: Three-Dimensional (re)Constructions as Digital Scholarly Editions", *International Journal of Digital Humanities*, vol. 1, (2019), pp. 221–233, Doi: <https://doi.org/10.1007/s42803-019-00024-6>.