

A black and white photograph of a modern building facade. The facade is composed of numerous vertical wooden slats or panels, creating a rhythmic, textured pattern. The lighting is dramatic, with strong shadows and highlights that emphasize the grain and texture of the wood. The overall aesthetic is minimalist and contemporary.

Editorial

Modern and Sustainable

IDENTIFIED as a key issue for the future of environment, the argument of this **docomomo** Journal is Modern and Sustainable.

docomomo acknowledges the major relevance of reflecting on the Modern Movement heritage, focusing on two of the main contemporary issues: economy and energy. For this reason the year of 2011, that is to say, the first year of the 10', is dedicated to this issue.

In fact, Modern Movement Architecture is envisioned as a concept that deals with forms, spaces, techniques and social responsibility. In this **docomomo** Journal, the contributions on this discussion put together modernity and Modern heritage, economy and energy saving, the social mission and the responsibility of architects towards the future.

Modern Movement is often mistakenly related to a style, perceived in a skin-deep point of view and superficially adopted as simple form, as a modern shape, when in fact Modern Movement has always shown great concern with such issues, seeking for efficiency and economy, i.e., an accurate use of materials, a design approach that incorporates intelligent saving resources in order to create a better world.

This concept is nowadays synthesized in the so-called Sustainability, whose misuse might have lead sometimes to a trivialization of the word. That's why the identified theme to focus on is Modern Movement as the absolute primacy of the process over the style, looking for quality of life. The devices created to be efficient according to place and climate, the reflection made on building physics, the relation between heritage, energy and economy, are themes to be discussed both as Modern Movement concepts, on a documentation level, and as Modern Movement intervention nowadays, on a conservation level. After all, ideals that move **docomomo** between documentation and conservation.

The aim is to contribute for the discussion that relates heritage, economic constraints and energy issues, gathered underneath a global strategy for the future in order to fulfill a Modern Movement purpose: a better life quality for all!

I wish to thank Theo Prudon who acted as guest editor of this "Modern and Sustainable" dossier. Due to his commitment, knowledge and know-how—acquired within a transversal framework as a practitioner architect, researcher and professor—and his clear-sighted capacity of synthesizing and finding solutions, together with the knowledge shared by a range of researchers, in connection with pioneer academic research on the subject carried out by Columbia, Cornell, EPFL Lausanne, it is possible to extend this debate over the reflection on the creation itself and its durability, the tools created by Modern Movement architects to answer to efficiency and economy in a sustainable way.

Seeking sustainable solutions is also the way we choose to envisage the "Survival of Modern. From coffee cup to plan", the main concept of the 12th International **docomomo** Conference which will take place in Espoo, Finland, from the 7th to the 10th August 2012. The Conference themes will range from Environment and Urban Space large scale to the discussion on creation and its consciously operative conservation as Modern Heritage—the global design issue—and the relevance of furnishing in the adequacy of everyday environment space. These are certainly challenging issues that may support us, both undertaking an innovative conservation research and practice, and formulating new ideas for the future of the built environment based on the past experiences of Modern Movement Architecture as a condition for building a better future.

Ana Tostões, Chair of **docomomo** International

The Modern Movement and Sustainability: Yesterday, Today and in the Future

By Theodore Prudon

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CONCERN for the environment and a focus on the conservation of our natural resources have in general over the last couple of decades, entered into the dialogue around architecture and preservation.¹ In the last decade this focused more specifically on the more recent architecture. In some instances, the discussion about sustainability has begun to overshadow the preservation issues. Many countries have developed elaborate rating systems for buildings, whether new or old, that take into account a large number of factors to gauge and assess their impact. While these systems are intended to assist in deciding what actions can and should be undertaken, the discussion has remained quite limited and largely focused on the operational aspects of buildings and on new construction. The purpose of this issue of the Journal is not only to broaden the dialogue and the discussion about sustainability, but to include a much broader array of intrinsic values, and also to bring attention to the fact that there is much early research on building envelop performance.

The terminology surrounding our concerns for the natural and built environments is itself fraught with complications and, moreover, has changed over the last three decades as interests and concerns evolved. Sustainability is the term most commonly used in the English language today and describes an attitude as well as an approach to design, construction and operational issues. However, in the context of preservation, it is important to expand the meaning of the term to include not just the narrow operational concerns but also what it takes to sustain ourselves on more than just the physical level.² The slogan “the most sustainable building is one that exists” is often used in the US—echoed in this issue in Ivo Hammer’s article—and is a valid but too limited argument.

