

Hertziana Studies
in Art History



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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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HUMANITIESCONNECT

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Abstract

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



keywords – Digital art history, 3D models, CIDOC CRM
ontology, Ospedale degli Innocenti Florence, Geodata

Florence 4D draws on the principal spatial toolset for digital art history – 3D/Augmented Reality, GIS, and GPS-enabled mobile usage – to research works of art within their architectural and urban context, while ensuring access to underpinning evidence through a structured database. These approaches are brought together in Florence 4D's website, which allows researchers to explore material through a range of interfaces: maps, 3D models, locative AR apps and a database structured using the CIDOC CRM. Through guided navigation of the website, this short contribution considers a case study of the Ospedale degli Innocenti, Brunelleschi's famous foundlings' hospital, to demonstrate how digital tools can help us investigate the institution's footprint in the social and artistic life of Renaissance Florence at a variety of scales, from the wider urban context right down to individual decorative elements in the building interior.

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

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Chiara Capulli
Luca Brunke*

Introduction to the Florence 4D Project

Florence 4D adopts digital art history approaches to deliver a paradigm shift in how context-based research on art and architecture might be delivered through the integration of spatial methodologies, especially mapping and 3D visualization.¹ The project focuses on the well-studied city of Florence, to offer a new approach – drawing where possible on existing data – that favors diachronic histories over previously prevalent linear narratives. Our project workflow is reliant on a research-based modeling process, but creates interoperable data and visualizations, ensuring that our outputs address not only the research community in the university and museum sectors, but also the wider public.

Florence 4D draws on the principal spatial tool-set for digital art history – IIIF-enabled images, 3D/Augmented Reality, GIS, and GPS-enabled mobile usage – to research works of art within their architectural and urban context, while ensuring access to the underpinning evidence through a structured database. These approaches are brought together in Florence 4D's website, which allows researchers to explore the material through a range of interfaces: maps, 3D models, locative AR apps and the database where the research underpinning 3D reconstructions and the mapping layers is presented as structured data using CIDOC CRM triples. Through guided navigation of the website, this short contribution considers a case study of the Ospedale degli Innocenti, Brunelleschi's famous foundlings' hospital, to demonstrate how digital tools can

help us investigate the institution's footprint in the social and artistic life of Renaissance Florence at a variety of scales, from the wider urban context right down to individual decorative elements in the building interior.

Context in focus

The website landing page invites users to explore Florence through four main entry points: geospatial data plotted on historical maps, 3D models accessible via an online viewer built in Unity, locative mobile applications, and finally structured metadata.² The map interface (fig. 1) allows users to explore the data spatially at the widest urban scale, with a series of geo-datasets presented as points on a map which can be viewed in a variety of modes.³ An underlying Mapbox base-map and satellite view plots datapoints on the modern city, while georectified historic maps situate that same data on cartographic representations made in the late sixteenth and eighteenth centuries. In addition to datapoints the map also shows sites where we have conducted detailed building-scale research, rendered as small, colored 3D models that pop up on the map to invite further interaction. At this map scale, a number of datasets – city descriptions, censuses, pastoral visitations, artistic surveys – can be searched and filtered to reveal spatial relationships that research focused on specific case studies might not highlight.

The entry point to the maps presents a series of "Tours", curated datasets that are grouped thematically, to provide a degree of

¹ Florence4D project (www.florence4d.org) is led by Prof. Fabrizio Nevola (University of Exeter, UK) with Dr. Donal Cooper (University of Cambridge) and funded by the Getty

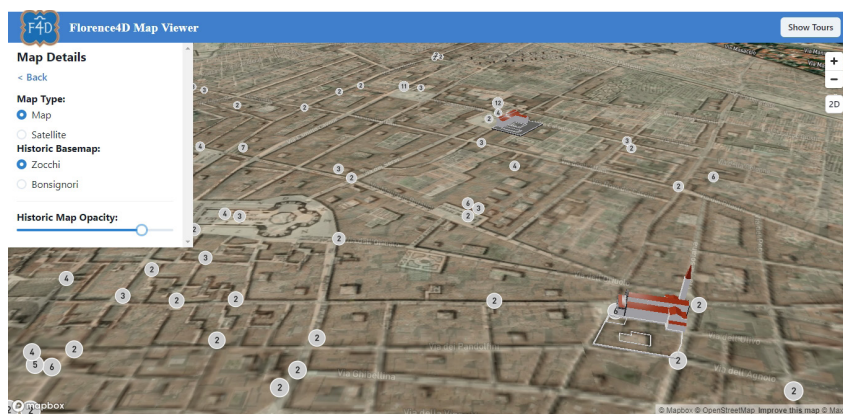
Foundation (2019–2021). All URLs in this article were accessed on 21.12.2021.

