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An Important Film: Polychromy in the Pier Luigi Nervi Halls at the Turin Exhibition Center

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Abstract: Hidden by several layers of white paint, the almost forgotten polychromy of Nervi's exhibition halls emerges from historical images, not necessarily intended to document the complex, but rather as a setting for exhibitions, fairs or film and advertising sets. Historical documentation reveals Nervi's presence on the building site and his desire to supervise the finishing phases. The first stratigraphic investigations also testify to his attention color, as well as the subsequent transformations of use. Specific theoretical and technical issues regarding the conservation of the pictorial layers in relation to the conservation of the reinforced concrete elements are outlined. Furthermore, the use of polychromy in combination with the original employment of natural and artificial light sources introduces new facets into the analysis of Nervi's work, offering the opportunity for original reflection. This is particularly true if we consider the impact of the interventions carried out so far, even those considered non-invasive, such as routine maintenance operations and some technological upgrades.

Key words: Polychromy, reinforced concrete, ferrocement, Turin Exhibition Halls, Pier Luigi Nervi, maintenance, preservation.

1. Introduction

The aim of this contribution is to illustrate the path that led to the rediscovery of the polychromy that was used by Pier Luigi Nervi in Halls B and C of the Turin Exhibition Center[1]. First of all, the accurate study of the bibliography and archival documentation made it possible to reconstruct the events which masked the original colors, and to locate the most significant areas *in situ* where direct and laboratory diagnostic analyses could be carried out. The direct analyses made it possible to identify the stratigraphy of the various layers that characterize the surfaces today. Subsequently, chemical-physical laboratory investigations on samples of selected materials characterized the pictorial films and their state of preservation. The analysis confirmed the presence of polychromy defined by Nervi himself on both the cast concrete and the ferrocement. Starting from this important data, a specific reflection was initiated on the problems of conserving the pictorial films and the supporting reinforced concrete. For this 20th-century architecture, it is unthinkable to bring to light the original films hidden under several layers of white paint covering thousands of square meters of surface. Furthermore, the two objectives of on-site safety and the preservation of the reinforced concrete are in conflict with the conservation of the layered surfaces.

Considering issues related to the future use of Halls B and C, with reference to structural analysis (which highlighted the vulnerability of the building with respect to safety issues) and analysis of materials and construction techniques (which highlighted peculiar aspects related

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[1] The partial results of the research conducted in the framework of the KIM Keeping It Modern Planning Grant of the Getty Foundation, 2019 "The Halls of Turin Exhibition Center by Pier Luigi Nervi: a multidisciplinary approach for their diagnosis and preservation" coordinated by Prof. R. Ceravolo, PoliTo-DISEG are presented here. The study submitted in this contribution refers to the Iuav working group (belonging to Cluster-lab Iuav HeModern) involved in the project: Prof. P. Faccio, arch. G. Bruschi, arch. F. Pasqual. The *in situ* stratigraphic analyses and data processing were conducted by *Leonardo s.r.l.*; the diagnostic investigations for the characterization of the materials and pictorial layers by *CMR Center Materials Research s.n.c.*, Vicenza; the consultancy for the cortical protective products on concrete by *Ecobeton Italy s.r.l.*, Vicenza.

to historical, aesthetic and conservation issues), shed light on the above-mentioned conflict. The necessity to prioritize between conflicting objectives is common during the final phase of design choices. To allow safety issues to prevail involves the loss, in this case, a substantial one, of material and constructive data, which are not at all insignificant, but nonetheless subordinate.

2. The Pier Luigi Nervi Halls at the Turin Exhibition Center

The center under study stands on the site previously occupied by the *Palazzo della Moda*, designed by Ettore Sottsass senior between 1936 and 1938, which was bombed in July 1943, during World War II. At the end of the war, the City gave the building to a new organization, *Torino Esposizioni*, which was majority-owned by Fiat. The company entrusted the project for the reconstruction and extension of the *Palazzo della Moda* to Roberto Biscaretti di Ruffia. In 1947, a competition organized by *Servizio Costruzioni e Impianti Fiat* resulted in the integration of Biscaretti di Ruffia's preliminary work with a more detailed structural design. The execution of the project was then carried out by the competition winner Pier Luigi Nervi, through his Roman company, Ingg. Nervi & Bartoli-Anonima per costruzioni.

