



From Knowledge to Wisdom

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# Journal of Civil Engineering and Architecture

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# Modern Architecture and Color

## Conservation of 20th century building materials and surfaces

In 20th century architecture, color plays different roles determining both aesthetic value and significance of modern buildings: from a tool of spatial qualification, to an element connected to social, pedagogical or healing aspects, to a feature of natural and urban landscape. The legacy of this season of experimentation and innovation is today dealing with the fragility of building materials and surfaces, that are progressively changing the heritage in the eyes of the observer.

The theme of conservation and preservation of modern polychrome surfaces highlights aspects and criticalities, both theoretical and operative, that require specific in-depth studies.

The special issue of JCEA brings together relevant ongoing researches and recent studies presented as part of the International Research Seminar “Modern Architecture and Color. Knowledge and conservation of 20th century building materials and surfaces”<sup>1</sup> promoted by the Research Cluster “He.Modern - Heritage culture and Modern design” of the Iuav University of Venice, held in Venice on 28th October 2022.

Each paper is based both on the historical analysis of the archival documentation and the *in situ* investigation of relevant buildings characterized by an experimental use of color, understanding their qualities and providing new methods of characterization of materials and techniques, new approaches for the analysis of alteration and degradation phenomena, and innovative strategies for the preservation and maintenance program.

The studies reflect the interdisciplinary nature of the international research intended as an opportunity for dialogue between Italian and foreign scholars on case-studies and topics not yet investigated, with the aim of making a contribution to knowledge and preservation of modern architectural heritage.

Sara Di Resta, Greta Bruschi, Paolo Faccio

*Department of Architecture and Arts, Università Iuav di Venezia*

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<sup>1</sup> International Research Seminar “Architettura e colore. Conoscenza e conservazione di materiali e superfici del XX secolo / Modern Architecture and Color. Knowledge and conservation of 20th century building materials and surfaces”, Aula Magna Tolentini, Università Iuav di Venezia, 28th October 2022. As part of the research and educational activities of SSIBAP - Post-graduate School of Specialization in Architectural and Landscape Heritage, and research cluster He.Modern - Heritage culture and Modern design. Under the auspices of SIRA – the Italian Society for Architectural Conservation/Restoration, DOCOMOMO Italy, FOAV Federazione Regionale Ordini Architetti Pianificatori Paesaggisti e Conservatori del Veneto, and Ordine degli Architetti, Pianificatori, Paesaggisti e Conservatori di Venezia. Organizing Committee: Sara Di Resta, Greta Bruschi. Scientific Committee: Paolo Faccio, Susanna Caccia Gherardini, Angelo Maggi, Marco Pretelli, Pierre-Antoine Gatier, Giacinta Jean.

The outcomes of the International Research Seminar are collected in this JCEA special issue, edited by G. Bruschi, S. Di Resta, P. Faccio.

# Preface

## Modern Architecture and Color. University, Research, Education.

Benno Albrecht

Rector, Università Iuav di Venezia

The special issue of the *Journal of Civil Engineering and Architecture* focuses on the activities of the research cluster “HeModern - Heritage, culture and Modern design” of the Università Iuav di Venezia, that consists of national and international scholars, institutions and companies in the field of architectural preservation.

The Department of Architecture and Arts is the place where the investigation activities are fuelled by the discussion and collaboration between different cluster research, that carry out multidisciplinary paths interpreted not as a sum but as an interaction of skills.

The research cluster “HeModern” investigates tools and methods of preservation of modern heritage, from design items to buildings, from cities to territories.

Architectural conservation, science and technology, history, design and urban planning are the subject areas that converge on the themes explored in the special issue.

The selected papers address the theme of color in 20th-century as a result of the international research seminar “Modern Architecture and Color. Knowledge and conservation of 20th century building materials and surfaces”, held in Venice in October 2022. The main topics include the role of color in the design path and in photographic representation; the knowledge of modern building materials between polychromy and polymateriality, tradition and innovation; sustainable diagnostic methods for modern heritage; new strategies for conservation intervention.

Modern and contemporary heritage represents the legacy of the most important architects of the 20th century. The preservation of their works involves research and education, and represents one of the cultural challenges that the Università Iuav di Venezia has decided to take up.



**ARCHITETTURA E COLORE**

**conoscenza e conservazione di materiali e superfici del XX secolo**

Giornata internazionale di studi organizzata in occasione della IV edizione di Iuav per il Restauro

a cura di Sara Di Resta e Greta Bruschi

comitato scientifico Paolo Faccio, Susanna Caccia Gherardini, Pierre-Antoine Gatier, Giacinta Jean, Angelo Maggi, Marco Pretelli

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# Color, Time, Layering and Preservation

Paolo Faccio

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**Abstract:** The preservation of polychromy in 20th century architecture is here considered from both theoretical and operational perspectives. A further theme is that of polymatericity, which addresses issues related to the experimental context with reference to the materials and technologies employed. The passage of time and the lack of durability of innovative materials, the transformations and the presence of forms of alteration and degradation, pose problems related to the will and the possibility of preserving layering, without falling into the restoration of the presumed original document, in relation to the authorial project documentation and the underlying theories.

**Key words:** Polychromy, polymatericity, 20th century architecture, innovative materials, layering, preservation.

## 1. Introduction

The recognition of the role of color in the architecture of the past was first expressed in 1832 by Quatremère de Quincy in the *Dictionary of Architecture* [1]. The theme of color, beginning with archaeological findings, became part of the theoretical debate in architecture and, therefore, was also faced by the many architectural movements that animated the Modern Movement.

Giulio Carlo Argan (1909-1992) wrote that color should not be a mere decorative component, but rather a fundamental element of formal structure. Argan stated that architecture and color must be conceived and designed simultaneously. This clarification highlights an extraordinarily complex issue for the preservation of polychromy architectures nowadays. Indeed, we cannot neglect to consider the role of time, whose action shapes the architecture, transforms the surfaces and sometimes modifies or deletes the original colors.

Argan, referring to movements and actors that characterize the early 20th century, identified “De Stijl” as a key episode in the history of contemporary art [2].

## 2. The Color Issue and the 20th Century Architecture

Theo van Doesburg (1883-1931) is known as the

founder and leader of “De Stijl”. In 1924 he published the essay “Toward a Plastic Architecture” in which he outlined 16 points on the neo-plastic vision of modern architecture. The 14th and 15th points faced the color issues. In particular, the 15th point explains: “The new architecture is anti-decorative. Color (and this is something the color-shy must try to grasp) is not a decorative part of architecture, but its organic medium of expression” [3]. Van Doesburg also wrote: “We have given color its rightful place in architecture and we affirm that painting separated from architectural construction has no right to exist” [4].

Van Doesburg exemplifies this concept in the study of the *Maison Particulière* where volumes are emphasized with the use of the primary colors: blue, yellow and red (Fig. 1).

In 20th architecture, color becomes a very important theme expressed in the poetics of the masters [5].

Le Corbusier constitutes the best-known example to emphasize the fundamental importance of color in architecture. He proposed the concept of *Polychromie Architecturale*, introducing the *claviers de couleurs* (keyboards of colors). The first *palette* of 1931, which would be used by the company *Salubra* for a wallpaper collection, included 43 hues in 14 sets of solid colors and calibrated tones. Le Corbusier, based on previous





**Fig. 1** Theo Van Doesburg, Cornelis van Eesteren, *Maison Particulière* 1923.

experience, including Maison La Roche (1924), created color combinations that recalled studies on optical sensations and moods [6].

In 1959 a second collection completed the first *Polychromie Architecturale* and consisted of 20 additional bright colors and 63 shades, used in the *Unité d'Habitation* and at the *Maison De L'Homme* in Zurich. The harmonization of the various colors in the palette was compared to the role of a piano master. As a further supplement to the previous comment Le Corbusier writes "It was necessary to prevent colors from reducing the aesthetic value of the walls [...]. Therefore, an authoritative assumption: eliminate colors that can be considered non-architectural. Better yet: identify, choose colors that can be called exclusively architectural, and limit yourself to them. These are more than enough!" [7] (Fig. 2).

These synthetically reported examples are followed by later experiences in which color also finds a relationship with the surrounding landscape. The Italian case of Edoardo Gellner provides an important topic. In the former ENI village of Borca di Cadore, Gellner indeed introduces a selection of colors that accompany the changing of nature in the different seasons [8] (Fig. 3).



**Fig. 2** Le Corbusier's apartment in Paris after renovations (Scaramuzza, 2018).



**Fig. 3** E. Gellner, former ENI village in Borca di Cadore (Faccio, 2018).

### 3. Conclusions

The examples given, though fragmentary, are nonetheless significant in highlighting conservation issues. The possibility of reading layers over time, and the role of time shaping and transforming architecture (and surfaces), seems to be contradictory to theories of color in architecture, which would seem to suggest the need to innovate/restore polychromy in its full and total legibility.

It is necessary to mention the conservation of materials, in relation to the experimental techniques employed in the twentieth century, where technological innovation also assumes an important role related to both color and polymatericity.

In this context, therefore, fundamental issues arise with which the preservation of twentieth-century architecture

has to deal. The question is whether to pursue the approach of preserving the layering over time or to prioritize the memory of theoretical assumptions and design outcomes that constitute a fundamental part of the Modern Movement.

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# Restoring 20th Century Architecture: Few Words about a Possible Theory

Susanna Caccia Gherardini

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**Abstract:** The restoration of twentieth-century architecture has led the discipline to develop a solid theory which, considering the complexity of new issues to be resolved, can provide useful instruments, above all critical ones, for operational practice.

