Collection of forts and defensive structures at the time of the Grand Duchy

Research and historical-architectural interpretation of lost landscapes and territories

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Introduction

This research aims to develop a methodology to replicate digital 3D models of architectures, structures, and military forts painted in past pictorial works. A procedure of interest, while almost all these structures are transformed, in whole or in parts, in the modern territorial and urban fabric.

The main subject will focus on *Palazzo Vecchio* in Florence and the great frescos of the wars won by the Grand Duke of Tuscany, Cosimo I, realized in the "Hall of the 500" under the guidance of Giorgio Vasari, celebrating the Florentine achievements.

The reconstruction of the painted structures started with a match between the texts and archival sources, the digital survey of the Palace, the studying of the Hall, and the relationship between the topic shown in the painting and its ambience.

The main starting questions were: How to efficiently rebuild a 3D object from a 2D view? How to read the pictorial choices related to their historical time frame? How and where to find the historic contents needed to correctly reconstruct these structures? Which sources are more valuable? How to discover the point of view chosen by the author?

Methodology and operations

This project is part of the digital survey of Palazzo Vecchio, commissioned by the city municipality to the Department of Architecture (DIDA), University of Florence. This digital survey was operated in 2019 using up to three 3D laser scanner units along three weeks of survey work, acquiring about 5500 unique scans.

Palazzo Vecchio dates to 1299 and its surface covers an entire district of the city. The survey intervention processed all the major spaces as well as all the secondary, even minimal, rooms, to create

the first, fully digital 3D map of the whole building. In it, one of the main spaces is the Hall of the Five Hundred. Here there is a large space. It is located on the first floor and measures 54 × 23 × 18 meters. It was built by Simone del Pollaiolo, called Cronaca, and Francesco di Domenico and commissioned by Girolamo Savonarola (1495–1496). During the governance of the Great Duke Cosimo I, it was restored by Giorgio Vasari (1555–1572). All the transformations of the hall, together with the frescoes painted by Giorgio Vasari in the formerly "Sala Grande" (the great hall), took about 14 years to be completed.

In order to report the scenery in the paintings, Vasari sent his collaborators to the territories of the battles to sketch the landscape and then develop studies about the proper point of views to set the scenes. All these works were done interpreting the space out of the present geometric construction rules, and getting various "licenses" in favour of a more impressive and dynamic result.

Table 1. Classification of the frescos.

Cycle	Title	Date of realization	Date of the event	Position in the Hall	Authors
war with Pisa	*Assalto di Pisa* – Assault to Pisa	1568	1499	North-West	G. Vasari and collaborators
war with Pisa	Massimiliano d'Austria toglie l'assedio a Livorno – Maximilian I ends the siege in Livorno	1567	1496	Central-West	G. Vasari and collaborators
war with Pisa	*Sconfitta dei Pisani alla torre di San Vincenzo* – The Pisan army defeated at the St. Vincent Tower.	1569	1505	South-West	G. Vasari and collaborators
war with Siena	*Assalto al forte di Siena presso Porta Camollia* – Assault to the Siena fortress near the Camollia's gate.	1570	1554	North-East	G. Vasari and collaborators
war with Siena	*Presa di Porto Ercole* – The fall of Porto Ercole.	1570	1555	Central-East	G. Vasari and collaborators
war with Siena	*Rotta di Piero Strozzi a Scannagallo in Valdichiana* – Pietro Strozzi defeated in the Scannagallo battle, Valdichiana.	1571	1554	South-East	G. Vasari and collaborators

A specific digital survey intervention

The base obtained from the 3D LS survey operated in 2019 was integrated by a specific high-resolution photographic survey. The tools in use were: a DSLR NIKON D800E with 36.3 Megapixels resolution and two different lenses: a NIkkor AF 24–120mm F4 zoom and a Nikkor AF 70–300mm F4.5 zoom. The first lens permitted high-resolution shots of each painting in the context of the room. The second lens allowed detailed shots of the architecture painted in the background of the scene. All the shots were later processed to correct perspective distortions on the base of the 3D laser scanner survey. After the first analysis of the painting, a site-inspection was conducted in Porto Ercole, a small city located nearby Monte Argentario, southern Tuscany, one of the areas where the battles, painted by Vasari, took place. It was the first testing ground for this research.

Meet "The hold of Porto Ercole"

In Porto Ercole in 1555, the troops from France and Siena faced the Spanish-Medici forces in defence of the territories of the Republic of Siena. This event was depicted in several works. In *Palazzo Vecchio*, there are two paintings that narrate "la Presa di Porto Ercole": one is analysed in this case study, the other was created by Giovanni Stradano in 1572.