Announced as "the most beautiful building Italy has ever built", the new Turin Exhibition Center was to host the XXXI Motor Show, scheduled for September 1948. In record construction time of just 9 months, Pier Luigi Nervi built the largest ferrocement construction in the world [1]: a pavilion 110.5 m long and 95 m wide, distributed like a basilica, with a glazed apse 30 m in diameter overlooking the *Parco del Valentino* and with a rectangular floor with no intermediate supports (75 m long × 81 m wide). The space is delimited by inclined pillars, which branch off with brackets to support the galleries above, and is covered by a large vault. The roofing vault of this hall (Hall B, later *Salone Agnelli*) consists of arches made of ferrocement elements prefabricated on site, raised and assembled with a system of mobile scaffolding. The system of wave-shaped prefabricated ashlars (with inbuilt windows) and scaffolding, along with the half-dome roofing of the apse, obtained with cement castings consisting of more than 300 lozenges (also made of ferrocement and produced on site) are patented by Pier Luigi Nervi himself (Fig. 1).

In 1950, *Torino Esposizioni* decided to expand the building's spaces to accommodate the new editions of the Car and Technology Shows, once again entrusting Pier Luigi Nervi with the construction of Hall C. The new Hall (50×60 m) has a pavilion vault supported by four arches, covered with the same ferrocement system as the half-dome of the apse of Hall B (Fig. 2). The perimeter slabs to the roof of Hall C are made of

Fig. 1 Hall B, interior by Aldo Moisio (Private collection, Ing. Ravelli).

Fig. 2 Hall C, International Car Show of 1950 by Aldo Moisio (Archivio Storico Fiat).

corrugated ferrocement beams and provide rigidity along the perimeter of the roof.

Finally, a new extension was built in 1953, which increased the length of Hall B by another four bays [2-5].

3. The Film Sequence That Reveals Polychromy at the Turin Exhibition Center

There are no published or construction site images which show the colors of the Halls. Even in the publications signed by Pier Luigi Nervi the images are in black and white [6, 7]. The use of black and white images was not only due to the possibilities offered by the technology at the time, or due to the need for low-cost printing, but also due to an intention to improve the perception of forms and enhance the role of light, and volume. The author himself never mentions the choice of color adopted for these buildings, instead, he used his writing to promote his patents and his new fast, cheap and innovative construction techniques. Another influence was the revolution dictated by the Modern Movement: the color white became the starting point for a new story, expressing the cleanliness of forms and the principles of abstraction. Elementary geometry was used to aspire to essentialism [8]. The image of white-painted interiors was therefore consolidated. We think this happened because of a misunderstanding of the principles inherent to Modern architecture, along with the widespread circulation of images depicting the Halls which were used during the 2006 Olympics, and other documents showing their current state of neglect in which the structures are painted white (Fig. 3).

The comparative analysis of different historical sources such as archives, images and videos shed light on the use of color, an aspect that is often underestimated. From some sequences of the film “The Italian Job”, filmed in 1969, which has been a fundamental first source for this research, certain colors can be perceived that clearly show how some parts of the building were painted cream, others gray (Fig. 4). What seems certain is the absence of bright white paint.

This initial clue led to the consultation of historical images not necessarily aimed at documenting the Center, but rather as the setting for exhibitions, fairs or film and advertising sets, confirming that Hall B was once multicolored (Fig. 5) and raised doubts about the possible presence of polychromy also in Hall C (Fig. 6).

On closer inspection of the bibliography, it is possible to make a few hints about polychromy at the Turin Exhibition Center. The ferrocement parts, due to their executive precision, are exposed while the cast elements, e.g. pillars and shelves, that support the galleries are plastered and painted with a bright ochre color. This color is also used for the large façade of the entrance both internally and externally [3].

Fig. 3 Hall B, the appearance of the interior in white at present (courtesy of Fabio Oggero, 2022).

Fig. 4 A scene from “The Italian Job” (1969) set in Hall B directed by Peter Collinson.

Fig. 5 Hall B, Flor61, 1961 (Archivio Amici d'Italia).

Fig. 6 Polychrome in Hall C, current state (photo by author).

The forecast expenditure for the project demonstrated that the pillars and other structures in Hall B were colored with *Duranova* plaster. However, no information is given about the specific color that was to be used or its area of application. Specifications state that all exposed concrete surfaces were to be plastered, while prefabricated structures would be treated like the existing one. Contrary to the expectation that the documentation would show no finishings planned for ferrocement, it seems that a finishing treatment was also envisaged for the prefabricated elements.