**Key words:** 20th century architecture, restoration, preservation, heritage.

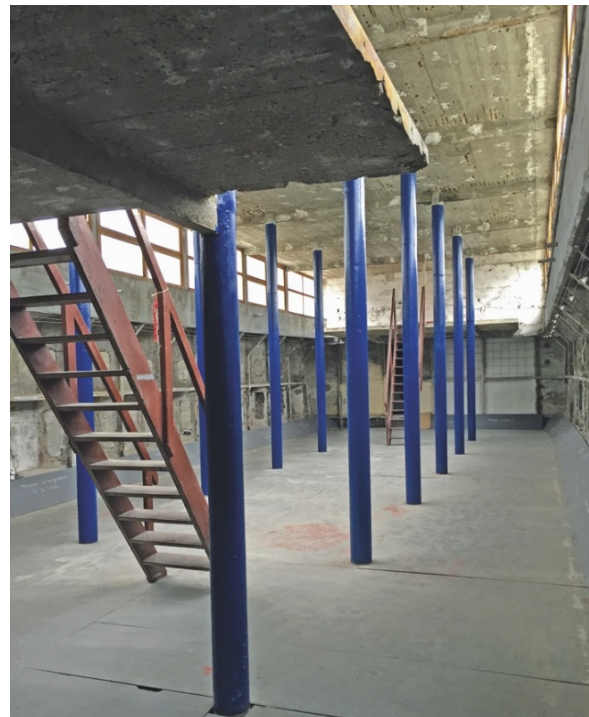
## 1. Introduction

An expansion of the boundaries of what can now be recognized as heritage opens up not only linguistic conflicts about what is or is not defined by that term, but also what restoration methodologies can or should be<sup>1</sup> [1-4]. If these conflicts exist within questions concerning already established operational practices for architecture considered “historical”, even within the European context alone, the disagreements are amplified if the gaze shifts to 20th century heritage [5]. In order to address and establish intervention practices, it seems more necessary than ever to develop an adequate theoretical approach to problems that 20th century architecture poses to the restorer today. Especially at a time when various technocratic drifts have pushed the discipline mainly towards micro-specialist solutions, when in fact the problems posed involve far more complex critical issues, first and foremost the intertwining of recognition, memory and political use of the past [6].

## 2. Authorial/Anonymous Architecture

Moving into the 20th century, the first issue that arises is how different artistic movements and geographical contexts approached the question of surfaces and color.

We need only recall the differences between De Stijl and Constructivism, between Bauhaus and Dadaism. The other fundamental aspect is that this problem arises in different ways between authorial architecture, with the added difficulty of the transition to icon, and anonymous buildings (a term preferred to “minor”, but there is much to discuss in this sense, too) [7].



**Fig. 1** Le Corbusier, Asile flottant, Paris (2016).

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<sup>1</sup> On the evolution of the concept of heritage note at least: Babelon, J.-P., and Chastel, A. 1995; Poulot, D. 1998; Caccia Gherardini, S., and Olmo, C. 2015. For a general overview of the problem see also Swenson, A. 2013.

The works of Le Corbusier (Fig. 1), Mies van der Rohe or Terragni have not only undergone multiple restorations, but in these cases the most deeply rooted disease in the restoration culture offers an almost paradoxical example. The search for the origin, the cult of traces left behind by customs and time, and the transition from testimony (of an artistic conception, a constructive culture, a cultural and social environment), gives way to an almost ontological value of the work.

These problems are compounded by an additional one that further complexifies the definition of a theoretical framework: the reproducibility was made possible by materials and techniques throughout the 20th century [8].

Moreover, the prevalence of the photographic image as the primary source of restoration over the materiality and stratification of interventions and uses of the work has resulted in aesthetic precaution prevailing over heritage precaution [9, 10].

The problem of color, materials and more generally surfaces in 20th century architecture finds answers articulated on a case-by-case basis, as also demonstrated by the essays within this volume, which well exemplify the complexity of the matter especially in terms of research and practice (Figs. 2 and 3).

A starting point could be to transfer the complexity of the issues listed above to a testing ground using the arguments and procedures of microhistory<sup>2</sup> [11, 12].

### 3. A Possible Theory

The first characteristic that may pertain to what could be defined as a potential micro-restoration [13] is the possibility of proposing a scientific approach in the strong sense of experimental science, highlighting causal links from small to large scale. But perhaps the real issue concerns the sources. The illusion of the mirroring of reality does not belong to micro-history: what is interesting is the presence of the past in our

contemporary world, that is the set of sources that represent the “real” for the historian and the restorer. In this sense, micro-history goes beyond the traditional criticism of sources: the problem becomes the textual, as well as material, construction of the source, its uses over time, its conservation, and the consistency of its distribution with respect to other documents.

The reflection should be shifted to what it means to talk about micro-restoration, the plan shifts to textual construction, to the construction of the fact, starting with a review of the usual approaches to the debate on documentality [14].



Fig. 2 V. Garatti, R. Gottardi, R. Porro, *Las Escuelas de Arte, La Habana* (2019).



Fig. 3 J.-F. Zevaco, *Thermal Bath Station, Sidi Harazem* (2023).

<sup>2</sup> There is a well-established bibliography on microhistory, among many see Revel, J. 2006; Vito, C. G. 2015.

Criticism of the sources, whether paper or “material”, does not make the investigation “scientific” but is a precondition, today more than ever, for the restorer’s cognitive and decision-making process to move from the extremely delicate relationship between awareness of what they reveal to us today and knowledge of their origin. Sources are in fact social productions that must be decoded as such.

The relationship between investigations, research, surveys and studies is far from a simple problem and is constructed in the concatenation of the different work phases and their placement in a hierarchy, while there is a very strong risk of evolutionism and/or descriptivism in these transitions. The problem of how to structure a historical-critical investigation of 20th century buildings with the aim of clearly revealing the building’s physiognomy, nature and characteristics, not without declaring any gaps that may have emerged in the cognitive process, is anything but trivial and, to date, is a largely underestimated problem [15].

#### 4. Conclusions

In restoration, there is no theory of oblivion, of what has been forgotten, why and especially whether it should remain so. Whatever architecture is restored, what does not exist has a hermeneutic force almost as much as the traces that can be found in its material. Referring to the heritage of the 20th century, all these cues have to be measured against an architecture that is experiencing a quantitative leap never before seen in history, and coming to terms with the question of reproducibility, whose sources are on the one hand exorbitant and on the other hand repetitive, with the consequent undermining of the tools and methods of

traditional restoration.

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# The Colors of the Eiffel Tower: A Case Study

Pierre-Antoine Gatier

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**Abstract:** Architectures undergoing restoration often have numerous layers of color related to their history and previous interventions. Each layer takes on its own precise meaning related to a specific history and cultural context. The case of the Eiffel Tower becomes significant in illustrating past events and designing future intervention.

**Key words:** 20th century architecture, Eiffel Tower, colors, history, preservation.

## 1. Colors of 20th Century Architecture

There are many ways to talk about color in architecture:

- Color of the designed architecture
- Color of the built architecture
- Color of the architecture reproduced and broadcast
- Color of the urban and landscape context
- Modified color of the architecture, before the

color of the restored architecture

It all adds up to the color of the architecture.

Each of these colors represents a moment in the history of a project and of an architecture, its transformation, the techniques of the image and the evolution of its reception. Each of these colors needs to be analyzed before they can all be confronted. Together they form a coherent materiality, dissonant or shifting materialities, to perceive a real or dreamed about color.

## 2. The Eiffel Tower: An Example

The Eiffel Tower, designed by Gustave Eiffel for the 1889 Universal Exhibition in Paris and a founding symbol of modernity, illustrates all these issues. The 20th repainting campaign<sup>1</sup> currently underway has provided an opportunity to analyze the history of its colors in order to define a heritage repainting project: archives

research, surveys by restorers (Fig. 1), analysis by the Laboratory (LRMH), health constraints on lead paint.



**Fig. 1** Eiffel Tower, picture of a stratigraphic survey detail.

## 3. Color of the Designed Architecture

### 3.1 The Prussian Blue Tower

A complex structure designed by engineers from the Eiffel design office is expressed using the codes for representing its material. Built of iron, it is designed and colored in blue, a hue that identifies ferrous

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<sup>1</sup> The Eiffel Tower is the property of the City of Paris and its management is entrusted to SETE. The main Contractor for the 20th repainting campaign is Agence Pierre-Antoine Gatier, represented by Marion Gauchard, architecte, project director.

materials. Since the end of the 18th century, the colored representation of the material of modernity has used a new pigment, the Prussian blue. It categorizes iron, without claiming to identify strictly the alloy chosen by Eiffel, puddled iron. The Musée d'Orsay collections include drawings of the Nice Observatory designed by Charles Garnier, rigorously colored in blue to document the use of puddled iron. In 1889, however, the engineer's mastery of the nuances of blue mixed with the red of carmine and the black of Indian ink enabled him to express the major materials of metal construction, iron, cast iron and steel.

## 4. Color of the Built Architecture

### 4.1 *The Venetian Red Eiffel Tower*

The black-and-white photographs taken by the Chevojon studio and those of the photographers who followed the gradual construction of the Tower cannot convey the color. We need the records of the paint supply, which specifies the use of Venetian red pigment. After the Tower's inauguration, the chromolithographs produced spectacular images of a red tower. For Gustave Eiffel, the construction of the Tower was the culmination of the construction processes used on the great bridges' pylons. The parts were systematically prepared and inspected in the workshop, and painted with a first layer of lead-based anti-corrosion paint. Once the Tower has been riveted together and assembled, two new coats of paint are applied, colored with Venetian red. After the blue of the drawings, this tint was an aesthetic display of both the anti-corrosion necessary for the conservation of the metal as well as the engineer's work. The survey carried out during the 20th painting campaign identified these initial red layers. It confirmed the exceptional three-tone gradation from base to top described by Gustave Eiffel. His total mastery of the processes involved in iron construction enabled him to go beyond the engineer's point of view and create an aesthetic work of art. By coloring the Tower, Eiffel became part of a history of architecture in the 19th century that was imposing color

as a means of writing, following on from the work of Paxton and Owen Jones on the Crystal Palace in 1851. The Eiffel Tower in red embodies the new architecture of the 19th century.

## 5. Colors of the Architecture Reproduced and Broadcast

### 5.1 *The Yellow-Brown Tower*

Gustave Eiffel undertook the first repainting campaign in 1893, and established a regular schedule of one campaign every seven years. This new protocol involved a new color scheme. Gustave Eiffel abandoned Venetian red and chose ochre pigments in an oil-based binder. For the 1900 Universal Exhibition, Gustave Eiffel publishes "The 300m Tower". The collection of technical drawings from the design office reflected the ochre hue of the iron. The color was henceforth known as the "Yellow-Brown". The process of painting the Tower intersected with the history of anti-corrosion painting techniques and the invention of protocols adapted to the new steel structures. From 1907 onwards, Gustave Eiffel used "Ferrubron" for the regular repainting campaigns of the puddled iron. The Eiffel Tower, built for the Universal Exhibition, was to be dismantled twenty years later. Gustave Eiffel gradually obtained permission to maintain the Tower. The 1907 color was faithfully reproduced until his death in 1923 and maintained until 1965. The Eiffel Tower was red for three years, forming an image that has become mythical for artists.

## 6. Color of the Urban and Landscape Context

### 6.1 *The Brown Tower*

In 1965, the Eiffel Tower was listed a Historic Monument. A new color was chosen, a grey-brown that would express the iron of the Tower. The blue hue was considered; it was not the forgotten memory of the technical designs of the 19th century; it was a request to erase the Tower from the Parisian sky. The attempt to paint the Tower blue in a way that breaks with Gustave Eiffel's choices is a paradox. Monumental

architecture that dominates the Parisian landscape, anticipates the heritage rediscovery of this architectural century.