² These locative components cannot be hosted on the website. Links to the AppStore

and GooglePlay are provided to download the Hidden Florence and Hidden Florence 3D apps.

³ The map interface was designed by David Heyman of AxisMaps (www.axismaps.com).

Figure 1
Florence 4D map interface with entry points to full digital assets as small 3D models overlaid onto the historical map layer.
© Florence 4D 2021



interpretation to assist with free exploration. One of these, “Spatializing Charity: The Innocenti in its context”, includes four separate datasets that work at different scales to contextualize the hospital and its artworks, to show how this major charitable institution of Renaissance Florence sat at the heart of multiple networks – of property ownership, artistic patronage, health provision, and poor relief. At the broadest scale we have plotted all known charitable institutions in the city, to show how the Innocenti is one of a vast network.⁴ Full details on the archival sources, and the secondary source from which these are derived, are included in the data ingested to the Omeka S database, ensuring that any subsequent reuse remains a transparent process. Such an approach to the geospatial visualization of existing research offers rich potential for the addition of geo-datasets through contributions from the wider scholarly community.⁵

Homing in on the Innocenti itself, the “property records” dataset presents data selectively ingested from the DECIMAGIS platform, containing records from the 1561 Decima tax census showing the Innocenti’s extensive property portfolio across the city.⁶ This socio-economic dataset confirms the varied nature of the charitable institution’s interests, revealing clusters of low-income housing managed on the urban periphery, and commercial, high-value rent

properties in the center. While of course this helps to illustrate the web of relations and endowments that sustained the hospital’s activities, it also invites users to explore and test how socio-economic census data can enrich our interpretation of the art and architectural evidence that is the principal focus of our project. In so doing it is a demonstration of the potential of linked open data (LOD) to radically scale up networks of structured data drawn from diverse repositories.⁷

A rather different approach is signaled in the “Marietta and her life” tour which invites users to experience spatial research in an embodied way, by linking to a walking trail in the *Hidden Florence* locative app, led by a *nocentina* (a foundling). Marietta, a composite character derived from historical records, is a foundling raised by the Innocenti who goes on to work as a silk weaver, offers an experiential and kinetic view of how Florentine institutions sustained and shaped the life of the urban poor.⁸ For our present purposes, however, the attention now shifts from this wider urban panorama at map scale, to the 3D modeling of lost architectural features and settings for works of art, in which more forensic attention is afforded to the material fabric of the building in a diachronic perspective.

The “Visualizing Arts” tour presents the artworks originally preserved in the hospital

⁴ Data drawn, with permission, from Henderson 2006.

⁵ There are some similarities here to the recent updates to DECIMA’s curated “project maps”, see <https://decima-map.net/maps/>.

⁶ For a discussion of this property portfolio, see Jamison 2016.

⁷ The potential for the convergence of various DH projects centred on pre-modern Florence is being promoted by the Florentia Illustrata consortium, coordinated from Villa I Tatti, Harvard University Centre for Italian Renaissance Studies, Florence; see https://dh.itatti.harvard.edu/#florentia_illustrata.

⁸ Read more at <https://hiddenflorence.org/stories/marietta/> with links to AppStore and GooglePlay; on locative apps as a research approach, see now the Open Access collection (Nevola/Rosenthal/Terpstra 2021).

Figure 2
Screengrab of the church of Santa Maria degli Innocenti interior, from the Unity 3D viewer within the www.florence4d.org website.
© Florence 4D 2021.



church of Santa Maria degli Innocenti; clicking any of these listed works launches the 3D viewer to reveal the item in its original context within the church interior, rendered for a series of different phases from the fifteenth to the eighteenth centuries, when the last renovation of the interior erased its Renaissance layout and caused the dismantling of the original altar structures. The research-based 3D model of the church virtually reinstates artworks now distributed elsewhere in the Museo degli Innocenti complex, as well as further afield, such as the terracotta angels that are now displayed in the Victoria and Albert Museum in London. As such, not only does the model provide a visualization of the church as a whole, it also proposes how individual altars might originally have been arranged.⁹ The 3D viewer for the model supports annotations in the form of hotspots that provide additional information via popups with links back to the underpinning metadata (fig. 2), discussed below. Furthermore, as the viewer is designed using the Unity engine, this has made it possible for us to repurpose these same models into location aware apps that allow users to explore the buildings at 1:1 scale in situ, in today's urban setting. We are currently finalizing updates to our *Hidden Florence 3D* app that will include the Innocenti church, again with information hotspots for location-based discovery.¹⁰