A document found in Ing. Ravelli's private archive testifies Nervi's presence at the construction site and his desire to supervise the finishing phases. In a letter written by Nervi to the lawyer Gino Poletti, Secretary General of *Torino Esposizioni*, he declares his dissatisfaction with the selected shades. The letter also deals with the issue of plant equipment, which Nervi holds responsible for preventing the legibility of the architecture.

4. The Analysis of the Polychromy: Method and Materials

The analysis phase had two objectives: the first was to define the type and sequence of coatings and colors attributable to the different interventions through *in-situ* micro-destructive testing. The identification of the various layers also aimed to define the execution technique of execution and colors. The second was to characterize the constituent materials of some samples through laboratory investigations.

4.1 Direct in Situ Analysis

The target areas were identified through the historical analysis. So twelve stratigraphic tests were carried out on the coatings in Halls B and C, by *Leonardo srl*, a restoration company involved in this research. We then proceeded with the investigation through direct surveys done with hammers and thin-blade scalpels.

For each layer that emerged, the functional typology was defined (monochrome finish, polychrome decoration, shaving, dull, plaster, etc.) and the color was recorded with a digital colorimeter (NCS ColourPin3, Bluetooth Colorimeter-NCS Colour AB-Stockholm).

At the conclusion of the stratigraphic survey, a relative chronology of the resulting stratifications was defined, which is represented through coating diagrams in which the various layers identified in the different tests are related. The diagrams make it possible to interpret the layers of each sample not as point information, but as an integral part of the complex of buildings investigated in a certain execution phase. The bichromy illustrated in Fig. 7 plausibly represents the original configuration of the perimeter wall in Hall C as well as all the pillars in Hall B (apse and balcony) (Fig. 7).

Fig. 7 Hall C, perimeter wall, sample No. 5: bichromy between the upper part, beige in color, and the brownish skirting (*Leonardo srl*).

The analyses led to the identification of coating and finishing layers attributable to three macro-periods of activity.

Period 1 (from 1949 to approximately 1969) is the original configuration of the finishes, and the oldest among the finishes found. In Hall C it is characterized by a two-tone effect obtained by differentiating the surfaces of the background walls, of light beige color with brown skirting, while the architectural elements are characterized by a dark gray finish. The chromatic configuration of Hall B is comparable to that found in the adjacent Hall C, therefore distinguished by a bichrome obtained by differentiating the light ochre yellow pilaster surfaces with a brown skirting. The other architectural elements are characterized by a layer of finish with rough textures of gray (wave ashlars and lozenges apse).

In period 2 (from approximately 1969 to an unknown date) the original finishes were modified. In Hall C the perimeter walls were painted a dark yellow ochre while in Hall B they were painted a light ochre yellow with a light hazelnut skirting. The architectural elements were painted light gray (Hall C) and ivory and white (Hall B). Moreover, a bright blue maintenance layer was found on Hall B's lozenges apse and a very bright yellow color on Hall C's arches.

Period 3 (from an unknown date to the present day) is related to the current appearance characterized by a two-tone effect obtained by differentiating the surfaces of the back walls, which are pink-beige, from the architectural elements (pillars, balconies, roofing elements) which are all indistinctly white.

4.2 In-Depth Laboratory Analysis

Petrographic, microstratigraphic and chemical-physical investigations were carried out by the CMR Center Material Research Snc, in order to identify seven significant plaster fragments taken from the interiors of Halls B and C of the Turin Exhibition Center.

The analytical plan employed the following instrumentation:

- Analysis using a polarizing microscope with reflected light on a polished section: to identify the sequence of layers present;
- SEM (scanning electron microscope) analysis accompanied by an elementary chemical micro-wave microanalysis of EDS (energy dispersion electrons) on a polished section: to identify the type of inorganic elements present in the stratigraphic package;
- FT-IR (Fourier transform infrared spectrophotometric) microanalysis: to determine the presence of organic substances.

In all samples, the stratigraphy is complex, characterized by many different layers, which is not easy to correlate between the different samples taken. More specifically, we noticed the presence in all samples of carbonate matrices based on calcium carbonate and less on magnesium carbonate, often mixed with synthetic resins of the vinyl type. If present, pigmentation is based on traditional pigments, such as yellow ochre, green earth and carbon black, with a rounded morphology and fine grain size.