## 7. Modified Color of the Architecture, before the Color of the Restored Architecture

### 7.1 The Work in Progress

The 20th repainting campaign respects the goals of the anti-corrosion treatment. A new analysis of the history of the Tower’s colors has guided the choice of the new tint: it respects Gustave Eiffel’s choice of a “Yellow-Brown” oil paint graded into three tones. Eiffel invented a red Tower for the Universal Exhibition, then the ochre hue of the stone of the Parisian monuments.

Color was constantly reinterpreted to express the changing values of architecture (Figs. 2 and 3).

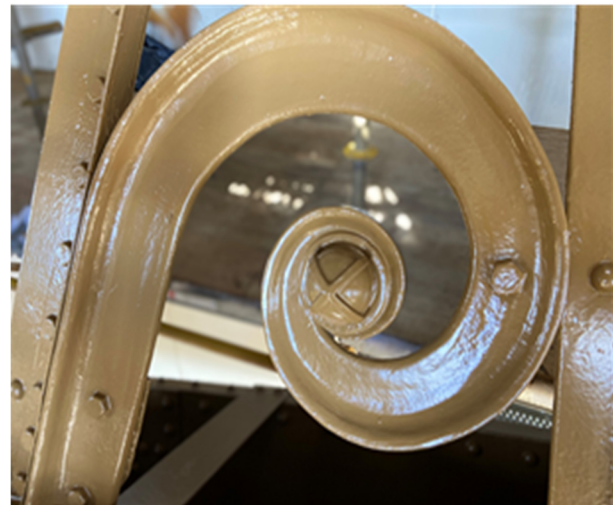


Fig. 2 Eiffel Tower, detail on pickled framework.

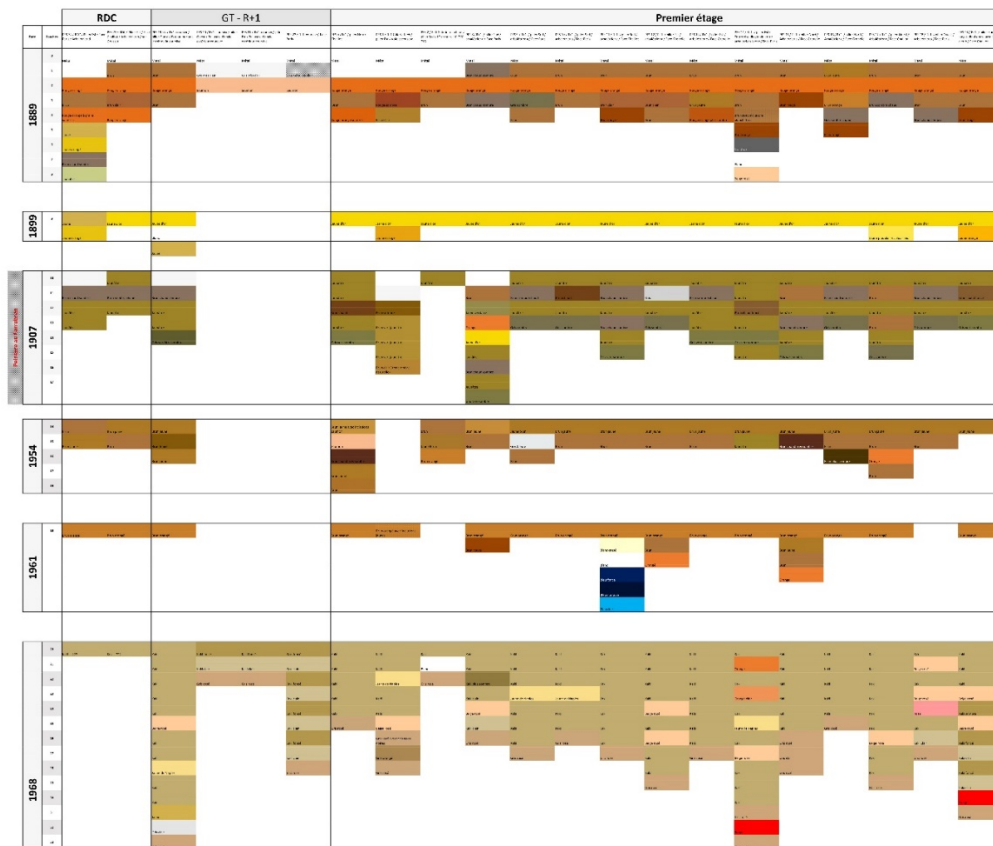


Fig. 3 Summary table of the stratigraphic surveys, PAG Agency with Claire Dandrel and Annick Texier, LRM.

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[1] The Eiffel Tower is the property of the City of Paris and its

management is entrusted to SETE. The main Contractor for the 20th repainting campaign is Agence Pierre-Antoine Gatier, represented by Marion Gauchard, architecte, project director.



# From Winckelmann to Restoration of the Colors: Modern Architecture from Kodachrome to B&W

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**Abstract:** The restoration of modern architecture raises open issues starting from the interpretation of its original colors. The essay investigates the different approaches emerged by restoration works that have led to erroneous restitution of the building's image.

**Key words:** 20th century architecture, restoration, color, photography.

## 1. Introduction

“Restaurer un édifice, ce n’est pas l’entretenir, le réparer ou le refaire, c’est le rétablir dans un état complet qui peut n’avoir jamais existé à un moment donné”. Unchanging, unforgettable, incisive, incipit of the entry *Restauration* [1] written by Eugène Emmanuel Viollet-le-Duc is still capable to explain, better than any subsequent theories in the field of architectural restoration, the ways in which the restoration of existing buildings, no matter how old, was conceived, but more importantly, was realized.

## 2. From Kodachrome to B&W

Architects involved in restoration works usually have the goal of restoring the buildings “dans un état complet qui peut n’avoir jamais existé à un moment donné”. However, respecting only the visual integrity of Modern heritage does not require testing, nor analysis, nor checks. That state of completeness lies in our retinas, even before the countless stock images (actually, always the same) that usually accompanied the inauguration of modern buildings that were manifestos of a new way of living, even before new places to live.

Those photographs were made in black & white: color photography, made available on the market since

1936 by Kodak company with the introduction of Kodachrome film, would not become commonplace until after World War II (although the architectural photographers would often continue to use black & white, considered more elegant, less distracting in relation to the qualities of volumes, of the shadows, of the surfaces of buildings whose main value laid in the purity of the surfaces, the absence of ornamentation, the sculptural volumes; all qualities for which the chromatisms of Kodachrome and later color films represented an unnecessary distracting factor).

The fate of modern architectures was thus, inevitably, to be restored to a state of renovated completeness, we are now certain, that buildings had never had.

But what are the reasons for the “return” to black & (especially) white (Fig. 1)? When was it decided that modern buildings should be white, somewhat like cathedrals, almost a retaliation to what Le Corbusier [2] stated in one of his famous books?

We do not have a certain data, nor a precise author or event; the answer may lie in what has been written above, in the image that books, journals and magazines have created over decades, in the absence of color in those photos, republished countless times. But there is also a possible critical thinking that moves away from the European context and, through the Cornell University



**Fig. 1** Le Corbusier, Pierre Jeanneret, Doppelhaus, Weissenhofsiedlung, Stuttgart (Germany) (restoration works: 2003-2005).

and New York, returns to Europe, contributing to the creation of the myth of White Architecture. The proposed interpretation is probably affected by those who, like us, were trained in the last quarter of 20th century with the myth of the Five Architects and their white architecture.

Richard Meier<sup>1</sup> [3] claimed to have trained through the Alberto Sartoris's book entitled *Gli elementi dell'architettura funzionale: sintesi panoramica dell'architettura moderna*, published in Milan in 1932 by the publisher Hoepli. The volume contained many photographs, obviously in black and white. That is why the idea of the whiteness of rationalist architecture would find a new legitimacy through the reflections of Meier, Eisenmann, Gwathmey, Graves and Hejduk, reflections destined to have good fortune not only in the design of new buildings<sup>2</sup> (Fig. 2) but, in a kind of mirror game,



**Fig. 2** R. Meier, Arp Museum Rolandseck, Remagen (Germany), 2004-2007.

in the restoration of modern heritage.

The reference to Sartoris also introduces the question of the classical inspiration in the choice of the white color for modern architectures, when they were really white and there is no doubt that there were some: "It is particularly the Italian Rationalism that pursued this idea of the Classic, an issue in relation to which there is a wide critical thinking" [4].

The classic and the white immediately refer back to the initiator of that misunderstanding, to him who had wrongly interpreted the white color as the only hue of classical sculpture and architecture: Johann Joachim Winckelmann. Just under three centuries after the theories of the German historian we know that his assumptions about the whiteness of the sculptures and buildings of Classicism, were completely wrong; and

<sup>1</sup> On Richard Meier and the use of white color in architecture, cf. Zammerini, M. 2016.

<sup>2</sup> The fortune of the white color in contemporary architecture is vast: from Sverre Fehn to Santiago Calatrava, from Steven Holl

to Kenzo Tange, there are many examples of architectures in which the pervasive choice of white is a decisive factor in building of their image.

we know that such an idea not only led to the glories of Neoclassicism, but also led to the removal of many colored fragments that resisted and were preserved on ancient statues and temples.

Our hope is that, long before what happened in Winckelmann's case, it will be accepted today that modern buildings were much less monochromatic than the images in which they are captured, as evidenced by numerous studies carried out on the different layers of plaster and paintings present on their surfaces<sup>3</sup> [5]. If we are not yet culturally ready to choose the "simple" material conservation, let us then at least refer to the category of scientific restoration dear to Gustavo Giovannoni, trying to return to the color palettes that distinguished modern buildings at the time of their inauguration.

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<sup>3</sup> One of the most pioneering studies on the subject was that of Le Corbusier's Doppelhaus in Weissenhof; beyond the result, on which opinions differ, it is necessary to note that the attention to

the analysis didn't set an example for many subsequent interventions, where the will for renewal prevailed.

# A New Chromatic Vision: The Early Impact of Color Photography on the Representation of Architecture

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**Abstract:** The role of color photography in the representation of architecture is a subject little investigated by architectural historiography. The link between the color values of architectural design and its visual transmission in the early phase of modernism was certainly problematic. Color photography had an undeniable impact on architectural color in practice: color photographs in books and periodicals published between the 1940s and 1960s clearly influenced the use of color in architectural design.