In this global and often confusing discussion on the sustainability of Modern Movement architecture and particularly Modernist architecture—in many people’s minds epitomized by the modern curtain wall—is seen as bad environmental design. While it is argued that many of these buildings were created when energy was cheap and abundant, it is equally important to recognize that energy use was then only a fraction of what is needed or desired today.³ The greater demand is partially the result of changes in perceptions of comfort, but also as a result of the explosion in the use and application of all sorts of equipment and electrical devices that—presumably—make our lives more comfortable or enjoyable.

Focusing entirely on those early curtain walls is neither doing justice to the level of awareness and concern that existed in the design and construction profession at the time, nor the efforts that were being made to achieve efficient and effective solutions. No self-respecting architect in the immediate postwar period would not take into account such basic considerations as orientation or exposure. Many drawings of that era, particular for tropical or subtropical climates, would not only show on its plans the orientation and the direction of the prevailing winds but also adapt the plans and elevations accordingly. The popularity and architectural use of the *brise-soleil*, large pivoted doors or large overhangs, to give just a few examples, were by no means accidental or mere stylistic accessories.

Before discussing the articles presented in this journal it is necessary to reflect on some of the fundamental dilemmas that exist. Materiality and permanence have played important roles in preservation theory, particularly in the context of material authenticity as well as durability as it pertains to the sustainability discourse. Permanence

and thus durability of buildings and building construction is not always encountered in these Modern structures, where functional specificity and experimentation with materials are seen as integral to their concepts. This leads to arguments that these structures are fundamentally temporal and were not intended to remain. This is in many instances a gross simplification and the very fact that they remain would seem to indicate their relative durability.

The other issue often raised—although not within this journal—in the discussion about preserving Modern architecture, concerns the idea of functional obsolescence. In other words, buildings that are tailor-made for particular functions become easily and quickly operationally, technically and economically redundant when those functions change. By being in turn tied into return on investment, permanence and durability are not necessarily promoted beyond the investment term unless the building can be recycled, which requires reinvestment.⁴ It is there that by comparing the existing structure with a new building the argument often made is that building new is more efficient and sustainable. The idea that buildings have limited functional life spans is not new and is something that appears early in the preservation related literature.⁵ This perceived obsolescence, which may have been predicted or desired, provides an impetus to build new, but would seem to be contradictory to the sustainability concept. However, given that so much of our economies are based on consumption and turn-over—representing as much as seventy percent of GDP in the US—durability may not be considered that desirable. Also with the strong emphasis on operational and performance efficiencies for both the interior and the exterior the intrinsic value of the original fabric is frequently discounted.

The articles in this Journal address sustainability not in the currently conventional sense, but rather address different issues that have to do with performance and retention of buildings as a functioning part of the built environment. It also seeks to acknowledge the skills and thoughtfulness of those early architects paying attention to what is called here *building physics* or the science and technology seeking to optimize the performance of the building and its exterior envelop.

Carl Stein titles his article, somewhat provocatively, “Greening Modernism.” He argues that the pioneers of the Modern Movement provided us with all the tools or design processes, as he calls them, for resolving the issues in the search for sustainability. In his book with the eponymous title, he states:

*While Modernism does not, in itself, offer new design tools for buildings reuse and historic preservation, it does provide a very clear framework for the appropriate application of these tools.*⁶

Using examples and quotations from various authors ranging from Gropius to Ada-Louise Huxtable, a well-known architectural critic for the *New York Times*, he seeks to establish that intellectual framework.

In many ways the article by João Vieira Caldas “Design with Climate in Africa: the world of galleries, *brise-soleil* and *Beta* windows” proves that point. Focusing on a series of schools built in Angola and Mozambique he describes the work of young Portuguese architects in these former Portuguese colonies. Orientation, massing, the use of overhangs, galleries and *brise-soleils* are the design tools and vocabulary used to achieve climatically the most effective solutions. Not only shading but particularly cross ventilation (presumably to the prevailing wind directions although the article does not specifically refer to it) are the most important features. The *Beta* window is a commercial louvered window type that provided both the opportunity for shading and cross ventilation. The description of the school buildings is reminiscent of the work of other architects of the period in the Caribbean,⁷ Africa or, for instance, Richard Neutra’s schools in Puerto Rico.⁸ The author, somewhat rightfully, bemoans the fact of how the addition of mechanical ventilation systems in a few of the buildings has not only affected the appearance but, more importantly, made the original design concept entirely ineffective. The practice of either installing so-called package units in all sorts of individual locations or introducing a more centralized system by creating a ‘box within a box’ eliminating entirely the advantages of the original cross ventilation [figure 1]. Individual cooling units have become ubiquitous in many of the early modernist buildings.