Given the heterogeneity of the samples, it is plausible that there were different phases of restoration or maintenance. To simplify the reading, it was decided to divide the stratigraphic package into two. In fact, it is interesting to note that in all the samples analyzed there is an initial execution phase, based on calcium carbonate and magnesium, sometimes mixed with vinyl

resin (resin not present in the b-c layers of sample No. 2 (Figs. 8-10), in the c layer of sample No. 3 and in the b-c layers of sample No. 7) and a second layer of calcium carbonate mixed only with white titanium particles and silico-aluminate and quartz. In the second period, the layers have a homogeneously distributed microporosity throughout the examined sample, alternating with a macroporosity with relative cavities and blisters caused by the incorporation and subsequent loss of air.

As mentioned above, the coloring of materials was always carried out with traditional pigments; on the contrary, the very bright yellow pigmentation found in sample No. 3, and the layer (d) of intense blue in sample No. 4, essentially based on phthalocyanines, are the result of more recent interventions.

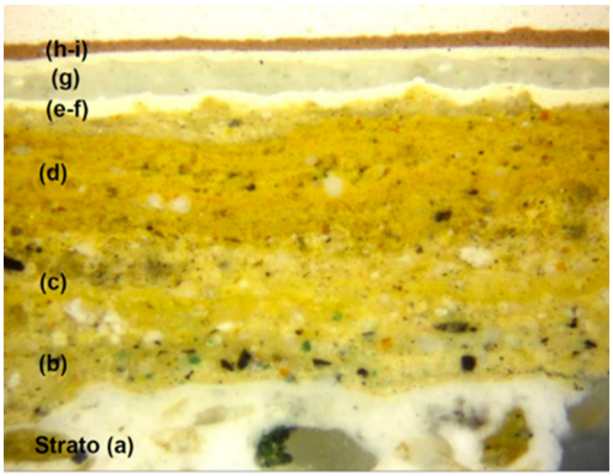

Fig. 8 Hall C, Perimetral wall, sample No. 2, stratigraphic analysis under the optical microscope: "b" and "c" layers without vinyl resins (CMR Center Material Research Snc).

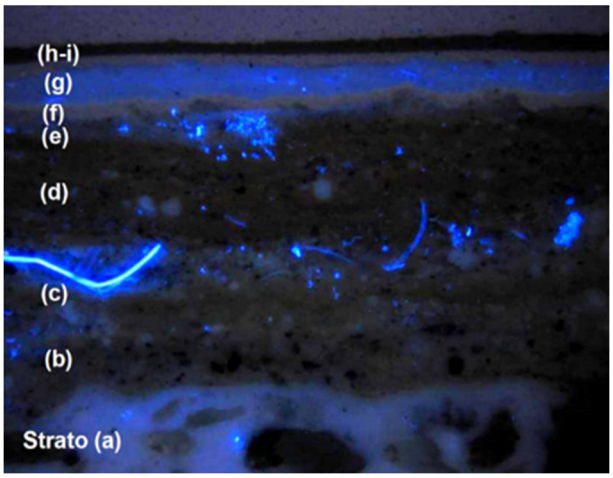

Fig. 9 Hall C, sample No. 2, analysis under the optical microscope with UV (ultraviolet) illumination (CMR Center Material Research Snc).

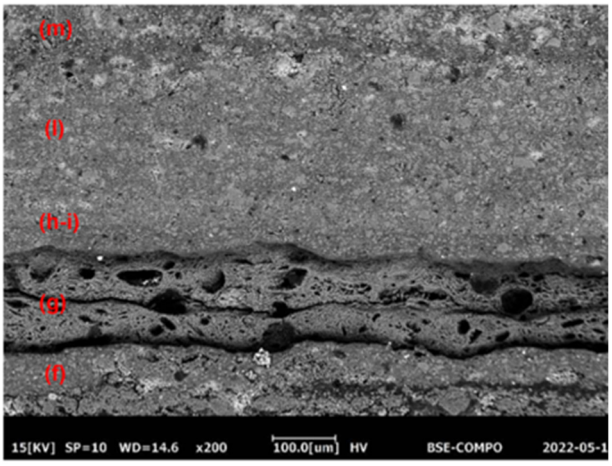

Fig. 10 Hall C, sample No. 2, examination with the SEM electron microscope: layers from "f" to "m" where the alternation between micro and macro porosities is clearly visible (CMR Center Material Research Snc).