**Key words:** 20th century architecture, color, photography, historiography.

## 1. Introduction

On 28 April 1952, a crowded audience attended a lecture at the RIBA by the American architectural critic, educator, and photographer George Everard Kidder Smith (1913-1997), who surprised them with a superb selection of color transparencies of Italian architecture. The *Architectural Review* editor James Maude Richards (1907-1992) wrote afterwards: “If only one had colored photographs like Mr. Kidder Smith’s readily available, and technical resources to reproduce them, architectural publications could be very much livelier and do a more worthwhile job in bringing architecture on the printed page than is possible at the moment” [1]. This anecdote makes us rethink the role of color photography in the representation of architecture, a subject that has remained under-investigated in architectural historiography.

Kidder Smith had a very strong interest in capturing the buildings he visited and wrote about recording them on black and white film or color transparencies (Fig. 1). He believed that architecture seen in color pictures would finally give a new strength to the perception of space on lifestyle magazines, even if most photographers continued regarding it with suspicion.

Edwin Smith (1912-1971) resented the loss of creative

control that stemmed from the fact that few photographers had the facilities to process their own color material [2]. Jan Versnel (1924-2007) thought that color photography interfered from the photographer’s primary task of delineating architectural features.

## 2. The Chromatic Values of Architectural Design and Its Visual Transmission

Attempts to develop color photography had been undertaken since the invention of the medium, but it was only with the introduction of the Kodachrome transparency film in 1935, followed by Kodacolor negative stock in 1942, that a major breakthrough was achieved. Although these processes later became mainstream in architectural photography, there has been no clear account of its origins in practice. We know that John Maltby (1910-1980) in UK experimented with color and that the *Architectural Review* essayed its first major attempt at color printing in its feature on the new BBC (British Broadcasting Corporation) building in London in 1932. One of the first projects by American architectural photographer Ezra Stoller (1915-2004) was a set of color pictures to be taken during New York’s World Fair, which were published in *Architectural Forum* in 1939.

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**Fig. 1** Self-portrait in color of G.E. Kidder Smith (lower left) and his wife Dorothea (upper middle with a raised arm), Temple of Juppiter, Baalbek, Lebanon, 1950. © Archivio Progetti, Università Iuav di Venezia.

The connection between the chromatic values of architectural design and its visual transmission in the early phase of modernism was certainly problematic. Color photography had an undeniable impact on architectural color in practice: color photographs in books and periodicals published between the 1940s and 1960s clearly influenced the use of color in architectural design. Le Corbusier's *Villa Savoye* was almost exactly as monochrome as the many black and white photographs taken of it. This kind of imagery was spawning an architecture deficient in chromatic values.

But some architects, such as Gio Ponti (1891-1979), and photographers, like Giorgio Casali (1913-1995), went beyond the established monochromatic representation of their buildings, and in their pictures and articles for *Domus Magazine* considered color in a new way. Ponti was enthusiast when *Domus* No. 312 (November 1955),

dropped few lines regarding his happiness in publishing in architectural color photographed images. The images he refers to were elevations of Swedish houses in Gutenberg, placing the emphasis on chromaticism in architecture so that even in Italy, where various vernacular buildings are traditionally painted or plastered with lively colors, we move from deliberately melancholic grey buildings to a colorful new architecture, “because—as Ponti states—you have to make beautiful houses, beautiful neighborhoods, and lively happy colorful cities” [3].

Exactly a year before, Ettore Sottsass (1917-2007) published in *Domus* No. 299 an article titled “Structure and Color” concerning the role in design, using the chromatic issue in order to construct a critical approach towards a culture of design considered no longer suitable to provide answers to the social and cultural transformations taking place. Sottsass became known for his asymmetric forms and, perhaps most of all, his flamboyant use of color, often in bold, clashing combinations. “You don’t save your soul just painting everything in white,” he once wrote. “Color can arise and be in harmony with the imperatives of structure, without destroying it.” In the same article, Sottsass notes how the expressiveness of architecture had been entrusted, up to that moment, exclusively to the shape and structure: “By dint of whitening the walls, by dint of lightening and wanting light we have almost lost the meaning of the colors in Architecture” [4]. And quoting the painter Theo van Doesburg (1883-1931) it allows him to reiterate his opposition and to affirm not only that the color must regain its expressive function but also “reach the maximum emotional intensity beyond, far beyond the structural reality” [4].

The factual representation of architectural color had in fact long been desired by architects in professional practice. Many architects travelled with two cameras: one for shooting in black and white, and another to record colored architectural surfaces and interiors. One of these was Bruno Morassutti (1920-2008), who spent a long period at Taliesin West looking deeply at Frank

Lloyd Wright's color schemes. Morrassutti's visual legacy is only one of the many examples of color photography informing an understanding of architectural color in its historical contexts [5]. Konrad Gatz and Wilhelm O. Wallenfang's book *Color in Architecture: A Guide to Exterior Design* (1960), is a significant volume that makes the point of how color photography interpreted and transmitted architectural color<sup>1</sup> [6-8]. Translated into several languages, it has never been considered as a photo-book where the medium expressed the increasingly polychromatic nature of contemporary architecture.

### 3. Conclusions

The visual representation of architecture in color was more than an analytical tool; it had an important role in the historical development of our general knowledge and provided information on the character of modern architecture, helping to define a more rounded approach to architectural design.

The identity of a building becomes clear in an architect's choices of how material, texture, sheen, and color come together. Gatz and Wallenfang's photographs predate and challenge the now-standard notions of architectural visual identity that have been formed by more recent and candy-colored photography. Traditionally,

photography has always commodified buildings, transforming the newly built houses and their facades into objects of desire. Yet fifty years before their repurposing as a pastel fantasy, the city's modern buildings were pictured as optimistic symbols of urban life. These photographs depict the city as a humanist artefact of the modern world and deliver a more accurate understanding of the intentions of their creators. Today, they provide valuable information toward preservation efforts, elucidating, not only the details of the architectural physical appearance, but the poignant drama of the city's ambition as well.

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<sup>1</sup> Gatz and Wallenfang's book was published by Reinhold in New York and it had a French edition titled *La Couleur dans les Facades* published the same year by Eyrolles Editeur in

Paris. On the same subject see also: Gatz, K. (1956), Luckhardt K. (1959), and Taussig, M. 2006.

# The Rediscovery of Polychromy in Some Le Corbusier's Works: A Problem of Restitution

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**Abstract:** The theme of the restoration and conservation of polychrome surfaces will be addressed through several recent case studies of interventions on Le Corbusier's work owned by the Fondation Le Corbusier: the Petite Villa sur Le Lac Léman (1923-1924), the Maisons La Roche and Jeanneret (1923-1925), and his apartment-studio in the Immeuble Molitor (1931-1934). The recent interventions allowed for numerous preliminary studies (*in situ*, archival, and laboratory), and proved to be an opportunity for historical and material knowledge, paying close attention to discoveries and observations during the construction phase. An important aspect of these experiences was the in-depth study of polychromes, conducted on architectural surfaces but also on furniture and fixed furnishings made of concrete, metal and wood. This was an important moment in the knowledge of the work during the restoration phase because of the richness of the stratigraphic surveys related to the many modifications made over time sometimes by Le Corbusier himself. This text exposes technical, scientific, and operational aspects specific to the study of interior and exterior polychromes, and in parallel raises theoretical-methodological questions of restoration of the polychromies and the painting.

**Key words:** Le Corbusier's polychromies, world heritage, modern heritage preservation.

## 1. Introduction

The Fondation Le Corbusier, universal legatee of the architect, custodian of all his archives and owner of three of his architectural works, holds the moral and patrimonial rights of the architectural, literary, artistic and plastic works of Le Corbusier. Therefore, any intervention on the architectural work anywhere in the world, should be authorized by the Fondation, whether or not the work is protected as an historic monument.

Many of Le Corbusier's works have been restored, in the last years, including projects under the control of the Fondation Le Corbusier, as the La Roche and Jeanneret houses, between 2008 and 2015, which underwent restitution of the interior's polychromies and of the original colored plaster on the facades.

Some of these projects have contributed to renewing the methods of approach to restoration to more understand the authenticity, integrity, and history of the

buildings. Each restoration campaign is also the opportunity to enrich the material understanding of the work, its genesis, and the processes involved, thanks to the research undertaken, and the materials uncovered.

This is particularly true for the knowledge of polychromies in Le Corbusier's work.

### 1.1 The Le Corbusier's Polychromies

Color is a constant theme in Le Corbusier's work, both as an artist and an architect. From his earliest texts (articles in *Esprit Nouveau*, *Almanach*, etc.), color in architecture seems to have a clear function, which is at the same time necessary, repeating the truth already recalled by Fernand Léger: "Man needs color to live, it is an element as necessary as water and fire" [1].

In his fundamental text on this subject (1931), "Polychromie architecturale, étude faite par un architecte (mêlé, d'ailleurs, à l'aventure de la peinture contemporaine) pour des architectes"<sup>1</sup>, which was to

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<sup>1</sup> Archives Fondation Le Corbusier, Paris.

accompany the presentation of the *Salubra* 1 Keyboards, the role of color is clearly defined by Le Corbusier: “color acts on a psychophysiological level, producing sensations that are specific to it, sometimes even unrelated to the concrete fact of the architectural spaces in which we find ourselves; color can provide a ‘lyrical escape’ from the constraints of reality. [...] attached to sensations of ‘order and sentimental wellbeing’; color masks form, alters volume ‘allowing you to appreciate from a volume only what you wish to show’” [2].

To work with Le Corbusier's architectural polychromy in today's restoration projects, it is essential to understand the architect's intentions.

Among the authors who have analyzed the theme of color in architecture through Le Corbusier's texts, we should mention historian Luisa Martina Colli in the early 1980s, who traces the path from Le Corbusier's youth, through the articles in *L'Esprit Nouveau* with Amédée Ozenfant, to the development of the three *Gammes du purisme* in the *Salubra* Color Keyboards. In the 1987 *Encyclopédie*, she wrote: “on this tool for organizing architectural color, which is in any case one of Le Corbusier's most sensitive and beautiful ideas” [2]. This author had already stressed the importance of other texts in addition to the 1931 text, and of conferences such as Le Corbusier's 1936 speech at the *Congresso Volta* in Rome, notably on the role of mural painting in architecture.

