

Digital Technologies and New Evidence in Architectural History

CAROLINE BRUZELIUS

Duke University



Architectural historians, rejoice! We have entered an age in which our discipline can be immeasurably assisted, enriched, and sometimes transformed by the advent of accessible, low-cost, and increasingly user-friendly technologies. These tools can enable us to identify evidence that was not previously visible or accessible, synthesize and map geographically and chronologically referenced data points with precision, fuse databases to combine information from secondary sources that in turn generate new types of data, and test hypotheses through 3-D models and animations. We can stimulate new questions about buildings, places, and spaces with mapping and measuring tools. In this short summary, I will mention some examples of digital projects in which new evidence has been discovered or combined in new ways to illuminate questions in architectural history. The potential tools include the following:

- Ground-penetrating radar (GPR), which under the right conditions permits “vision” through the earth or through pavements to foundations and other kinds of underground information. This new evidence can be used to generate rationalized reconstructions, such as the hypothetical reconstruction of the choir screen of Santa Chiara in Naples (Figure 1).
- LiDAR (light detection and ranging), a form of remote sensing, and drone imagery, both of which at present are used primarily by archaeologists.¹ These are emerging as important tools for landscape and garden studies.²
- 3-D laser scanning, which can be used to produce exact recordings of the dimensions and materials of extant monuments (Figure 2).
- Photogrammetric 3-D models of buildings, sites, and objects, which can be generated with ordinary cameras (including those on portable devices).
- Geo-referenced database software that records archival or historical information with absolute geolocated precision. By combining published scholarship into databases, researchers can map geolocations and generate new forms of knowledge to produce synthetic narratives (Figure 3).
- Historic building information modeling (HBIM) software, which can embed historical information within 3-D scans and photogrammetric models.³
- Mapping technologies that enable scholars to trace development and chronologies, for example, in the use of structural concepts and materials.⁴
- Animations that narrate the construction or development of places or spaces unfolding in time, instead of in a series of sequential, crystallized, or “frozen” snapshots. Such animations can be viewed online and through apps on mobile devices.

Critical to many of these efforts is the availability of open-source software and the Creative Commons license. These mean that scholars can build on existing data sets and technologies to reorient research questions and generate recombinations of existing data and software frames.⁵ Technologies can also be used to narrate the history of a building, a site, or a city over time, and the storytelling component can itself spur new reflection.

Archaeology often establishes the groundwork for other disciplines, and especially for architectural historians. As a

Journal of the Society of Architectural Historians 76, no. 4 (December 2017), 436–439, ISSN 0037-9808, electronic ISSN 2150-5926. © 2017 by the Society of Architectural Historians. All rights reserved. Please direct all requests for permission to photocopy or reproduce article content through the University of California Press's Reprints and Permissions web page, <http://www.ucpress.edu/journals.php?p=reprints>, or via email: jpermissions@ucpress.edu. DOI: <https://doi.org/10.1525/jсах.2017.76.4.436>.

