VILLA MIRABELLO IN MONZA (Italy)
LOCALIZE HISTORICAL CLUES BY IRT

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Fig. 1, Villa Mirabello, main entrance.

Introduction

Villa Mirabello is located in Parco di Monza, near to Cavriga Avenue and Lambro River. It is the most ancient mansion in the park. Durini's family built it up from an existing smaller house at half of 17th centuries. In 18 hundreds, Durini's family designed a new enlargement of the park and Mirabello, a new villa, which was named Mirabellino, placed on the opposite side of Mirabello. At the beginning of 19th centuries, Royal Park of Monza included also Durini's properties. Nowadays, Monza park is a public estate, owned by Monza's municipality.

Villa Mirabello was neglected for may years, until last decade. Lately, a renewed interest led municipality to commit restoration project of Villa; for that a diagnostic campaign and historic research started. Damage assessment resulted that most urgent intervention is to be performed at first floor. For this reason, at the moment preliminary investigation began at this level, and it consisted of IRT (Infrared Thermography), endoscopy, in addition to measured drawings. On the other side, historic documentation refers information about the whole complex. Moreover, archive document directly describe results of 17th century building yard. Further documentation mainly relies on building modification in the next centuries, because documents are notary's acts. Their contents deal with inventories of objects and furniture, which are linked to variation of uses of rooms, and they indirectly inform us about occurred modification of building.

Detailed descriptions of 17th century, effectively helped to define uses of rooms and function of structures. Only recent tests (IRT) allowed to locate modifications of masonry underbeneath plaster.

This paper hosts first results of investigation, crossing historic documentation and non destructive diagnostic.

Focus of diagnostics is mapping texture of structures beneath plaster; plus, for damage assessment, IRT helped to evaluate total extension of delaminated coating. Results of IRT were verified by endoscopy and stratigraphic sampling.

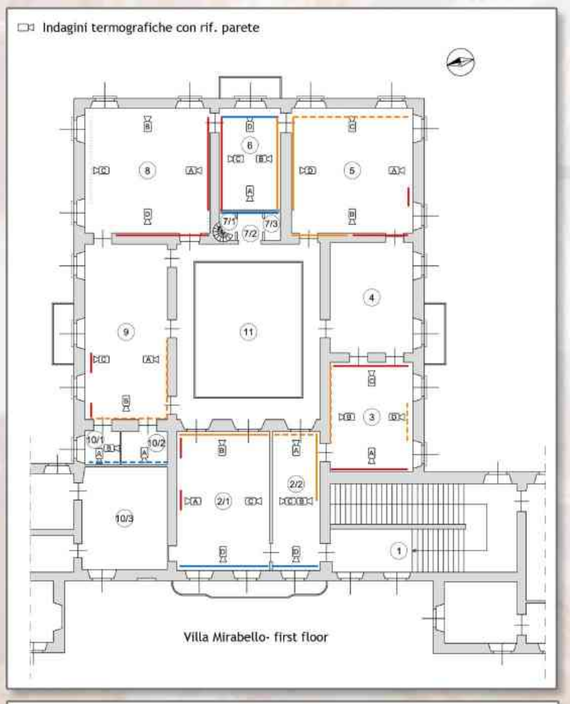

Fig. 2, plant of first floor showing results of integration between historic research and IRT

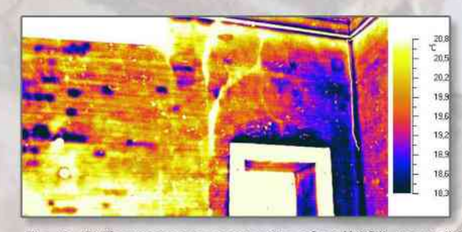

Fig. 5, IR Thermograms composite of wall "B", room # 5

Results

IRT showed four texture typologies: their location within the building proved historicacl hypothesis. A unique texture, timber framed, was found between rooms 2.1 and 2.2. It is totally different from the others, and it was used for subsplitting the existing large room, facing facade, at first floor. [fig. 2]

Especially, investigation at Villa Mirabello allowed to map four kinds of recurrent texture: bricks and mortar, pebbles and bricks embedded in alternate string courses, bricks and few stone quoins (irregularly shaped), timber frame wall. The following image shows location of resulting texture within Villa's plant.