The discussion thus far has focused on the user experience through a discussion of the “Tours”

accessed through the ‘Map’ section on the website (also accessible from the homepage), broadly speaking geo-datasets presented on the map interface, 3D models accessed through the viewer, and links out to geolocated apps. Much of the project frontend has been designed to facilitate discovery through visualization in maps and 3D models, with design features that encourage understanding of the buildings as embedded within a complex urban ecosystem, and interpretative “Tours” that guide the user through meaningful connections in the data. However, as with all humanities research these visualizations, observations and interpretations rest upon multiple sources of evidence (archival, secondary scholarship, digital survey work etc.). These sources can be accessed from the fourth entry point from the homepage that points to the project database.¹¹

Metadata for each datapoint in the geo-data contained in the map interface, as well as for the artworks and features contained within the models, is included in an Omeka S database. Omeka S is an easy system to use, widely supported by University IT services, and allows us to import controlled vocabularies to structure the data. So, for instance, in the example of the predella from the Innocenti church high altarpiece (fig. 3), structured metadata indicates the object's typology through the Getty vocabulary URI, providing additional basic information such as might be found on a museum label.¹² Further, by adopting the CIDOC CRM ontology,

⁹ It is not possible to discuss our research-based modeling process in any further detail here; see Nevola *et al.* 2022.

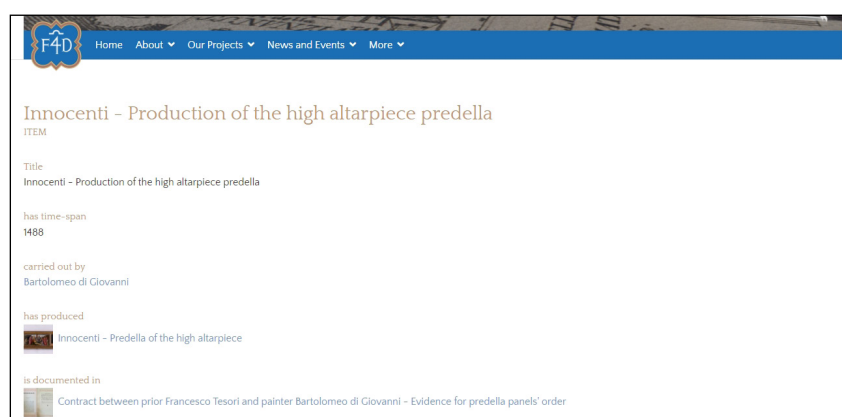
¹⁰ For an account of the San Pier Maggiore 3D AR app, see www.florence4d.org, “San

Pier Maggiore: A Neighbourhood Story”, as well as <https://hiddenflorence.org/hf-3d/> and its subpages. The open access app code is available at: <https://github.com/ZubrVirtualReality/Hidden-Florence>.

¹¹ www.florence4d.org/item/search.

¹² <http://vocab.getty.edu/page/aat/300003745>.

Figure 3
 Screengrab from the Omeka S data
 repository.
 © Florence 4D 2021.



it is possible to create semantic, machine readable links to events that led to the predella's production: for instance, an event-centric ontology places the production of the painting at the center of a set of relationships between actors, places and objects.¹³ Furthermore a digital representation may convey relationships that do not pertain to the physical object, but to its virtual surrogate – in this instance the digital reconstruction of the predella panel is arranged with each panel placed in the order as was originally commissioned, documented in a lost contract transcribed at the beginning of the twentieth century.¹⁴ The semantic data relationship explains such subtleties, making interpretation presented in the reconstruction intelligible, by providing such digital “footnotes” to the digital assets.

Such considerations are equally important for the 3D models themselves, where the mimetic quality of well-made visualizations is sometimes challenged by scholars for obscuring complexities or uncertainty contained in the evidential record. A multiplicity of features (from architectural finish – color of plaster, floor tiles, wood grains etc. – to ageing processes, light sources and so on) introduce varying degrees of conjecture to the modeling process. These elements of uncertainty can be addressed appropriately through supporting structured metadata that essentially provides an epistemological basis for the logically ordered elements of evidence that inform the visualization. As is so often repeated with digital humanities/ digital art

history work, such processes are iterative, and structured data means that new evidence can easily be brought into the system to adapt or update findings at a later date.

Conclusions

Projects such as Florence 4D adopt the affordances of “born digital” research, at once presenting innovative findings, and providing an open data repository that can be reused by other researchers. The value of standardized, semantically oriented, machine-readable metadata is that it is interoperable and through LOD protocols can be incorporated into other systems, just as we are able to draw on existing structured datasets for our own work. So, for instance, to remain within the context of digital spatial research on Florence, we have joined the *Florentia Illustrata* consortium (and the related *Metapolis* project), which is designed on a ResearchSpace web environment that harnesses LOD as a “a research and publication tool” to which multiple scholars will be able to contribute.¹⁵ Interoperable standards and cross institutional collaborations are key aspects in the future scalability of Digital Art History work.