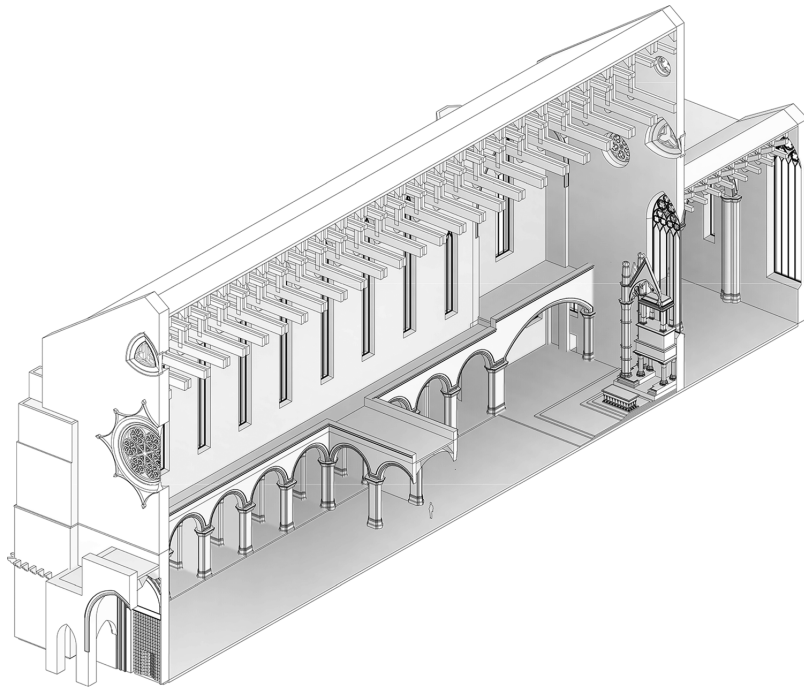


Figure 1 Church of Santa Chiara, Naples, 3-D model with a reconstruction of the choir screen (created by Andrea Basso, Elisa Castagna, and Lucas Giles based on ground-penetrating radar analysis by Leopoldo Repola of the University of Suor Orsola Benincasa, Naples, and a laser scan produced by Emanuela de Feo, University of Salerno).

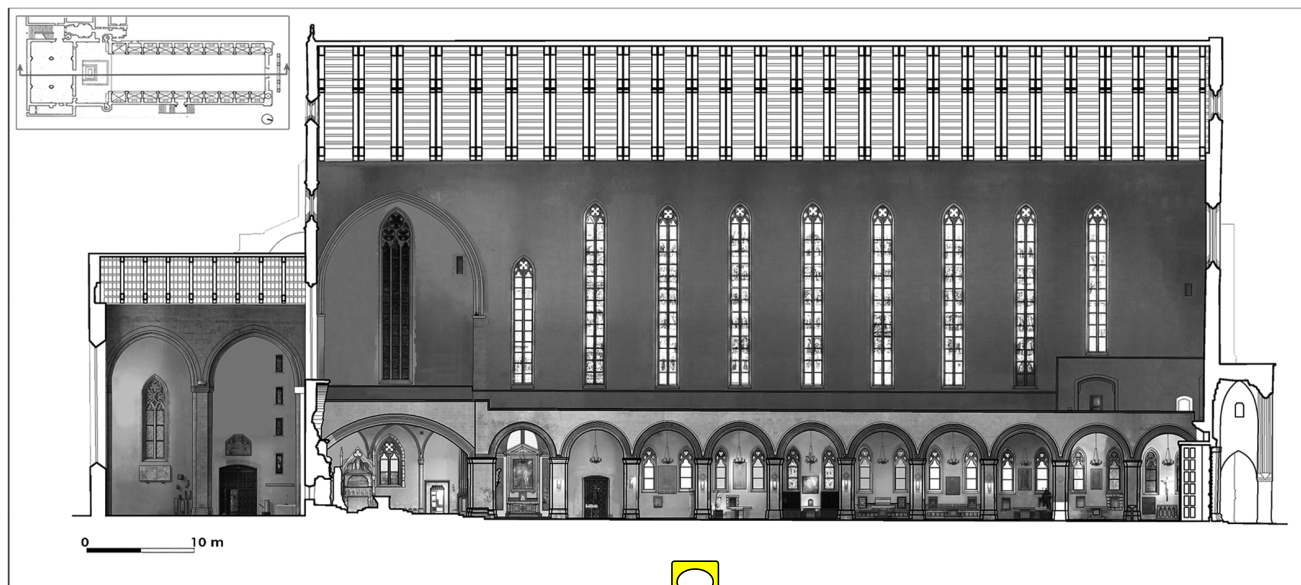


Figure 2 Church of Santa Chiara, Naples, laser scan (produced by Emanuela de Feo, University of Salerno).

result, we can step into a wide range of tested software and integrate existing documentation with new evidence to develop and present research questions.⁶ Drones and LiDAR have been particularly revolutionary in opening up new avenues and new evidence, perhaps most notably for ancient sites in Mesoamerica and Greco-Roman antiquity.