Main results are briefly listed below:

1) First floor masonry, are due to a wide refurbishment and enlargement of and existing house. Quadrio architect preserved all existing walls which could be included in his project and he consolidated ancient masonry, if required, to ensure static support to new roof.

By now, historic documentation explains consolidating technique: builders inserted "ceppo"stone quoins in brick masonry. These stones are now recognizable at IR, because of different thermal characteristics of stone and brick [fig. 3, 8]

17th century masonry, which was refurbished, has a regular pattern. Three typologies resulted for that period: bricks&pebbles, "ceppo"quoins&pebbles, bricks&"ceppo"quoins. All these building fabric were built up to pre-existing ones, along both exterior and interior walls.

More over, historic documentation refers about the consolidating use of "ceppo" in masonry.

Other typology (bricks&pebbles), could be dated both 16 and 17th century. In fact, it could have been included in 17th century refurbishment, without any modification, if its static condition were already satisfactory, or it could have rebuilt during Quadrio's modifications, with the same building technique which was used in 16th century (and lasted until 20th century, in most Padana Plain).

2) Performed investigations in rooms 2.1-2.2 solved some enigmas regarding was placed a Loggia location of rooms before 18th century refurbishment. In fact, in this area, which now appears walled up. Later, it was subdivided by a transversal wooden frame wall. Further investigation (endoscopy), allowed to find out two granite columns inside this wall, very similar to portico's ones at ground level.

Moreover, IRT showed a hidden large arch in "B" wall over the present entrance door [fig. 6] (the investigated "B" wall is the rear of staircase). Presence of arch means that entrance door was wider than the present one and that stairs changed during their first building, probably because of weakness of roof supporting structures (from a report in historic documentation).

3) Discovery of another arch, in wall "B", room 9, let us hypotize that it was an entrance of Cardinal Durini aisle, which connected this part of the apartment of a gallery on the chapel' side, close to the altar. Only archive documents report about this aisle, nowadays none traces was found, apart from IRT detection of the arch.

Moreover, observing arch shape and dimension, authors noticed that arch's left pillar is lacking, and wall "A" leans on "B", therefore "B" belongs to the first building, and it was used by Quadrio for the new aisle.

At the end of 18th century, a new refurbishment canceled any traces of the aisle, and its door was walled up.

4) IRT detected many "stitching" in the walls, masonry's integration, plaster's patches: all these details are not visible by visual inspection. Archive documentation describes them in details, unfortunately without localizing them.

5) In addition, results of investigation allows to localize Cardinal Durini modifications, made at the end of 18th century. First floor Loggia (facade), and vestibule at ground level, (towards Lambro river), were substancially changed and infilled up. In fact, from archives research, it is known that Cardinal changed use of numerous rooms, and consequently he ordered many modifications, without leaving any scheme or drawings of these variations. Only IRT allowed to locate these variations, by visualizing masonry texture: in fact, masonry produced in the yard committed by Cardinal Durini, has a regular pattern and it is mostly localized in the exterior walls of rooms 2.1, 2.2 and 6.

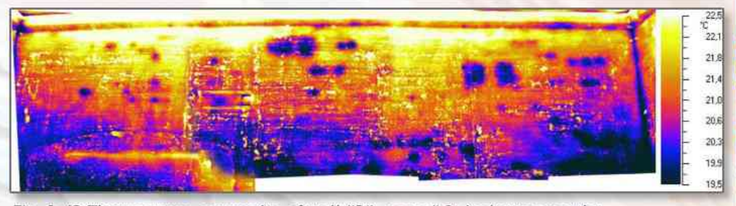

Fig. 3, IR Thermograms composite of wall "B", room # 3; it shows a regular bricks pattern, in which stone quoins are included (blue spots). "Ceppo" quoins have different size and shapes.