5. Results and Discussion

Over the years, the Turin Exhibition Halls have hosted numerous events. Many changes have been implemented: continuous repainting; the updating of technological systems and lighting (often in contrast with the natural and neon light of the original project); the replacement or modification of windows; the closure of portions of balconies on the first or ground floor; and the partitioning of spaces in the stands with plasterboard structures. Ordinary maintenance has been frequent, and has taken place without a coordinated global plan. Maintenance was generally carried out in an ad hoc way, in reaction to the needs of the day or damage that had occurred. Consequently, the original appearance of the Halls has been altered.

The overlapping layers of paint make us forget the original polychromy. White paint is the most recent finishing and the surfaces appear to be uniform. Documentation of transformation over time is largely lacking and the few existing testimonies are limited to some advertising images of past events, which do not allow us to reconstruct the transformations in detail.

Another important change is the fact that in both halls B and C, the entire original neon lighting system of the project was removed.

Finally, over the years, rainwater infiltration has spread, leading to the waterproofing of the extrados of roofs with bituminous sheaths, which however, are no longer effective. Abandonment and the lack of a conservation plan are problems that must be solved, and along with vandalism these threaten the future of the exhibition buildings.

6. Conclusions

In a heritage-listed building such as the Turin Exposition Center, the presence of original layers of paint, documented by indirect sources and by the analyses carried out, poses a challenge to conservation efforts.

First, it is unthinkable to bring back to an original state the thousands of square meters of the interior surfaces of the Halls back to an original state, exposing the colors selected by Nervi.

The three-dimensional reliefs created, together with the historical documentation collected, could make it possible to "see" an overview of the original polychromy in a virtual way, thanks to augmented reality technologies.

Secondly, the current state of neglect, the infiltration of water, the presence of moisture, and incongruous uses have brought about an accentuated degradation not only of the surfaces, but also of the concrete and masonry used as support materials. In addition, protective products for the preservation of reinforced concrete (water repelling, consolidating, migrating anti-corrosive products and techniques) must be applied to exposed concrete, making the choice of methodology even more complex.

At the same time, an experiment aimed at verifying the durability of the ferrocement material, through accelerated aging, was also carried out. Some series of ferrocement samples were treated with protective products provided by Ecobeton Italy srl, in particular migrant inhibitors of corrosion and water-repellent products.

In relation to the presence of original layers, one of the series of samples was intended to test the effectiveness of the migrant products on samples with and without layers of paint.

The structural analysis related to the future use of Halls B and C (which highlighted the vulnerability of the building in terms of safety issues) and the analysis of materials and construction techniques (which highlighted particular aspects related to historical and aesthetic issues and conservation), define a conflict of interests: how can we guarantee the safety of the exhibition spaces without the loss of material and constructive data for not secondary, but however subordinate.

The CMP (Conservation Management Plan), is an operational tool used to support the process of preparatory research, documentation and management of historical sites, for the preservation of cultural heritage. This tool could be useful for collating the variety of issues arising from the knowledge path developed in an interdisciplinary way. A specific CMP for the Turin Exhibition Halls is the result of the KIM (Keeping It Modern) initiative [9, 10]. The promotion of methods and strategies for maintenance and daily management, through the CMP, plays a role of primary importance, especially for the heritage of contemporary architecture, whose fragility and complexity are at risk of getting lost even before they have been totally appreciated and understood in a thorough way.

Before the start of the Getty KIM project on the Turin Exhibitions Center, a specific function for the complex had been assigned. Halls B and C are now confirmed to become a Civic Library and plans for its realization are ongoing. Given the interdisciplinary path of analysis undertaken in our study and the iconic architecture at stake, it is important to highlight and consider some specific issues.

The complex relationship between form, structure and function that characterizes Nervi's architecture is

indeed a critical issue to be addressed. Conservation and safety must coexist in a non-conflicting way, to avoid the prevalence of one over the other and to ensure respect for the original fabric. Safety and conservation should go hand in hand, and this is precisely the approach followed in the preparation of the CMP for the Turin Exhibitions Center.

From the analysis of Nervi's Halls, we found that the definition of a function compatible with the existing building could resolve the conflict mentioned above.

The concept of integrated conservation, introduced in 1975 with the "European Charter of Architectural Heritage" and defined as "the result of the joint action of restoration techniques and the search for appropriate functions" may be of great use in this case [11]. The development of a specific project, for this place, with these characteristics, will have to take into account the vulnerabilities and peculiarities highlighted by the path of knowledge. Intervention can be carried out by way of proper and skilled architectural design rather than with direct actions on materials and constructions. Thus, it is possible to adapt architectural choices to devices that will also solve the contemporary needs of the building.

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