Although the software has become increasingly user-friendly, digital work usually requires and naturally encourages collaboration across disciplines.⁷ Because collaboration requires dialogue and the exchange of knowledge, this process

can enrich both research questions and outcomes. The Visualizing Venice project is an example of a long-term collaboration that combines the work of historians, architects, engineers, and experts in media studies and mobile app development.⁸ This cross-disciplinary approach has not only generated new knowledge through the creation of maps and 3-D models but also laid the groundwork for exhibitions, mobile applications, and websites. In Visualizing Venice, each part of the project involves fluid and international “regrouping” to create teams with the appropriate skills. For example, in connection with an



Figure 3 Athenian Agora, GIS overlay of sequential changes (created in Mapbox by Alina Taalman, Alexis Smith, Sheila Dillon, Timothy Shea, and Nikos Gkiokas; Digital Athens, Wired! Digital Art History & Visual Culture, <http://www.dukewired.org/projects/digital-athens>). See *JSAH* Online for full-color version.

exhibition at the Palazzo Ducale curated by Donatella Calabi to commemorate the five hundredth anniversary of the Venetian Ghetto, an architect (Paolo Borin from Padua), an expert in database-driven spatial media (Victoria Szabo at Duke University), and an architectural historian (Ludovica Galeazzo, research fellow at Duke) developed a mobile application that could guide visitors through the Venetian Ghetto and its buildings.⁹

Digital work is all about evidence. The evidence in question may be revealed as the result of a recombination of existing information from secondary sources through a geographic information systems (GIS) database or mapping platform, such as in the cases of the Digital Athens project (see Figure 3) and Paul Jaskot's database on German architecture between the two world wars.¹⁰ These projects fuse evidence “already under our eyes” to generate new knowledge and prompt hitherto unasked questions, such as questions about the relationships between architectural design and large-scale engineering projects (hydraulic

dams, for example), or the shifting use of space over time in the Athenian Agora.

“Already under our eyes” also applies to the capacities of digital tools to create precise records of structures through laser scans and photogrammetry. This is particularly important for historic buildings, such as the church of Santa Chiara in Naples, which was profoundly modified or reconstructed on several occasions, most notably after World War II (see Figures 1 and 2). The data captured by the precise recording of historic structures can help unfold construction chronologies and changes in design, moving our discipline away from formalist criteria (the evolution of base profiles, for example) toward a more evidence-based analysis of construction. With better data, we have better evidence.

And new types of evidence are critical for historical interpretation. Digital work is a *modus concipiendi*—it presents a new way of thinking about old topics and well-discussed questions. As Sara Galletti demonstrates in a recent article on the development of stereotomy in the Mediterranean, mapping

architectural construction phenomena can elucidate important research questions and change the parameters of a discussion.¹¹

The creation of 3-D models can sometimes transform our capacity to understand structures and resolve issues of plausible historical design in buildings that are highly modified or no longer extant. For historians of the distant past, the creation of 3-D models based on GPR, LiDAR, and other types of scans offers a method of intellectual reasoning in which the architectural historian must grapple with testing plausible solutions (see Figure 1). Through the use of mobile applications and websites, these 3-D models, in turn, can become highly effective means of narrating historical process: change and time in places and spaces.

What's not to like here? For me, as a scholar who was trained decades ago in the formalist tradition of architectural analysis, the potential of digital technologies has been revolutionary. But of course nothing is simple, and there are also challenges, questions, and areas of ambiguity. In practical terms, there is the need to encourage academic institutions to provide laboratory spaces for hardware and software, with staff/collaborators who can train faculty and students in the use of technologies, help select appropriate software, and assist in project management.¹² Humanistic disciplines, and especially architectural history, need to acknowledge and support the critical importance of engaging with new technologies, while at the same time maintaining the skills and expertise that we have traditionally needed to do our work. And both in the United States and abroad, academic institutions need to find ways to acknowledge collaboration and digital work as equal to traditional publication for tenure and promotion.

There are also scholarly questions about the interpretation and use of digital work, its implications, and its dangers and pitfalls. These will surely provide fodder for debate and discussion as we refine our methods and develop the parameters of research and presentation. Given that the capacities of digital technologies are constantly changing and expanding, these will be especially complex tasks. But for the fields of urban, environmental, and architectural history, for the study of structures, places, and spaces in time, digital technologies represent an almost miraculous advance. This is a brave and wonderful new world, so: *avanti con brio!* But *avanti* with thoughtfulness, care, and a lot of hard work.

Notes

1. See, for example, Arlen F. Chase, Diane Z. Chase, Christopher T. Fisher, Stephen J. Leisz, and John F. Weishampel, "Geospatial Revolution and Remote Sensing LiDAR in Mesoamerican Archaeology," *Proceedings of the National Academy of Sciences* 109, no. 32 (7 Aug. 2012), 12916–21, <http://www.pnas.org/content/109/32/12916.full> (accessed 31 July 2017).