The contribution “Building Physics and its performance in Modern Movement Architecture” by Jos Tomlow presents the other part of the early design puzzle. In many ways, early modern architects anticipated and sought to address scientifically the building performance problems, which are the same issues discussed so prominently today in the literature.⁹ Because so many of these early proponents worked in northern Europe, the emphasis was on heating and thus insulation. However, Tomlow also points out correctly that this represents the emergence of what the Europeans called Building Physics, not only as a discipline and a serious academic science, but also as the beginning of formulating standards (the full implication of the German word *Normalisierung* is not easily translated into English). His focus is primarily on the European continent but parallels in other countries could probably be found [figures 2, 3].

“Modern and Green: heritage, energy and economy” by Franz Graf and Giulia Marino reports on a pilot project in a satellite precinct of Geneva built in the



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APPLICATION OF INSULATING TELEBOARD TO CEILING BY MEANS OF AN AIRBOTE
Courtesy of Armstrong Cork Products Co., Lancaster, Pa.

BUILDING INSULATION

A Treatise on the Principles and Application of Heat and Sound Insulation for Buildings

By PAUL DUNHAM CLOSE, B.S.
Technical Secretary, Insulation Board Institute
Formerly Technical Secretary, American Society of Heating & Ventilating Engineers

ILLUSTRATED

1942

AMERICAN TECHNICAL SOCIETY
CHICAGO, ILLINOIS

2



3

Figure 1. Student Services Building, University of Puerto Rico, Rio Piedras Campus, designed by **Henry Klumb** (1905–1984) and completed 1959. Designed to allow the “prevailing breeze” to pass through, modern requirements for air conditioning resulted in the insertion of enclosed box in an otherwise open space plan. Photo by the Author, c. 1998.

Figure 2. This ‘treatise’ is an American example of a comprehensive publication that provides formulas, methods of calculation and transmission coefficients and tables as well as materials and application methods of application. Author’s Collection.

Figure 3. Gropius House, Lincoln, MA, designed by **Walter Gropius**, 1938. The floors are insulated with natural fiber wrapped in paper, which was marketed under the name Cabot’s Quilt. Photo by the Author, 2007.

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1960s in response to the postwar growth in population is a more contemporary example of the same discipline that Tomlow identified. The Laboratory for Techniques and Preservation of Modern Architecture, located in the École Polytechnique Fédérale in Lausanne, looked at the problem of the performance of the 1960s outer skin. Appropriate interventions were developed in the context of the Swiss initiative of the “2000 Watts Society” referring to a goal of energy use of 2000 Watts only by 2050 (for comparison the current average in Western Europe is 6000 Watts, while the US uses some 12,000 Watts). The project itself was guided by a Swiss Federal policy document titled: “Recommendations on Improving Energy Consumption in Historic Monuments” from which the authors quote an important sentence that is worth repeating:

*...heritage and energy are both legitimate issues; they share essentially the same concerns and seek the same outcomes: supporting sustainable development by preserving non-replaceable natural and cultural resources...*¹⁰

The study of remedial options for the curtain walls with their operable windows shows a number of strategies

aimed at maintaining as much of the original as possible, not only for historic and cultural reasons, but because the payback for more intrusive or far reaching interventions would be very far out in the future.

The Lignon project aims at reducing energy consumption through visually minimal interventions. The projects of the students in the 3rd year architecture graduate studio of Cornell University seek to employ all modern tools in studying the energy use and impact on well-being in all aspects of a building. Not limiting it to wall studies but also addressing noise, light, glare and comfort levels that make interior and exterior spaces more comfortable and contribute to our overall sense of well-being. While the level of interventions may be well beyond what preservationists would deem appropriate, it is an interesting and innovative way of approaching the performance of architectural icons such as the Seagram Building or the Ford Foundation Building in New York City.

Although most of the articles in this issue have focused on systems, it is not the only factor to be considered. The last two articles return to the beginning of this introduction and its discussion of materials. Ivo Hammer’s “The

Tugendhat House: between artisan tradition and technological innovation. Preservation as sustainable building policy" focuses initially on the pre-modern craft and the quality of its finishes in this modernist building. He argues at the end of his article that not only the materials but also the craft is worth preserving because they reflect a different type of sustainability: the authenticity of the original material, the craft it represents and being the most sustainable simply because it already exists.

