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Data Report: Brunelleschi Pulpit Preliminary Study Church of Santa Maria Novella Florence, Italy October 19th 2024

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Brunelleschi Pulpit
Preliminary Study

Church of Santa Maria Novella
Florence, Italy
October 19th 2024

CHEI
CULTURAL HERITAGE ENGINEERING INITIATIVE

EDITECH

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CHEI projects are performed under the direction of Dr. Dominique Rissolo and Prof. Falko Kuester at the University of California San Diego



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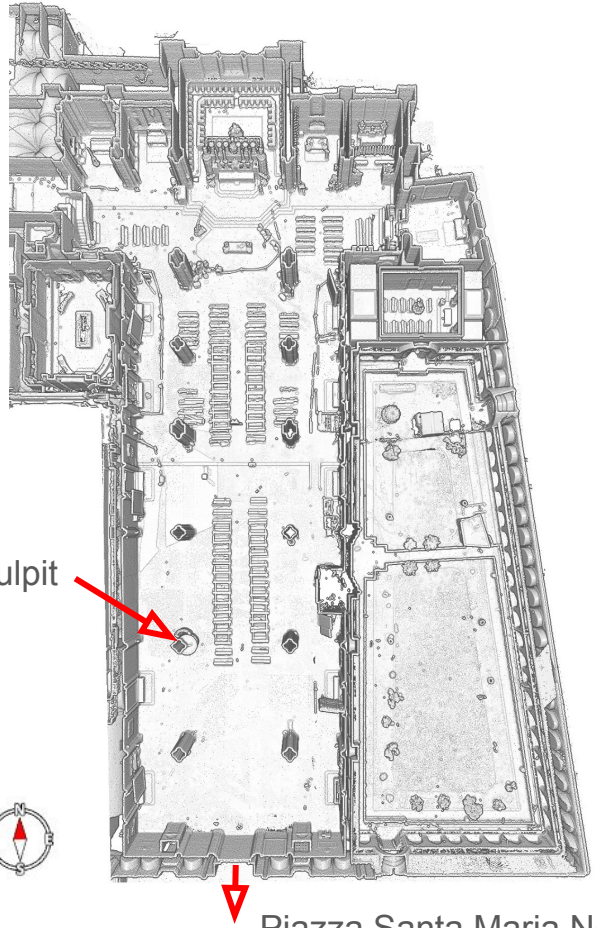
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This study incorporates high resolution structured light scans, photogrammetry, terrestrial LiDAR, and thermography. Data was processed and fused into 3D models, and delivered through the Florence 3D Atlas project, a collaboration between CHEI and the Florence as it Was project at Washington and Lee University. This complex object is best viewed as a 3D object, a video of this project showing a 3 dimensional context is available here.



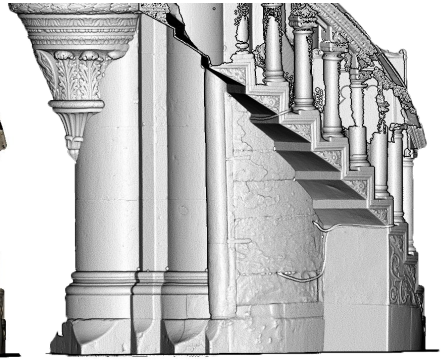
The stone column supporting of the pulpit in the church of Santa Maria Novella shows clear signs of water damage. In October of 2024 members of CHEI, Editech, and the University of Florence's Masters program in Architecture performed a preliminary imaging campaign to map the current condition of the exterior structure. The study was performed a day after moderate rainfall, hoping that water absorbed from beneath the pulpit would have been absorbed by the stone, and expressed thermally as the water evaporated. Though this effect was not visible, the project provided an opportunity to create useful foundational benchmarks for the continued monitoring of the structure, and methodologies for the scalable 3D mosaicing of low resolution thermal data over a large photogrammetric model.

Two types of stone were used to support the pulpit. The the original column is of a harder limestone which shows discoloration. Additional stones, added later on the west side to support the stairway, is crumbling.

The wooden gate on the western side of the pulpit was also analyzed for damage, as some warping could have been due to water damage.



