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Understanding and re-functionalizing the old heating systems at Stupinigi Hunting Lodge

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Stupinigi Hunting Lodge was built in 1729 by the genius of the architect Filippo Juvarra, after being commissioned by King Re Vittorio Amedeo II to construct a hunting lodge to accommodate the Royal family and its court during the hunting season.

The residence consists of a central fulcrum, which is represented by the elliptic hall, from which the royal apartments and a series of buildings serving the residence, for example the royal stalls, the tool rooms and kennels branch off to the east and to the west.



Stupinigi Hunting Lodge

Stupinigi Hunting Lodge represents a masterpiece of European Baroque architecture, in other words of that stylistic trend, which was born in France under the reign of Louis XIV and triumphed during the reign of Louis XV, with the principal change in the architecture of noble palaces being represented by the building of residences, which were less grandiose, but more intimate and elegant, where not only the state room was heated, but where each area also had its own fireplace.

Fireplaces have always represented a particularly connotative element of the area in which they are built, a true expression of the artist's and architect's imagination; however this thesis analyses the historical evolution of these artefacts over the centuries from a functional and technological point of view, highlighting the importance of their preservation and, if possible, of their re-functionalization, fully in keeping with the original artefact, in other words excluding interventions of an invasive nature.

The thesis deals with the problem of understanding eighteenth and nineteenth century heating systems according to three fundamental aspects :

- **historical**, with a study of nineteenth-century technical manuals related to heating systems, with particular focus on chimney systems and air radiators ;
- **technical**, with a thorough survey of the existing heating systems at Stupinigi Hunting Lodge ;
- **scientific**, with a thermal inspection carried out on two eighteenth-century fireplaces taken as a sample to determine their effective capacity for heating the area in which they were located.



Eighteenth-century fireplace situated in the first antechamber of the apartment to the west

In particular, the thermal inspection analyzes the thermal flows leaving the room in which the fireplaces are set by means of transmission and ventilation, and subsequently determines the useful power they were able to give the room, as well as finally checking their draught.

The calculations obtained have led to a particularly high value in the depression in the intake section of the fireplace, consequently indicating a problem with the draught of the fireplaces that took in an excessive amount of external air.

After demonstrating the inadequacy of these fireplaces as efficient heating systems, a proposal for re-functionalization was made aimed at showing how their performance could be increased.

To reduce the draught caused by the excessive size of their chimney flues and prevent double air currents from forming inside them, a proposal was made to insert a pre-insulated steel chimney flue inside the old fume disposal duct; this design solution can also be integrated by introducing external air beneath the surface of the hearth of the fireplaces to feed the combustion and consequently further increase their performance.

However, the current use of the fireplaces for heating the rooms in the Lodge is not feasible for obvious reasons related to protecting the artistic-historical heritage, although it could be used in other contexts. The most suitable intervention solution for Stupinigi Lodge consists of integrating the envisaged radiant panel system with a primary air system made up of small air handling units to be installed inside the casing in stone of the old air radiators located in the basement.



One of the twelve air radiators located in the basement of Stupinigi Hunting Lodge

The air would be circulated using the pre-existing intake grids and the relative ducts present in the floors of the rooms on the ground floor.

To this end surveys were carried out on all of the radiators in the Lodge, on the relative circulation ducts, as well as on the intake grids to enable them to be reused to heat the rooms on the piano nobile.

This proposal for intervention offers the advantage of being completely reversible and does not jeopardize the pre-existing wall structures with heavy interventions.

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