Other authors who have dealt with this subject include Arthur Ruegg, who has worked extensively on the 1910s and the Purist period, on the use of color from artist to architect: “it was obviously a transfer of the painter Jeanneret's experiments to the practice of the architect Le Corbusier” [3]. He also deserves credit, as an architect and restorer, for having understood the value of republishing the *Salubra* Color Keyboards with Le Corbusier's 1931 text, stressing first and foremost the importance of “matter”. Indeed, he explains that: “Le Corbusier, for example, often

demanded very smooth, matt paints. Before the war, these were powdered pigments bound with glue or oil, and painted with a brush [...] today's synthetic paints give quite different results, the only advantage being their resistance to wear” [3].

The problem of documentation and iconography is fundamental to the question of color when it comes to restoration projects. Indeed, we have images in black and white at least up to the end of the 1950s. As Gérard Monnier pointed out at the *Fondation Le Corbusier's Rencontres* on the theme of Color in 1982<sup>2</sup> in the text “*la couleur absente*”: “[...] contemporary ‘colored’ sources are lacking. Long after the end of the Second World War, architectural photography was still not represented in color in books and magazines (particularly in Europe and France). So we have to make do with a deficit in the representation of color in buildings”. Another of Monnier's observations is that “until the 1960s, color work in LC buildings was absent and ignored” [4].

All these elements certainly also contributed—but that is another subject—to transmitting an image of Le Corbusier's architecture, and modern architecture in general, as white architecture (Fig. 1).

In all the works on architectural polychromies, focused on its theoretical reflection, it seems to us that



**Fig. 1** Maisons La Roche et Jeanneret, Paris XVI, 1926 © FLC.

<sup>2</sup> The IVth *Rencontres de la Fondation Le Corbusier* was held in Paris in 1982.



the question of interior polychromy is limited to paint, in particular to tint (red, blue, green...), without taking into account its materiality, its composition, which can modify its perception and effect in space. For interiors, other surfaces beyond walls, such as “cream”, black or ochre porcelain stoneware flooring, dark havana or green marbled linoleum or pink or grey rubber; right down to the color of curtains and furniture.

Information on *Salubra* (1931-1959) is also necessary to understand Le Corbusier's projects. *Salubra* wallpapers are “oil paints sold in rolls” for interiors. They are color charts, the first of which, from 1931, derives from purist ranges, notably the Grande Gamme, made up of natural pigments: earths, ochres, ultramarines ...). These color keyboards were designed to facilitate the construction phase, the painting of interiors, in an industrialized approach, to apply the desired color evenly and without error: “To the architect who is always more or less at the mercy of a painter's mishap, *Salubra* offers great peace of mind, ensuring, with a proportion of oil and color that is always right, a constant quality of tone and material” [5], just as one chooses a door handle or porcelain stoneware tiles from a catalog. It is worth remembering that, in those days, painting was done on site: the painter prepared the mixture to obtain the desired shade, and mistakes were easy to make.

But what is even more interesting than the color charts and shades themselves is the combinations Le Corbusier proposes between these colors, presented in “ambiances”. As Martina Luisa Colli explains, “the collection comes with special masks that make it possible to isolate in detail two or three colors (for frames, chairs, rugs, etc.) by relating them to the basic colors of the walls, ceiling or floor” [2].

Reference publications often claim that there are no examples of *Salubra* wallpaper still in place. However, at the time of the restoration works, we found several walls still covered, notably in the architect's most intimate buildings: the Petite Villa and, above all, in Le Corbusier's apartment-studio (Fig. 2).

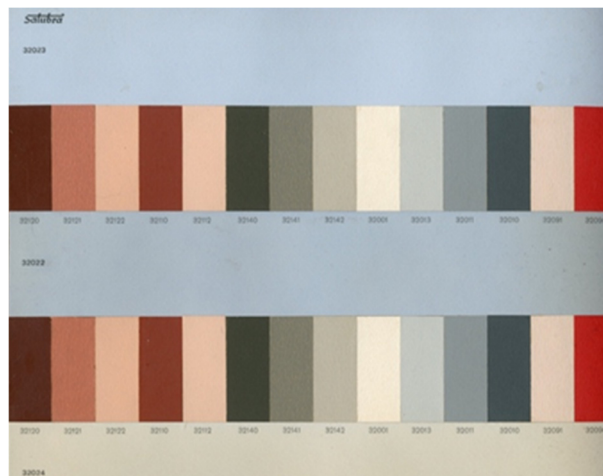


Fig. 2 Les claviers de couleurs, *Salubra* © FLC.

For all these reasons, the question of architectural polychromy remains, in our opinion, entirely open. This is apparent in every restoration project, with questions raised about materials, supports, pigments and binders, ageing, and about implementation, whether or not there has been any preparation, modifications, repainting or restoration, and so on. Indeed, the difficulty of studying the polychromes of Le Corbusier interiors and their transformations, through texts and archival documents (letters, estimates, invoices, company memoirs, annotations on sketches, etc.), black and white photos and possible *in situ* remains, has prompted us to present some of the discoveries made in the field, to answer questions, cross-reference information and formulate questions.

## 2. Method and Materials

The Fondation Le Corbusier is fortunate in its role, and as part of the creation of the archives of the restoration of Le Corbusier's architectural work, to participate in numerous projects, and to follow studies and construction sites, important moments in the knowledge of the work built.

Preliminary studies are an important and necessary phase in any restoration project. For each project, we are confronted with Le Corbusier's writings on polychromy, with archival and iconographic documents, and then with the site and the work itself. We have to take into

account the specificity of each architectural object, and each restoration project must be carefully examined.

Today, polychrome surveys are carried out almost systematically—it has become “normal”—before any work is carried out, often supplemented by specialized laboratory analyses.

These studies must be carried out before the choice of project, the objective (to return to an original state or another reference state, or to do nothing), and for documentary reasons. The context of a restoration project is a time for study and questioning, and the ideal moment to try and find new documents (color photos/diapositives, publications, testimonials, etc.), confirmations and new information on the polychromy of the work. These studies, carried out by specialists, are important beyond the scope of the planned project, since the aim is not to systematically return to the “original” polychromies or other reference condition. The aim is to understand, document and provide new elements of understanding for future research.

The presentation of some examples of restoration work on sites owned by the Fondation Le Corbusier may illustrate these questions and attempt to provide some starting points for reflection.

### 2.1 *The Maisons La Roche and Jeanneret*

The interior polychromies of the Maison La Roche are certainly the best-known and most studied. Indeed, in his 1931 text entitled “Polychromie architecturale, étude faite par un architecte (mêlé, d'ailleurs, à l'aventure de la peinture contemporaine) pour des architectes” [1], Le Corbusier presents two cases together: the Maison La Roche in Paris, for its interior polychromy, and the Cité Frugès in Pessac, for the polychromy of its façades<sup>3</sup>.

Begun in 2008 with the work on the interiors of Maison La Roche, and completed in 2015 with work on

the façades and garden of Maisons La Roche and Jeanneret, the restoration work on the buildings housing the Fondation Le Corbusier was the outcome of a process involving intense research and experimentation and intended to be exemplary<sup>4</sup> [6]. It contributed to renewing techniques used in previous decades for the preservation of Le Corbusier's built work. The aim was to systematize and combine historical and archival research, core drilling and other types of material analyses, technical studies, to confront data acquired with historical accounts, and to create scientific committee to monitor work in progress.

We know from the texts that for the first time Le Corbusier implemented an architectural polychromy based on purist theories at the Maison La Roche in 1925, before the creation of his *Salubra* color keyboards. In *L'oeuvre Complète* published in 1929, Le Corbusier explains: “Inside, the first polychromatic experiments, based on the specific reactions of colors, allow for ‘architectural camouflage’, i.e., the affirmation of certain volumes or, on the contrary, their concealment. The interior of the house must be white, but for this white to be appreciable, a well-adjusted polychromy must be present: walls in half-light will be blue, those in full light will be red; we make a body of the building disappear by painting it in pure natural umber, and so on”<sup>5</sup>. In the archives, we have two important documents. The specifications for the “painting lot”, in which it is described: “Kitchen, W.C., toilet, pantry, cloakroom, radiators: recoating and two coats of oil; on all joinery (wood and iron), recoating, priming and two coats of oil. In the rest of the building, sanding and two coats of glue”<sup>6</sup>. And an invoice from Célio from March 1925, at the end of the works, with “the list of colors used for the composition of the tones of glue and oil-based paints on Rue du Docteur Blanche in Auteuil [...]: yellow ochre, red ochre, ivory black, natural Sienna, burnt Sienna;

<sup>3</sup> About the case of Cité Frugès in Pessac, in this same publication: Paola Scaramuzza, *Le Corbusier and Pierre Jeanneret's Cité Frugès: The Polychromy Issues*.

<sup>4</sup> Study and work on the interiors between 2008-2015, by Pierre-Antoine Gatier chief architect des Monuments historiques and Ariel Bertrand, wall painting restorer.

<sup>5</sup> Le Corbusier. 1964, op.cit., p. 60.

<sup>6</sup> FLC 5-1-176, Archives de la FLC, Paris.



Fig. 3 Archive's document of the painter, Celio, 1925.

natural umber, burnt umber, English green, ultramarine blue, charcoal blue, chrome yellow<sup>7</sup> (Fig. 3).

As part of the pre-restoration study carried out in 2008 by the agency of Pierre-Antoine Gatier, chief architect of historic monuments in charge of restoring the houses, restorer Ariel Bertrand carried out a polychrome recognition campaign (stratigraphy, sampling of the pictorial layer and laboratory analysis) of the entire building (wall, ceiling, skirting boards, joinery, built-in furniture), in order to recover the shades and materials used. The reference layer chosen for the restoration was the original one, from the time of delivery in 1925. This work, combined with the analysis of archival documents such as period publications and old photographs, confirmed the use of the binders cited in the archival documents from the outset. Oil paint was used for metal (radiators, doors, window frames), wood (furniture, window frames), cement (shelves, window sills) and humid rooms (kitchen, pantry and bathrooms). Glue paint was used for certain pigments (such as sienna or ultramarine), while oil emulsions (a mixture of oil paint and water, which dries more quickly) were used for other rooms.

This type of application was found in all buildings of the period, from the Purist period onwards.

During the restoration project, a color chart was created for the interiors, based on La Roche's specific palette for maintenance work.

Important information about the Maison mitoyenne Jeanneret, the home of Albert Jeanneret, the architect's brother, and his wife Lotti Raaf, comes from a letter discovered in the living archives of the Fondation Le Corbusier. The letter was written by the former owner to the President of the Foundation in December 1970, following her visit to Paris for the inauguration of the Foundation. She writes about the colors restored during this first major restoration of the two houses. She vividly recalls her memories of the original colors: "The back wall of the salon was all white, as was the neighboring wall on the left, while the one on the right was pale green as you had it painted. The pink color was used only on the back wall on the left as you enter, as well as on the area around the large window. The tone of this pink you chose is not very good, it should be, not darker, but less yellow, more pinkish. The door to the kitchen was blue in the same tone as the other areas (...) The radiators were steel gray everywhere, as were the two garage doors. Terrace: skirting boards and shelves in a fairly deep blue-grey, fireplace in green-grey (...)"<sup>8</sup>.