Discoloration caused by leaching, eastern side



Crumbling on stairway support stones, western side

Profile Views from Terrestrial Lidar



Southern Viewpoint



Eastern Viewpoint

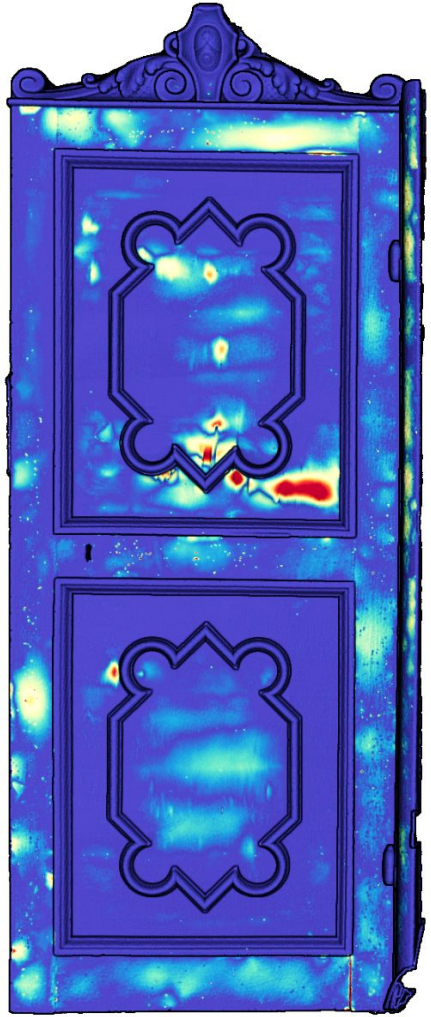


Northern Viewpoint



Western Viewpoint





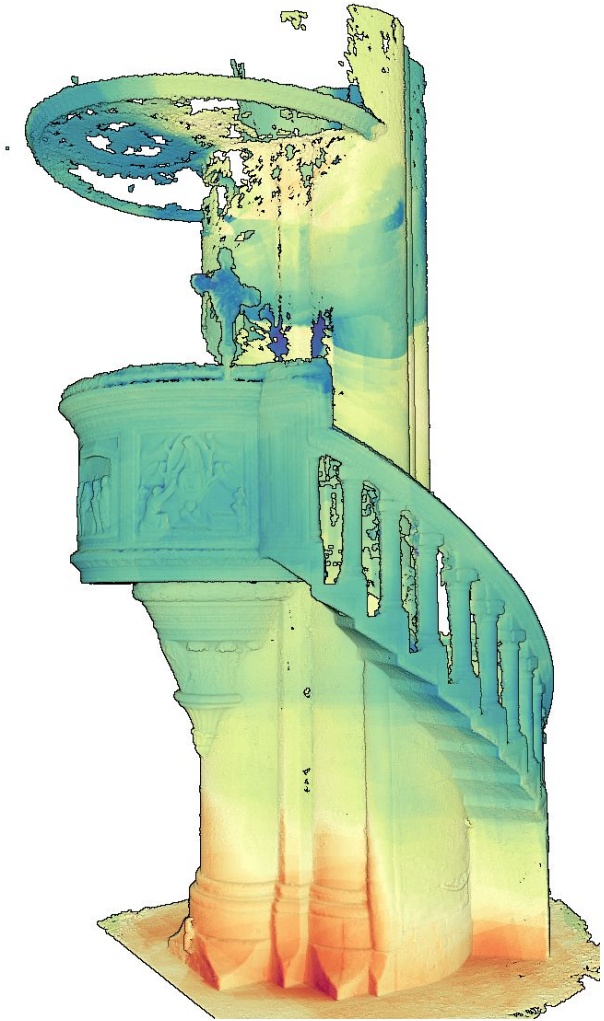
Discoloration on the stone column rises to approximately 2 meters above the floor, about level with the top of a wooden gate (1.63 meters high by 60cm wide) which is directly attached to the column.

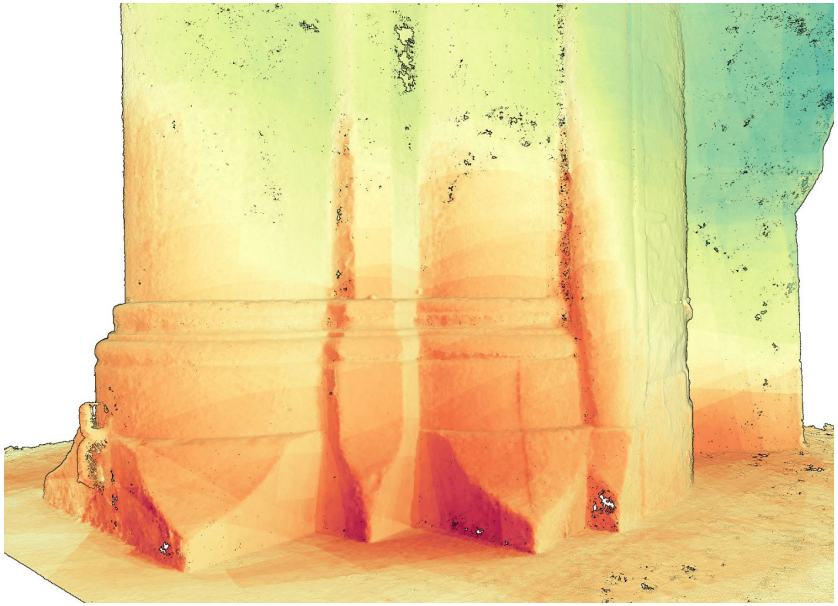
To analyze deformations on the wooden gate at the base of the pulpit stairs, a 0.5mm scan was simplified into planar surfaces. This simplified planar model was then compared to the original scan, highlighting fine deviations. In this deviation map we can see many small holes, possibly caused by insects, and warping of the wood in the central panels.

The blue color represents no deviation.
the deep red color represents 3 - 4 mm of deviation.









Ambient temperature 22.2 Celsius, humidity 67%, 1:40pm
Investigative thermographic studies require purposeful scheduling to negate the influence of solar heat. In these images, taken after mid-day in October, we can only see the heat of the sunlight on the stones facing the eastern windows. Further investigation is needed to confidently identify and track subtle anomalies related to moisture.









Geometric views of carved panels from high resolution structured light scans



The data used in this study can be made available by reuse under terms outlined by the the Florence as it Was project, and OpenHeritage3D.org.

Please contact the authors of this report for questions regarding data access.

Photogrammetry	Sony A7 r3 mirrorless	422 raw images
Structured Light	Artec Leo HD	5 large HD scans, processed at 0.5 mm resolution
Thermography	FLIR One camera module for iPhone	207 RGB/IR image pairs
Terrestrial LiDAR	Leica BLK 360 g2	17 scans
Terrestrial LiDAR	Leica RTC 360	Foundational basemap provided by Florence as it Was

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