2. See Ericka Witcher and Patrick Griffith, "Remote Sensing as a Botanic Garden Tool," *Arnoldia* 69, no. 1 (July 2011), 23–32, <http://arnoldia.arboretum.harvard.edu/pdf/articles/2011-69-1-remote-sensing-as-a-botanic-garden-tool.pdf> (accessed 31 July 2017).

3. See the work done on the Church of the Eremitani in Padua by Andrea Giordano and his colleagues, "The Eremitani Church in Padova: Survey, Representation and Preservation Project," <https://www.youtube.com/watch?v=JeWGlgiAgMg> (accessed 31 July 2017); and Culture Containers: A Project for the Cultural Spreading in Padua, <http://cult.dicea.unipd.it/cult/home> (accessed 31 July 2017).

4. See Sara Galletti, "Stereotomy and the Mediterranean: Notes toward an Architectural History," *Mediterranea: International Journal on the Transfer of Knowledge* 2 (2017), 73–120.

5. See Digital Athens, a project initiated by Sheila Dillon with the collaboration of Timothy Shea and Nikos Gkiokas, at Wired! Digital Art History & Visual Culture, <http://www.dukewired.org/projects/digital-athens> (accessed 31 July 2017). See also Digital Athens at Esri, <https://www.arcgis.com/apps/MapSeries/index.html?appid=5688f3fdc6d84d6b9a492f8ce9b6b930> (accessed 31 July 2017).

6. See, for example, the Stanford Geospatial Network Model of the Roman World, <http://orbis.stanford.edu> (accessed 31 July 2017); the Digital Atlas of Roman and Medieval Civilizations at Harvard, <https://darmc.harvard.edu> (accessed 31 July 2017); and the University of North Carolina's Barrington Atlas of the Greek and Roman World, created by the Ancient World Mapping Center, <http://awmc.unc.edu/wordpress> (accessed 31 July 2017). I will be using the maps of the Ancient World Mapping Center to generate maps for the diffusion of architectural forms and artists' itineraries in the Kingdom of Sicily Image Database, <http://kos.aahvs.duke.edu/index.php> (accessed 31 July 2017).

7. An example is the collaborative research of Paul Jaskot and Anne Knowles, which has produced numerous GIS maps. See "Holocaust Geographies Collaborative," Spatial History Project, Stanford University, <https://web.stanford.edu/group/spatialhistory/cgi-bin/site/project.php?id=1015> (accessed 31 July 2013). Jaskot is a professor of art history and director of the Wired! lab at Duke University, and Knowles is a professor in the Geography Department at Middlebury College.

8. Participating in the Visualizing Venice project are Duke University, the Engineering and Architecture Department of the University of Padua, and the Istituto Universitario di Architettura di Venezia. See the project's website, <http://www.visualizingvenice.org/visu>.

9. On the exhibition, see "Venice, the Jews and Europe, 1516–2016," Palazzo Ducale website, <http://palazzoducale.visitmuve.it/en/mostre-en/archivio-mostre-en/major-exhibition-dogespalace/2016/05/17279/venice-the-jews-and-europe> (accessed 31 July 2017). On the mobile app, see Victoria Szabo, Paolo Borin, and Ludovica Galeazzo, "Ghett/App," Wired! Digital Art History & Visual Culture, 2016, <http://www.dukewired.org/projects/ghettapp> (accessed 31 July 2017), and the GuidiGO software website at https://www.guidigo.com/Tour/Italie/Venise/Ghett-APP/iHuiQo6s_kk?lg=en (accessed 31 July 2017).

10. See Paul B. Jaskot and Ivo van der Graaff's article in this issue, "Historical Journals as Digital Sources: Mapping Architecture in Germany, 1914–24."

11. Galletti, "Stereotomy and the Mediterranean."

12. The Wired! lab at Duke University, which I directed until January 2017, integrates experimentation in digital technologies for research with a commitment to teaching and training students, from first-year undergraduates through the PhD and postdoctoral levels, through courses and workshops (see <http://www.dukewired.org/research>). Wired! also has participated in and/or generated exhibitions, interactive museum displays, tutorials for digital tools, and research collaborations.