This document gave us a better understanding of the polychrome surveys and the knowledge required for the restoration. For example, we were able to confirm that the radiators were painted dark grey, rather than the same color as the wall, to differentiate them as an element of comfort, a sign of modernity, but also for more technical reasons. This arrangement can also be seen in the photographs of the period, although in black and white something that had not been noticeable during the first restoration campaigns.

The correspondence also highlights the role played by Lotti Raaf, who seems to have played an important

<sup>7</sup> FLC H-1-3-2, Archives de la FLC, Paris.

<sup>8</sup> Letter of Lotti Raaf to Gimonet, president of the FLC, 7 December 1970, Archives vivantes de la FLC, Paris.

role in the choice of colors for her house. But this document also confirms the surveys carried out on the exterior facades, some years later the restoration work of the Maison La Roche's interiors, and reveals the original state of the coatings, as Le Corbusier had intended. Lotti Raff wrote to Gimonet: "As for the exterior of the two houses, I find it deplorable that they were painted, especially in white. Le Corbusier had applied a cement coating mixed with powdered cut stone, resulting in a 'slightly' rough surface with a very attractive yellowish sand color. (...), who told you that the houses have always been white, has forgotten what they were like in the beginning (...) would it be feasible to scrape it off and see for yourself? That would be n° 10, which has never been painted, only repainted"<sup>9</sup>. Surveys carried out by restorer Ariel Bertrand on the coating on the facades confirmed all the information given in Lotti Raaf's letter.

Rediscovering the polychromies of the interiors and the "stone colored" facades (Le Corbusier's expression) was a surprise to specialists and novices alike, reared on images of the famous "white villas" of the Modern Movement (Fig. 4).

As regards to the exteriors, the same principles presided over the choice of colors and materials when restoring



**Fig. 4 Stratigraphic survey on the facade of the Maison La Roche: in layer 1 the original plaster (Cimentaline).**

the interiors as closely as possible to the originals. Restoration of Maison La Roche helped to underline the pertinence and plastic qualities of the original architectural polychromies and to emphasize the role of color in the design and perception of the different spaces. It thus seemed logical to echo these interior spaces in the outward surfaces. Maisons La Roche and Jeanneret thus found again their original 1925 façades.

## 2.2 *The Petite Villa Sur le Lac Lemman*

The polychromies used for his parents' second house in Corseaux, is rarely mentioned in texts, yet it is still partly in place and present in archives and family correspondence.

The project and the work carried out since 2011, based on Elise Koering's historical study, first revealed a very pale green façade<sup>10</sup> [7]. We know from correspondence that Le Corbusier wanted a green-tinted lime (then "oiled") and that the company, convinced of its fragility, proposed a silicate paint. This arrangement still exists under the metal claddings of 1931 and 1951, whereas oil paints were used on the other facade elements (Fig. 5).

What is interesting to note for the interiors is that the first paint campaign was practically never called into question, apart from one proposal in 1951 which seems not to have been carried out, not being present in the *in situ* stratigraphic studies. Over time, the original shades were "evoked" by colors that were close to each other, but produced with different materials and applications, modifying the perception of color and space. During the most recent repainting of the interiors, carried out as part of the house's centenary celebrations, the shades were recaptured according to the original materials, based on polychrome surveys carried out on site: glue paint, oil paint and emulsion. During this last campaign of work, it was possible to observe the installation of the wallpapers as described in the archive documents. In a letter from Le Corbusier, precise instructions were

<sup>9</sup> Letter of Lotti Raaf to Gimonet, president of the FLC, 7 December 1970, Archives vivantes de la FLC, Paris.

<sup>10</sup> Historical studies: Elise Koering; Jean-François Dedominici painting; Fanny Pillet, restorer.

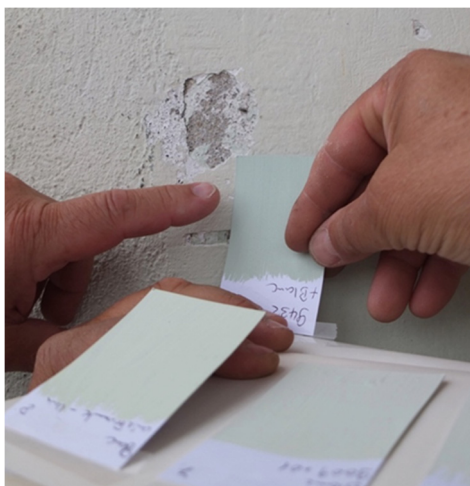


Fig. 5 Stratigraphic survey and essay of painting for the façade of the Petite Villa, 2012 © FLC.

given for horizontal wallpaper hanging, which was found here and, in his apartment-studio, notably in the servant's bedroom.

### 2.3 The Painting of His Personal Apartment-Studio in Paris

Indeed, one of the surprises of the restoration work on Le Corbusier's apartment-studio in the Immeuble Molitor is the discovery of *Salubra* wallpapers, not only those whose existence was known from the texts, but systematically, for example under the wooden plywood added in 1939 to the ceilings and walls. This was the first layer, the first campaign of "painting" that Le Corbusier had in mind, when he moved into his new apartment in 1934, a few years after *Salubra* had been marketed. The apartment subsequently underwent several painting campaigns, some of which were of Le Corbusier's own design, identified with the help of mural restorer Marie-Odile Hubert. We can summarize: a 1934 state, mainly wallpaper that disappeared under the wood panelling in 1939, with a partial repainting, of which Le Corbusier testified to his mother: "The painters left. We've rearranged and it's fine! It's going very well and now my apartment looks finished. The problem was the blackness due to the soot from

Boulogne: the ceiling was all covered in black, and the walls in pale green. I installed natural oak paneling on the ceiling. Ditto on the green wall. Ditto on the elevator shaft. The previously gray wall where the little fireplace used to be is now a slightly stunned vermilion red. The dining room has been repainted white (walls and vault)"<sup>11</sup>. A 1948-1950 state, with more vivid color changes, for example in the bedroom, the last state before the architect's death (Fig. 6).

Subsequent renovations were identified by the FLC's living archives and *in situ* surveys, the first of which dates back to 1969.

For the apartment, the Foundation wished to restore the interior polychromy of 1965, the last known state desired by the architect. Indeed, the state of the interior masonry made it impossible to preserve the historic paintings. So, once the layers had been identified, they were characterized using laboratory analysis to obtain the most precise possible knowledge of the paints used



Fig. 6 Bathroom, with the discovered blue of the apartment-studio of Le Corbusier, 2018 © FLC.

<sup>11</sup> Letter by Le Corbusier to his mother, 8 April, 1939. Le Corbusier-Correspondance-tome 1-Lettres à la famille 1900-1925, In-folio, 2011.

to restore them. The identification of pigments and binders enabled oil emulsions to be remade for the entire apartment-atelier<sup>12</sup>.

We therefore felt it necessary to preserve most of the stratigraphic surveys carried out by Marie-Odile Hubert *in situ*, after the restoration work, in order to leave a trace of this work, to understand the stratifications over time, and to enable us to reconsider a choice of shade [8-13].

### 3. Conclusion

As far as the Purist period is concerned, we now know—thanks also to academic work<sup>13</sup> confirmed by these latest restoration projects and the studies carried out in connection with them—that none of Le Corbusier's Purist works were originally “white”, despite the major references also by Le Corbusier. “Left totally white, the house would just be a pot of cream” [14]. Facades seem to have changed color from the late 1960s, after the architect's death, with the first major restoration campaigns. The very first was the Villa Savoye and the gardener's lodge, whose restoration started in 1967 by architect Jean Dubuisson (1914-2011), but shortly followed by the La Roche and Jeanneret houses in 1970 by the Fondation Le Corbusier.

The latest restorations, based on increasingly comprehensive historical and scientific studies, have also made it possible to rediscover the interior polychromes. This knowledge of the architect's wishes seems to have resulted in a choice to restore the original polychromes. This applies not only to the colors, but also to paint materials and application. For this reason, it is important to preserve the stratigraphic surveys, to conserve superimposed layers and the history of color changes, with an educational objective that also allows us to revisit the choices made in the restoration work.

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<sup>13</sup> For example, the work of Anna Rosellini for the grant of the FLC on “Théorie et construction de la surface Puriste”, 2005.

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# Le Corbusier and Pierre Jeanneret's Cité Frugès: The Polychromy Issues

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**Abstract:** From 1924 to 1926, with the Cité Frugès in Pessac, Le Corbusier and Pierre Jeanneret realized an urban area as a laboratory where research on architecture polychromy was achieved among others. Colored facade was applied as a tool to modify urban space. This neighbourhood has always been inhabited and transformed by its inhabitants over time. In the 90's, studies for the global image protection of the neighbourhood included polychromy research conducted to restore the shades of origin. However, the colors have often been interpreted in various ways. Nowadays, besides the shade problems, other challenges have arisen linked to the preservation of the facade materials. This paper presents the recent archive research done to clarify the shade references and lay the groundwork so as to choose the right material to use and further research in the future.

**Key words:** Le Corbusier, Cité Frugès, polychromy, architecture.

## 1. Introduction

The Cité Frugès, a housing project in Pessac in southwestern France, was an experiment of sorts, something entirely new, commissioned by Henry Frugès who allowed Le Corbusier to set up his theories.

In 1924-1926, with the so called "Quartiers Modernes Frugès" Le Corbusier and Pierre Jeanneret realized an urban area where each element was drawn in detail [1]. This is among the first research conducted by Le Corbusier on the modes of house grouping, the construction of a standardized housing, therefore cheap, and the implementation of facade polychromies. With standardization, industrialization and taylorized mass production were among the basic principles of the project. Combining a modular system six house types were created: the Quinconces, Zig Zag, Gratte-ciel, Arcades, Jumelles and Isolées. In this project Le Corbusier achieved a coherent and orderly landscape [2].

This neighbourhood has always been inhabited and will continue to be so, which is crucial to assure not only its life but also its authenticity. It is well-known that it has been transformed by its inhabitants over time [3].

The Cité Frugès was included in the UNESCO (United Nations Educational, Scientific, and Cultural Organization) World Heritage List in July 2016, among the 17 works by Le Corbusier that make up the series "The Architectural Work of Le Corbusier: An Exceptional Contribution to the Modern Movement" [4]. The history of its protection started in the '80 and went through various stages.

