Documenting and disseminating a Florentine church in 3D

Critical Reflections on a Case Study

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This paper reviews the recent 3D reconstruction of the Renaissance interior of Santa Maria degli Innocenti in Florence, the small but richly decorated church integrated within the larger hospital complex of the 'Innocenti', begun by the architect Filippo Brunelleschi in 1419 and dedicated to the care of the city's orphans. The reconstruction has been undertaken over two years by the Florence 4D project (previously 'Immersive Renaissance') funded by the Getty Foundation, led by PI Fabrizio Nevola (University of Exeter) and Co-I Donal Cooper (University of Cambridge). While Florence 4D aims to provide an urban-scale research platform combining a cartographic GIS interface with 3D models of a range of key monuments, the Innocenti church was the pilot selected to refine a modelling pipeline for the project and establish protocols for underpinning structured data.

Fig. 1: Interior of Santa Maria degli Innocenti, Florence, October 2019 (© Florence 4D)

The church interior had been entirely refashioned in later centuries (Fig. 1), but a number of factors - the building's relatively modest scale, detailed archival documentation and surviving artworks – lent themselves to the task. The project team could also draw on considerable experience of earlier

modelling and mapping projects with a Florentine focus. The readiness of the current authorities managing the building to collaborate opened opportunities to disseminate the model through an AR app within the adjacent museum. This presentation offers a critical assessment of the project from conception to completion, covering both its achievements and the problems encountered, not all of which could be resolved in the current iteration.

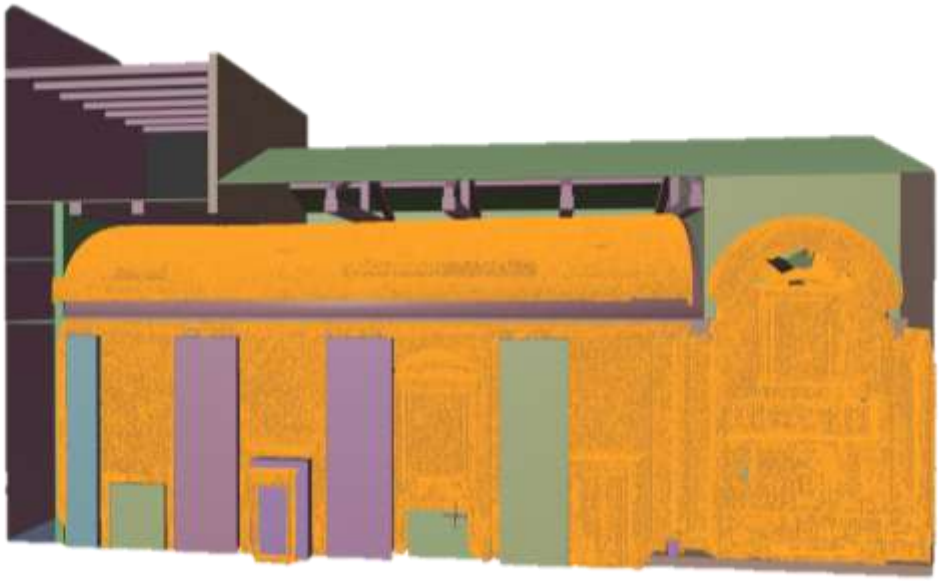

Fig. 2: Overlay between scanned data (orange) and procedure-based modelling (© Florence 4D)

The overarching aim was to achieve a better standard of what can be called 'research-based modelling', improving upon the project's earlier visualization of another Florentine church San Pier Maggiore (presented at CHNT 24, 2019) which would combine reality-based modelling via LiDAR and photogrammetry with procedural modelling of lost or dispersed elements (Fig. 2). The former creates a detailed record of extant fabric; the latter draws on thorough analysis of primary and secondary sources (published scholarship, archival documentation, historic plans, analogous monuments). The model aimed for the transparency and accessibility of underpinning data by linking the model to an Omeka S database structured according to the CIDOC-CRM ontology, allowing users and researchers to directly interrogate the sources and interpretative choices that stand behind discreet elements of the visualization. In addition, levels of certainty can be assessed by means of vertex colours baked into the model in Blender and in the rendered version by means of transparency for hypothetical elements.

The project team was configured to facilitate close working and frictionless feedback loops between 3D modellers and art historical researchers. Even so, the process of preliminary visualization, evaluation and revision can disrupt a smooth, sequential modelling workflow, or at least needs to be acknowledged within a pipeline design. Researching an interior for wholistic 3D visualization places different demands on humanities researchers than conventional research within a discipline like art history. Incidental and apparently inconsequential details of a building acquire much greater importance than is usually the case, as 3D models require all areas to be visualized to some degree. For the Innocenti church, much time was expended on clarifying framing elements for pictures, doorways and windows, floor materials and step design, glazing techniques and lighting levels – all aspects which sit on the margins of art historical research if at all, and which are fitfully signalled in the

historic source material. By contrast, the location and reconstruction of the major artworks within the church – where the project could draw on rich source material and extensive secondary literature – was comparatively straightforward.

Metadata for the artworks and features contained within the 3D model is included in an Omeka S database, which also includes geodata from the 2D map interface within which the model is accessed. 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 church's high altarpiece, 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. Further, by adopting the CIDOC CRM ontology, 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 centre of a set of relationships between actors, places and objects. In addition, 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 it was originally commissioned, rather than its current museum configuration. The semantic data relationship explains such subtleties, making interpretation presented in the reconstruction intelligible, by providing such digital "footnotes" to the digital assets.

Fig. 3: View of rendered model of Santa Maria degli Innocenti (© Florence 4D)

Such considerations are equally important for the 3D models themselves, where the mimetic quality of well-made visualisations is sometimes challenged by scholars for obscuring complexities or uncertainty contained in the evidential record. A multiplicity of features (from architectural finish – colour of plaster, floor tiles, wood grains etc. – to ageing processes, light sources and so on) introduce varying degrees of conjecture to the modelling 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 visualisation. 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. In terms of LOD, we are integrating the model with other datasets, for example, an archive of historic photographic material. The use of IIIF manifests assists the transfer/interoperability of project data.

Returning to the themes of the CFP, the paper also reflects on the external dissemination of the 3D model as well as its internal documentation. The model viewer runs in Unity as does the related 3D geo-aware AR app, for which the code is openly accessible on GitHub. This presents public-facing version of the model that allows the visitor to the Innocenti museum to stand outside the church or within the gallery space to visualize the Renaissance interior in Augumented Reality. This is a particularly powerful piece of interpretation for the museum as the highlight paintings in their museums are the Renaissance altarpieces that were originally in the church. For both the web-based viewer and the app, limitations on dynamic searching between the model and the underpinning data remain a challenge.

In conclusion the paper reviews both the successes of the project and the resulting lessons for future work, especially for further 3D models currently under development for the Florence 4D project and with a view to integration with IIIF viewers that are fast becoming the norm for museum collections. The importance is emphasized of creating models that are robust in terms of underpinning research and transparency but also sufficiently versatile and interoperable to be repurposed in a range of interpretative and mobile-enabled contexts.

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There are no conflicts of interests.

Author Contributions:

All attributes shared by the Florence 4D team: Principal Investigator Nevola, Co-Investigator Cooper and Research Associaties Brunke and Capulli, except the following:

Funding acquisition: Nevola and Cooper

Project Administration: Nevola

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