As yet, the potentialities of such platforms to support 3D visualization and related metadata have not reached a sufficient maturity for shared standards and systems to have emerged. We have shown here that this should not constitute a barrier to presenting 3D models

¹³ <http://www.cidoc-crm.org/>; for a detailed discussion of an example see also Nevola et al. 2022.

¹⁴ Cadogan 2000, pp. 269–270, after documents transcribed by Gaetano Bruscoli and later lost. See Bruscoli 1902, pp. 18–19.

¹⁵ https://dh.itatti.harvard.edu/#florentia_illustrata and <https://dh.itatti.harvard.edu/#Metapolis>.

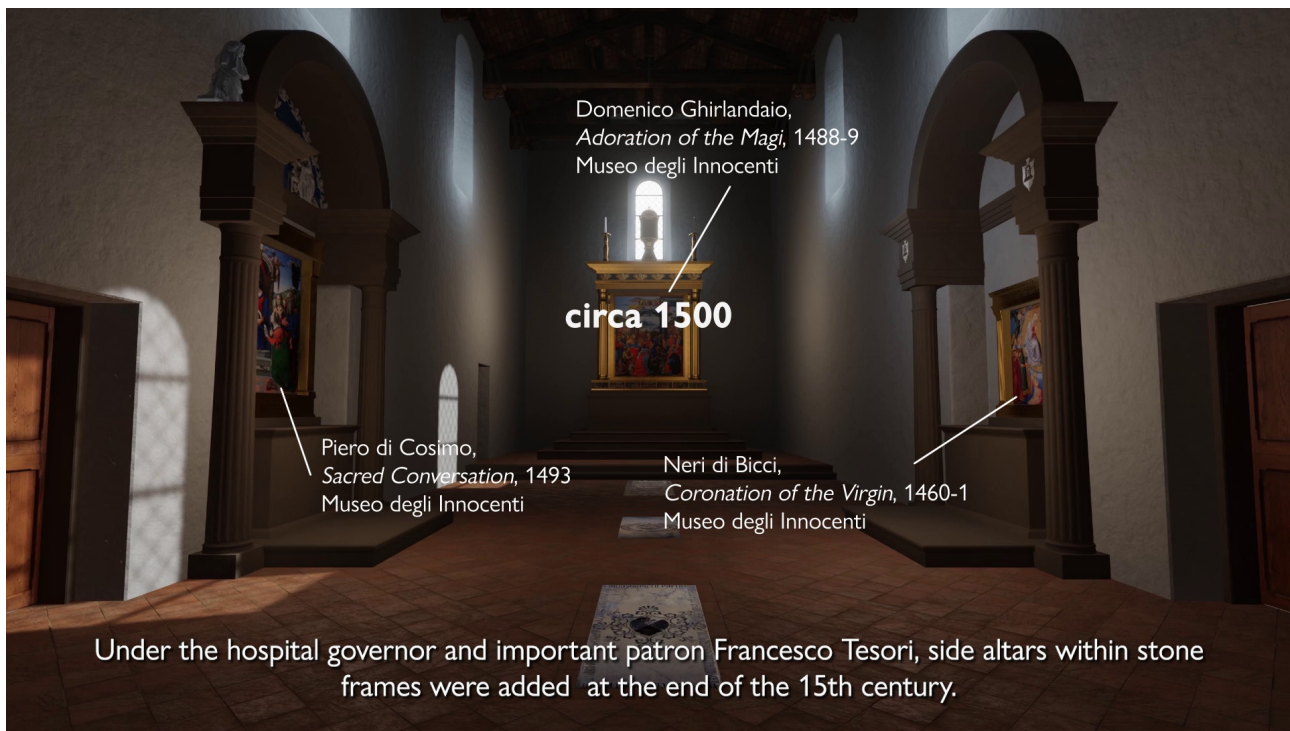


Figure 4

Screenshot from video (<https://doi.org/10.17617/3.IOLIEL>) describing the artistic and architectural transformations to the church of Santa Maria degli Innocenti that have taken place over the centuries.

as both fully contextualized within the map interface, and searchable from the structured database. Future work will focus on developing a closer integration of the semantic database with 3D models, contributing to the development of standards from the international image interoperability framework (IIIF) applied specifically to 3D.¹⁶ At the same time, as we have suggested here, rigorously research-based 3D models of

the sort described can be repurposed for use in public-facing contexts, as interpretative animation videos (fig. 4) in galleries and museums, or as location-aware apps delivered on ubiquitous consumer devices.¹⁷ In this way, by thinking holistically about the lifecycle of digital art history visualization work, researchers can shape new questions in the field, while also providing valuable resources to the wider public.

¹⁶ See <https://iiif.io/community/groups/3d/#about>.

¹⁷ See Nevola/Rosenthal/Terpstra 2022.

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