Since 1998 the ZPPAUP (Zones de Protection du Patrimoine Architectural Urbain et Paysager) regulation has especially provided constructive rules and advice on how to protect and develop housing<sup>1</sup>. It concerned the external appearance of the structures and therefore polychromy [5].

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<sup>1</sup> ZPPAUP (Zone de Protection du Patrimoine Architectural, Urbain et Paysager), provision of a law whose purpose was to ensure the protection of the landscape and urban heritage and to

highlight neighbourhoods and sites to be protected for reasons of an aesthetic or historical nature ("500 m perimeter" around a historic monument) by replacing it with a "smart perimeter". In 2010, the ZPPAUP was replaced by the AVAP (Aires de mise en valeur de l'architecture et du patrimoine).



Nowadays some of the contents of this regulation deserve to be re-examined in the light of the new protection measures as historic monuments, new knowledge, and the inhabitants' new expectations.

Restoration, repair, and maintenance projects (past or in development), confront with the current practices of the restoration of 20th century architecture and the essential issues of ecological transition and sustainable preservation of the environment.

This article presents the most recent archival research on the topic of polychromies, cross-referencing data with *in situ* surveys, which has helped to highlight several aspects and lay the foundations for deeper future research.

Besides, not only should we focus on the conservation issues but also on the demands of use and contemporary living respecting the French "Monument Historique" heritage<sup>2</sup>.

### 1.1 The Le Corbusier "Architectural Polychromies"

"Il se dégage des constructions de Pessac une esthétique inattendue, neuve. Nous avons aussi appliqué une conception entièrement neuve de la polychromie, poursuivant un but nettement architectural modeler l'espace grâce à la physique même de la couleur, affirmer certaines masses du lotissement, en faire fuir certaines autres, en un mot composer avec la couleur comme nous l'avions fait avec les formes. C'était ainsi conduire l'architecture dans l'urbanisme"<sup>3</sup>.

In Le Corbusier's words color is used as a tool to modify space. A psychological component of the perception of space is also present in his reflection.

The essential theme of the function of color in architecture, indeed in the entire urban space, is present

in the letter sent to Le Corbusier by Piero Bottoni on December 12, 1927, with "annexes" photographs of watercolors entitled "Cromatismi Architettonici" [6].

In the response to Bottoni in 1928 Le Corbusier explained the architectural polychromy in the case of the Cité Frugès, saying that when fifty or a hundred houses created between them a space that was like an exterior room, whose walls were formed from the facades of various houses, the same problem was happening. Instead of accepting the white uniformity of all the houses, one could feel obliged to call on the color to modify these spaces (*Chambre extérieures*) so as to continue, thanks to the color, the effects of the order and therefore create larger spaces and clearly set the composition intentions.

He affirms that at Cité Frugès the external polychromy, treated with precise rigor, has come to constitute a prodigiously eloquent contribution to modern architecture. The list of colours mentioned by LC for Pessac includes: Terre de Sienne brulée pure, Bleu pale, Blanc, Vert pale, Rose, Terre d'ombre pure, Noire<sup>4</sup> [7].

Over time, decay but also inhabitants' modifications made the external polychromy no longer recognizable in most cases [8].

The studies in the 1990s for the definition of the preservation document ZPPAUP, were a great opportunity to research the hues of polychromy<sup>5</sup>.

However, the references taken, and the recommendations of this document, are also reinterrogated today according to the choice of the material of the tinting as well as the presence of decay and cracks.

The recent architectural and landscape study commissioned by the Municipality of Pessac was an

<sup>2</sup> "Monument Historique": this status recognises the heritage interest of a property. The protection implies a shared responsibility between the owners and the national community with regard to its preservation.

<sup>3</sup> "The buildings in Pessac exude an unexpected, new aesthetic. We also applied an entirely new concept of polychromy, pursuing a distinctly architectural goal: to shape space through the very physics of color, to assert certain masses of the housing development, while making others vanish, in a word, to compose with color as we had done with shape. It was a way of bringing

architecture into urban planning". (translated by author). Le Corbusier, brochure and presentation at the inauguration of the Quartiers Modernes Frugès, on the occasion of the official visit of M. de Monzie, Minister of Public Works in Pessac on June 13, 1926, FLC H1-20-36-001/4.

<sup>4</sup> Le Corbusier letter to Piero Bottoni, January 15, 1928, in Jenger, J. (2002).

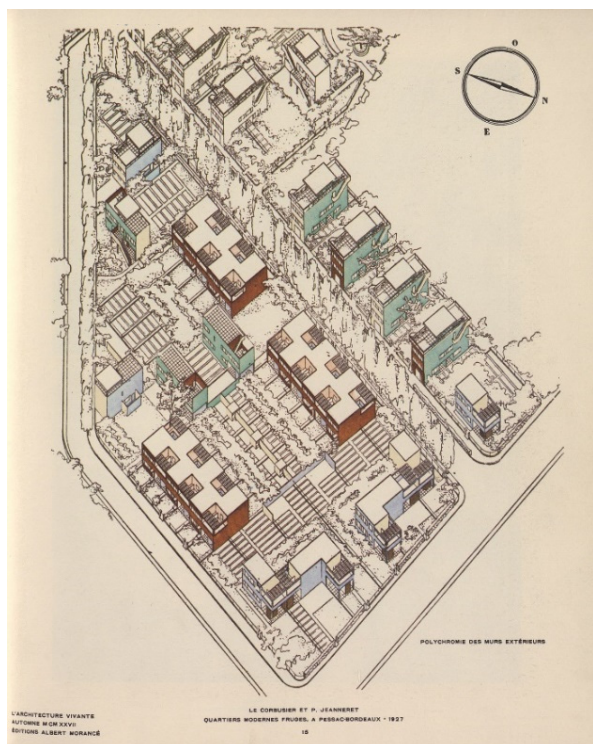
<sup>5</sup> ZPPAUP Ville de Pessac Accessed September 14, 2023. <https://urly.it/3y6bg>; <https://urly.it/3y6bp>; <https://urly.it/3y6bj>.

opportunity to reexamine archive documents in order to specify first of all the semantic definition of the tints, the materials and search for the principles of composition.

## 2. Cité Frugès Polychromy's Archival Research, Method and Materials

The historical research was based primarily on the corpus of archives of the Le Corbusier Foundation composed by the documents and letters between the architects and Henri Frugès and the operators on site<sup>6</sup>.

Three drawn plans describing façade polychromy are also well-known, as well as the color perspective published in the "L'Architecture Vivante" in fall 1927 [9] (Fig. 1). However, these documents do not give a complete and detailed view of the polychromy composition. Not all house façades are depicted.



**Fig. 1** Cité Frugès, Polychromie des murs extérieurs in *L'Architecture Vivante*, Automne & Hiver 1927.

<sup>6</sup> The main documentary sources are listed here: Archives FLC H1-17; H1-18; H1-19; H1-20; Archives FLC photographies d'époque, L2-15; Archives FLC "ensemble des plans des Quartier Modernes Frugès"; Archives Municipal Ville de Pessac-Bordeaux Métropole; Pessac 3Fi, 13W; T1; Archive DRAC Nouvelle Aquitaine: Quartiers modernes Frugès.

In order to understand the theme of polychromy in this period of Le Corbusier's oeuvre, a number of other slightly earlier projects belonging to the same client and geographical context were analysed.

The archives relating to the *Maison Tonkin*, the experimental house realized just before, contain a list and a description of the precisely planned polychromy. An estimate of the house of paintings "Lefranc", now "Lefranc Bourgeois" is present (FLC H1-19-328)<sup>7</sup>.

In March 1925, on the site of Lège, his first small housing development, Le Corbusier asked for photographs of the site to determine the polychromy of the facades (FLC H1-20-31)<sup>8</sup>.

The construction site photos of Pessac allow us to distinguish differences in shades on the facades and several details. For example, the shade of the entrance caps (a light or "Sienna earth" color as the wall) or the wall baseboard (darker than the wall). However, black and white images are still difficult to interpret, a closer look at the archives can give us more solid information.

### 2.1 Polychromy's Chronology through Archival Documents

On August 6, 1925, the first exchanges on the prices of the paintings include the treatment of the shutters, a quote of the painter Gintrac: mention of linseed oil on natural wood (shutter) and price for oil paint in two/three layers, "peinture à la colle" (glue-based paint), without location accuracy. The quote also mentions wallpaper laying (FLC H1-19-75).

On August 19, 1925, the painter Courbu, offers an estimate of "peinture à l'huile" (oil-based paint) three layers on wood or iron with preparatory work, cleaning and filler paint, three layers of baseboard paint, layer paint on interior plasters, price differences between smooth or speckled plaster (FLC H1-19-331).

<sup>7</sup> Letter from Le Corbusier to Henri Frugès, experimental house built on the factory site

<sup>8</sup> Le Corbusier asked Frugès for photographs "that would make it possible to see how the pavilions looked in space and consequently to determine the polychromy of the façade" (trans. by the author).

In November 1925 Henri Frugès wrote to Le Corbusier telling him they had fired the painter, refused his work as the paint was already peeling, it was too thick and uneven: "in a word, it was bad work". Since half of the palette that Le Corbusier had made was missing because the painter had left with it, Frugès asked Le Corbusier to send his own back to him (*FLC HI-19-331*).

The painter Courbu was replaced by Gintrac, a photo showing "Peinture G. Gintrac" sign is present in the archive (*FLC L2(15)29*). In November, the first group had almost finished, Frugès made an urgent request for wallpaper and colour kitchen tiles (red or red & white) and he was waiting for the furniture (*FLC HI-19-330*).

On December 2, 1925 the painter asked through Frugès which tones the other groups should have, in particular number 32, 33, 30 (the "*Gratte-ciel*" house type), and the whole line of his double two-storey houses (*Quinconce* house type), because he was going to start soon, as soon as he could. A chromatography plan for all possible houses was also requested (*FLC HI-19-255-001*).

On December 10, 1925, Frugès wrote to Le Corbusier: the painter asked about the tone of the woodwork of the 1st floor for 6 houses, and if he wanted skirting stairs or not. Should the ramp be passed to the minium? For the outside facade: what is the tone of the porches? Is it a white underside and bands of burnt shade? Is there color stump fireplace on the terrace leading to the pergola? Are the exterior baseboards painted? Which color? (*FLC HI-19-241-004*).

Unfortunately, we could not find a response letter.

In March 1926, HF told Le Corbusier that "It is important that you also see the effect of the new *terre de Sienne brûlée* (burnt sienna colours) on buildings 61 to 66." (*FLC HI-19-259-001*).