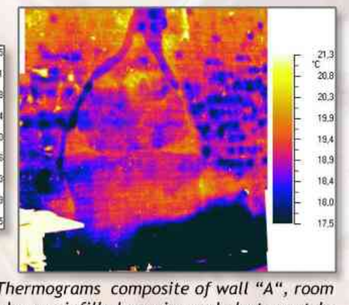

Fig. 4, IR Thermograms composite of wall "A", room # 2.1 ; it shows a infilled opening and plaster patches, arch shaped. Opening infilling consists of bricks, surrounding masonry has a bricks&pebbles texture.

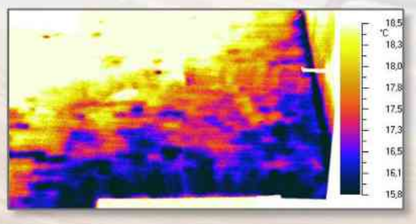

Fig. 6, IR Thermograms composite of wall "B ", room # 2.2; thermography allows to detect a large arch over the present entrance door.

Fig. 7, visual state of wall "B", room n 9

Fig. 8, IR Thermograms composite of wall "B", room # 9; thermovision allows to detect a large arch over the left door.

Fig. 9, visual state of vault in room # 6; damage of surface (stains, lack of color, lack of plaster, etc) masks delamination.

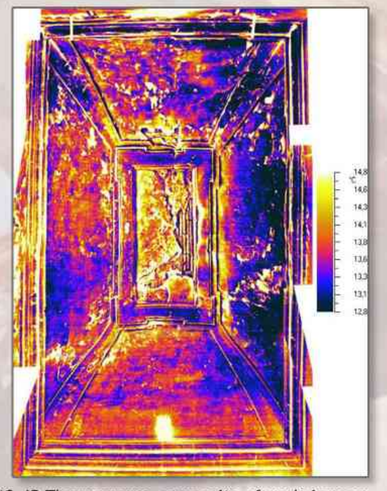

Fig. 10, IR Thermograms composite of vault in room # 6; thermovision allows to find out delamination of plaster and to evalutate percentage of damage.

Discussion

Obtained results allow to pinpoint following notes:

1) Some building techniques are substancially contemporary: they are employed at the same time, with short delay, and in any case in the same evolution phase of complex.

Especially, bricks&pebbles pattern is located both at top and bottom of interior masonry, and it included bricks, bricks&stone quoins pattern. Bricks&pebbles pattern does not mean an element of absolute dating in Padana Plain, because it is recurrently found in historic landscape for many centuries, up to 19 hundreds.

For example, in fig. 5, note that different patterns are side by side, without any joint or cut in masonry, IRT even shows that brick courses are perfectly aligned with pebbles ones.

2) Contra of IRT application depends on the adhesivity of plaster to substrate: where delamination occurs, it is not possible to detect masonry texture, as it happened in rooms n 3 and 8. In such cases, heat flux, which crosses the structure, is interrupted by interposed air layer; for this reason temperature distribution of surface is not representative of inner structure.

3) At last, localization of chimney stacks within masonry enriched knowledge of the buildings: these details are very valuable for static condition assessment

Conclusions

Investigation have good results for mainly localizing different building techniques, at first floor of Villa Mirabello.

Crossing data with historic archive documentation allowed to validate hypothesis about historical evolution of the complex, and localize modification occurred.

Information regarding modification occurred on structures has major importance for structural analysis, above all for structural validation of reuse project: for example, localization of intrinsic vulnerabilities (cracks and opening infilling in room 2.1, 2.2, 6) are a great deal for evaluation of supporting efforts of masonry.

Fig. 11, Villa Mirabello, Southern façade