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

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

Villa Mirabello was neglected for many 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 place. For this reason, at the moment preliminary investigation began at this level, and it consisted of IRT (Infrared Thermography), backup, in addition to measured drawings. On the other side, historic documentation refers information about the whole complex. Moreover, archive document directly describes results of 17th century building yard. Further documentation mainly relies on building modification in the next centuries, because documents are not always. Their content deal with inventories of objects and furniture, which are linked to variation of users, 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 underneath plaster.

Fig. 1. Villa Mirabello, main entrance.

This paper hosts first results of investigation, cross-referencing 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 deteriorated coating. Results of IRT were verified by endoscopy and stratigraphic sampling.

Results
IRT showed four texture typologies: their location within the building pointed historic 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 substituting the existing large rooms, facing facade, at first floor. (Fig. 2)

Especially, investigation at Villa Mirabello allowed to map four areas 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, due to a wide refurbishment and enlargement of and existing house. Quadri archeologist 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.
2) By now, historic documentation explains consolidating technique: builders inserted "corpo"/stone quoins in brick masonry. These stones are now recognizable at IR, because of different thermal characteristics of stone and brick (Fig. 3).
3) 17th century masonry, which was refurbished, has a regular pattern. The weep holes result for that period: brick/dolomites, "corpo"/stone quoins, bricks/"corpo" quoins. All these building fabric were built up to pre-existing ones, along bearing and interior walls.

More over, historic documentation refers to the consolidating use of "corpo" in masonry.

Other typology (brick/dolomites), could be dated both 16th and 17th century. In fact, it could have been included in 17th century refurbishment, without any modification, if its static conditions were satisfactory, or it could have resulted during Quadri’s modifications, with the same building technique which was used in 16th century and lasted until 20th century. In most Padana Plain.

By performed investigations in rooms 2.1 and 2.2, pointed some original walling was placed a Loggia location of rooms before 16th 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 particules 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 the staircase. Presence of arches shows that entrance door was wider then the present one and that it was changed during their first building, probably because of weakness of roof supporting structures (from a report in historic documentation).

Discovery of another arch, in wall "B", room 9, set on hypothesis that it was an entrance of Cardinal Durin aisle, which connected this part of the apartment of a gallery on the shop/ 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 leaning, and wall "A" leans on "B", therefore "B" belongs to the first building, and it was used by Quadri for the new aisle. At the end of 18th century, a new refurbishment cancelled any traces of the aisle, and its door was walled up.

8) IRT detection "B" arch (Fig. 7) in the main masonry’s thickness, shows how existing masonry is not sliced by visual inspection. Archive documentation described them in details, unfortunately without localizing them.

5) In addition, results of investigation allow to localize Cardinl Durin modifications, made at the end of 18th century. First floor Loggia facade, and vestibule at ground level (towards Lambro river), were substantially changed and divided 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 those variations. Only IRT allowed to locate those variations, by visualizing masonry texture. In fact, masonry produced in the yard owned by Cardinal Durin, has a regular pattern and it is mostly localized in the exterior walls of rooms 2.1, 2.2 and 4.

Discussion

Dyalyzed results allow to pose following notes:
1) Some building techniques are substentially contemporary: they are employed at the same time, with short delay, and in any case in the same evolution phase of complex.

Especially, brick/marble pattern is located both at top and bottom of interior masonry, and it included bricks, brick/dolomites pattern patterns. Brick/marble pattern does not mean an element of absolute dating, because it is recurrently found in historic landscape for many centuries, up 19th 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 areas.

2) Centre of IRT applications depends on the effectiveness of plaster to substitute: where degradation occurs, it is not possible to detect masonry texture, as it happened in rooms 3.3 and 3.5. In both cases, heat flux, which crosses the structure, is interrupted by interposed air layer, for this reason temperature distribution of surface is not representative of interior structure.

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

Conclusions

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

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

Information regarding modification occurred on structures has major importance for structural analysis, above all for structural validation of reuse projects: for example, localization of intradectors weaknesses (cracks and opening slitfing in room 2.1, 2.6, as a great deal of evaluation for supporting efforts at masonry.

Fig. 2. Plan at first floor showing results of Investigation between historic research and IRT

Fig. 5. IRT Thermograms composite of wall "A", room 2.

Fig. 6. IRT Thermograms composite of wall "B", rooms 2.1, 2.2. IRT imaging allows to detect a large arch over the present entrance door.

Fig. 9. Visual state of vault in room 4.3, damage of surface (erosion, lack of soil, lack of plaster, etc.) makes determination.

Fig. 12. IRT Thermograms composite of wall "A", room 9. This image allows to detect a large arch on the present entrance door.

Fig. 11. Villa Mirabello, Southern façade

Fig. 13. IRT Thermograms composite of wall "A", room 9. This image allows to detect a large arch on the present entrance door.

Fig. 14. IRT Thermograms composite of wall "A", rooms 2.1, 2.2, 2.3. IRT using allows to detect a large arch over the present entrance door.