It is interesting to note that on April 28, 1926, in preparation for the inauguration, LC indicated that the priority was for the facades to be painted (*FLC HI-20-3-004*).

In the article published in 1926 in "Mon chez moi" the author visits the neighbourhood and spoke about color images she refers to "brown, white or light green" houses [10].

Through the letter of July 21, 1927 we learn that they were very undecided about the type of paint to use for the final coats, because the provisional coat that had been applied for Monzie's visit, on an insufficient silicate base, had flaked all over, and the prices quoted for the complete restoration, the stripping, the first coat of pure silicate, then at least two coats of oil paint, made Frugès hesitate a little (*FLC HI-19-339*). On house No. 37 (the one destroyed during an allied bombing raid in the World War II) they used an oil paint containing 50% petrol, and the effect seemed good to Frugès; but he wondered if they could do without oil by applying two or three coats of silicate. Even if he knew that Le Corbusier was not in favour of implementing the latter process because of the streaks that rain makes. In any case it was urgent to know, or else definitively commit to the expense represented by oil paint, which would still have to be repainted every two or three years (*FLC HI-19-339*).

This reflection is noteworthy regarding the choice of materials and the issue of maintenance already present in this moment.

In September 1927 Mrs. Motorny, the painter's wife present on site, wrote to LC saying that work was in progress. This allows us to know that "three red groups, two green houses, and a blue house were completed. The first layer on seven *Gratte-ciel* as well as a red *Arcades* house was done. She asked Le Corbusier about the white color, because if it is pure white, it will not keep its freshness and within three weeks it will turn yellow. The painter should blend a small quantity of ultramarine or Prussian blue which will stabilize the white color or use a slightly creamy white"<sup>9</sup> (*FLC HI-19-340*). Le Corbusier answered proposing to add vermilion or Prussian blue as he did not like the creamy white (*FLC HI-19-341*). In the middle of

<sup>9</sup> Translated by author.

November 1927, Mrs. Motorny wrote that the work was almost finished (*FLC HI-19-342*).

Jumping in 1931, Mr. Gabriel, a lawyer, and Union President for the Defence of the Neighbourhood, asked if Le Corbusier could give some advice to make the neighbourhood more pleasant, he wanted some advice concerning maintenance as some inhabitants had begun to make some refurbishing.

Le Cobusiers visited the Cité Frugès in May and was really aggravated by the situation noting that some colors had been changed. He wrote to Mr. Vrinat, engineer, Frugès's employees who later inhabited the neighbourhood, saying that it was unacceptable to have allowed the *Quinconce* to be painted in the glycine color (June 16) (*FLC HI-20-120*). Mr. Gabriel answered on June 11, asking for a model to advise people on the proper shades to use (*FLC HI-20-119*). LC replied on June 16 "we had the useful drawings prepared for the colors of the houses" (*FLC HI-17-239*). Le Corbusier said that Mr. Gabriel had a large painted plan and side sheets and 8 exact color samples (N° 1, 12, 23, 42, 91, 112, 120, 130), and pure base colors "without mixing anything else but white". The letter mentioned the eight colors: 1 = blanc, 12 = noir + blanc, 23 = outremer+ blanc, 42 = vert anglais + blanc, 91 = rouge vermillon + blanc, (un vermillon solide de commerce), 112 = rouge anglais + blanc, 120 = terre sienne brulée, 130 = terre d'ombre brulée (*FLC HI-19-345*). This plan and this palette have never been found.

## 2.2 Polychromy since ZPPAUP

In the 90's, the ZPPAUP regulations addressed the issue of the overall image of the city, which means restoring the public space, the streets, and their visual boundaries. The ZPPAUP study also analysed the theme of polychromy in depth. In addition to the study of the archives, numerous color tests were carried out in order to define a reference shade palette<sup>10</sup> (Fig. 2).

This document introduced in the palette the "terre de

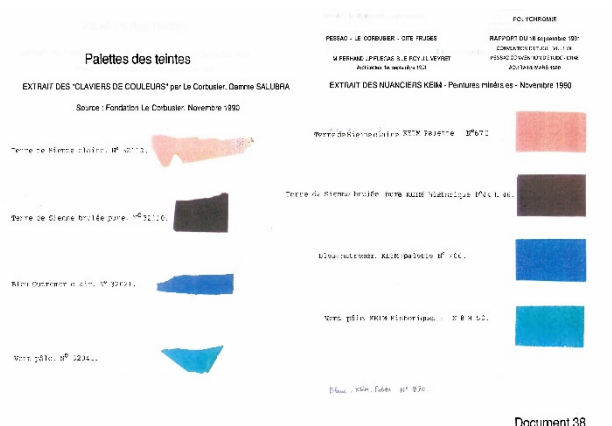
Sienna Claire" (light Sienna color, translated by the author), a color that was not found in the Cité Frugès archival documents but that refers to the "Salubra color keyboards" [11, 12]. The work with the Swiss wallpaper manufacturer *Salubra* was, however, a research that Le Corbusier developed after, in the 30's, and was probably based precisely on the experiences of the Pessac construction site<sup>11</sup>. The only reference for the wallpaper in Pessac project is the brand *Maison HEIBEL peinture* in Paris, 29 rue Bonaparte (*FLC HI-19-334; HI-19-335, HI-19-336*). Le Corbusier himself wrote that "*Salubra* is 'oil paint sold in rolls'. Instead of applying three coats of colour to walls and ceilings in a site full of workers, this paint is now applied by a machine, at the last minute. *Salubra* paint must be applied to a healthy, durable substrate, this product is both flexible and resistant, with fine colours whose purity have been previously tested by chemists. It is colourfast and washable. For architects who are always more or less at the mercy of a painter's mistakes, *Salubra* paint offers great peace of mind, ensuring a constant quality of tone and texture with the right proportion of oil and colour" [13].



**Fig. 2 Study on exterior polychromy as published in the ZPPAUP graphic document, document 30-31, 1998.**

<sup>10</sup> ZPPAUP Ville de Pessac Accessed September 14, 2023. <https://urly.it/3y6bg>; <https://urly.it/3y6bp>; <https://urly.it/3y6bj>.

<sup>11</sup> Le Corbusier designed two color collections for a Swiss wallpaper manufacturer *Salubra* brand in 1931 and in 1959.



**Fig. 3** Color palette: on the left the Salubra range, on the right the transposition in Keim paints, source: ZPPAUP document 38, 1998.

Therefore, the colour palette that emerged after the ZPPAUP studies was willfully both based on archive research and on the *Salubra* range. It stated that “In the interests of authenticity and respect for this very delicate issue, and after examining the available archive documents, it was decided to refer on the one hand to the colour palette described by Le Corbusier on 11 July 1931 in a letter addressed to Mr. Gabriel, the site manager; and on the other hand to the corresponding *Salubra* range of colours, bearing in mind that they were published for Le Corbusier a few years after the Pessac experience”<sup>12</sup>. The shades in this palette are: *Le Blanc-Le Noir-Le Terre de Siègne Claire-Le Terre de Siègne brûlée pure-Le Terre d’Ombre brûlée-Le Bleu outremer clair-Le Vert pâle*.<sup>13</sup>

Thanks to the ZPPAUP research, tests and studies, these tones have found equivalents in the *Keim* range of mineral paints (Fig. 3). However, these tints were not always respected and the choice of using mineral paints on surfaces with dynamic cracks is now questioned.

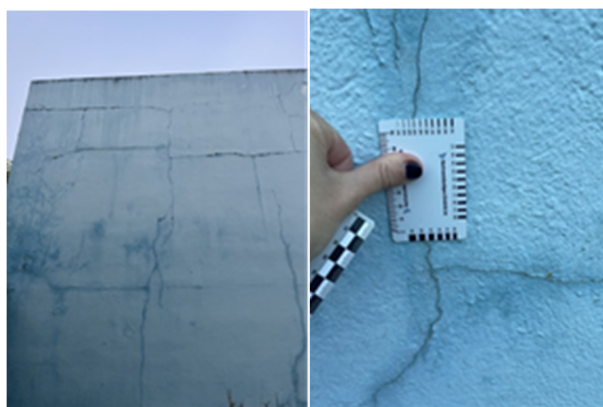
### 3. Results and Discussions

Since the last in-depth archive search, three phases of painting have been identified during the construction and early life of the district. The first was in late April-June 1926 for the inauguration with Mr. de Monzie

(*FLC HI-20-03*). The second phase took place in September-November 1927, during Mrs. Motorny’s letter, when the state of many of the houses was revealed (*FLC HI-19-340*). Finally, the third phase took place in July 1931 when the drawings and the palette of 8 colours were sent from Le Corbusier to Mr Gabriel (*FLC HI-19-345*). These three phases show us the challenges not only in the definition of colours, but also in the type of paint to be used, the choice of materials, number of paint layers, colour effects and maintenance issues. An “identical” restoration already poses a major problem in terms of interpreting the paintwork of origin.

Today, compared to the time when the ZPPAUP study took place, many issues relating to the reconfiguration of the overall image of the district can be considered achieved. The formal qualities of these architectures, which were previously falsified to the point of being unrecognisable in some cases—such as their massing, façades and polychromy—are now recognised, protected and even sought after by residents, who are asking for clarification so that they can intervene to conserve and sometimes restore them.

However, new issues and challenges arise nowadays. The deterioration of materials, and in particular of certain plasters and concrete parts, is becoming increasingly evident (Fig. 4).



**Fig. 4** Example of the current state of a Cité Frugès house’s polychromy and its analysis.

<sup>12</sup> ZPPAUP Zone P1 article 8, commentary 8.4.

<sup>13</sup> ZPPAUP Ville de Pessac Accessed September 14, 2023. <https://urly.it/3y6bg>; <https://urly.it/3y6bp>; <https://urly.it/3y6bj>.



Fig. 5 Examples of sampling points for polychromy analysis.

#### 4. Conclusions

Studies of architectural polychromy in Le Corbusier's work have progressed in recent years. The historical approach to documents, including the building as a document, as well as the question of authenticity, now leads us to consider chronology more carefully. The "colour keyboards" in the Salubra range, as is also shown in the ZPPAUP, were invented by Le Corbusier after the Cité Frugès project. The latter may have led Le Corbusier to seek out "colour in rolls" in order to avoid the ups and downs of the building site. The role of the Pessac experience in the architect's career is now being examined in greater depth, and is increasingly revealing itself to be the cradle of certain research, notably on polychromy, which will be developed in the years to come.

Today, research into the palette used for the Pessac project is going on. The next step is to identify the samples to be analysed during the *in situ* surveys carried out on the basis of this archive research (Fig. 5).

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