Table 2. The defensive structures depicted in the Fresco.

Fortifications	Settlement timeline	Archival references
La Rocca (readjustment)	1552–1553	Plan of the Fort found
Construction of forte avvoltoio	October 1552–May 1553	Missing plan
Construction of forte della Galera	April–May 1554	Missing plan, shape of the pentagonal fort
Construction of forte Stronco	October-November 1554	Missing plan, shape of the quadrangular fort
Construction of forte Guasparino	1555	Fort plan found, but uncertain
Construction of forte Sant'Ermo	March–April 1555	Fort plan found, but uncertain
Construction of forte Ercoletto	April–May 1555	Fort plan found
Construction of forte S.Ippolito	1555	Missing plan, simple bastion

In Vasari's Fresco, the two factions are seen facing each other. In the background the coastline between the sea and the land. Battleships, troops and camps settle around eight military forts. Small structures, located on promontories and strategic points, host few soldiers, ready to attack with artillery. The depicted forts were later replaced by two more advanced fortifications, which are still present in the area. From one of these, the *Forte Stella* may be identified as the point of view adopted by Vasari. From a first observation, comparing the painting with the photographs from the site, it may be noticed that Vasari had adapted the territory in order to fit it into the painting and had raised the horizon line to give more space to the scene and better show the forts, while the course of the coast is verisimilar.

Thanks to the contribution of the historian Gualtiero Della Monaca, it was possible to find the real position of the eight sixteenth-century forts and to realize models of their original form and structure. Della Monaca provided the plans (found in annexes to archival writings that he collected during his research), from which it was possible to reconstruct the fortifications.

Of the eight forts, four original plans have been found (although not all of them are fully confirmed) whereas four are missing and are only described in texts. Based on this information, the forts were digitally modeled in 3D and repositioned in the geographic map of Google Earth on the territory of Monte Argentario. The intention is to build a map with a well-defined degree of approximation for each model, in order to properly classify the level of knowledge achieved relative to all forts, while at the same time, to underline the transformation in the urban/natural landscape and the level of valorization (as a way of facts or as a potential) of the built heritage arrived in the present days from the late Renaissance scenario.
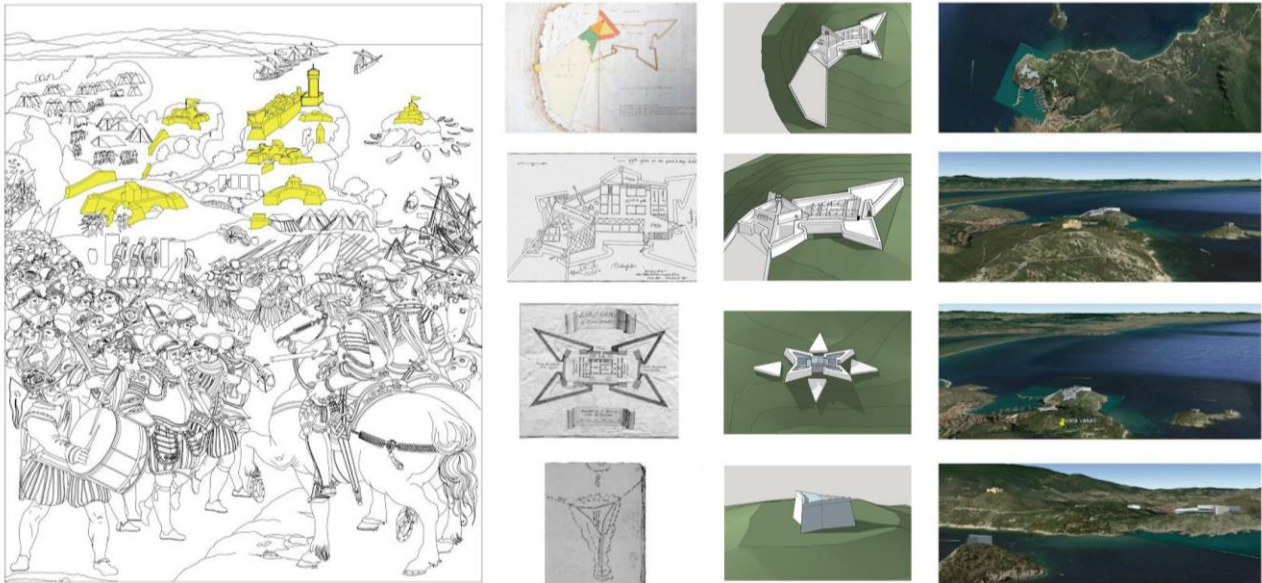
Fig. 1. Outline of the fresco "The fall of Porto Ercole" and a sample of the processing.

Short acknowledgements

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