Over the years we have used many different materials with great optimism for their durability and applicability, only to discover their deleterious effects years or even centuries later. Lead, lead paint or asbestos are the examples with a long use but serious impact that are best known to us. Asbestos as a material in building manuals or lead paint were in most instances not abandoned till the 1970s. Once their impact on health was recognized these materials were replaced without much concern from a preservation or authenticity point of view. However, these may not be the only examples that we will have to face with modern architecture and construction introducing many different and new materials. As an example one of the more traditional and well-respected materials that has become the subject of some scrutiny and regulatory action in Europe and California is copper. Copper does not directly affect humans but may have a negative effect on aquatic life. In the last contribution, Amy Swift looks at the copper cladding of Frank Lloyd Wright's Price Tower in Bartlesville, Oklahoma. Because the building is freestanding its run-off into the ground could easily be monitored. While the case study may not necessarily identify copper as a source of great concern, the study does pose two important questions that may be applicable to many other situations. First, at what point does the general well being or quality of life trump the authenticity of the material, particularly when the impact is not immediate but long term and is not easily quantified. Secondly how many other materials should we be concerned about and how much do we consider this even today, when we design or specify new materials for either old or new buildings.

The authors of the articles (in this issue) highlight each in their own way significant issues. They all illustrate how nuanced and broad the concept of sustainability is and must be. It is not just about carbon or trees but it must be integral to all the decisions we make. Moreover, architects, preservationists, conservators and others involved in the preservation of the built environment, with their much more extensive knowledge about buildings, materials and their use, have an important role to play. Hopefully this issue and its articles help in leading the way.

Notes

1. See, for instance, "Positioning Preservation in a Green World", *Forum Journal* (National Trust for Historic Preservation), Vol. 23, No.3 (Spring 2009).
2. See, for instance, Erica Avrami, "Sustainability and the Built Environment: Forging a Role for Heritage Conservation", *Conservation Perspectives, The GCI Newsletter* (Spring 2011), 4-9. She discusses not only the usual aspects of conservation but also emphasizes the social and more intangible values. This issue of the newsletter of the Getty Conservation Center includes other articles on environmental and sustainability issues related to conservation and preservation.
3. The initiative "2000 Watts Society", established in Switzerland, seeks to reduce consumption to 2000 Watts per capita by 2050. Ironically that was the common consumption in the 1960s, the period when many of these buildings were constructed.
4. For a discussion on the issues of functional and economic obsolescence, see Theodore Prudon's book, *Preservation of Modern Architecture*, New York, John Wiley & Sons, 2008, 30-34 and by the same author, "The 'Modern' Challenge to Preservation", *Forum Journal* (The National Trust for Historic Preservation), Vol. 24, No. 4 (Summer 2010), 9-14.
5. For a discussion of this issue with regards to a particular building, see Hubert-Jan Henket and Wessel de Jonge, "A restoration concept for Modern Movement architecture", Paul Meurs and Marie-Thérèse van Thoor (eds.), *Sanatorium Zonnestraal: the history and restoration of a modern monument* (Rotterdam, NAI Publishers, 2010): 98-101.
6. Carl Stein, *Greening Modernism: Preservation, Sustainability, and the Modern Movement* (New York, W.W. Norton & Co, 2010), 81.
7. A review of the buildings highlighted in the *docomomo* Journal 33 (September 2005) titled "The Modern Movement in the Caribbean Islands" or the *docomomo* Journal 28 titled "Modern Heritage in Africa" illustrates that very well.
8. Thomas S. Hines *Richard Neutra and the Search for Modern Architecture* (New York, Rizzoli, 2005), 212-215.
9. A more detailed discussion of this subject and including other countries may be found in Jos Tomlow, editor, and Ola Wedeburn, co-editor, *Climate and Building Physics in the Modern Movement, Proceedings of the 9th International docomomo Technology Seminar, June 24 and 25, 2005* *Wissenschaftliche Berichte der Hochschule Zittau/Görlitz (FH)* and *docomomo* Dossier No. 9, September 2006.
10. The translation from the original documents, as quoted in the text here, is found in the Graf/Marino article and is, presumably, by the authors.

Theodore H. M. Prudon

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Greening Modernism



THE Modern Movement is predicated on attitudes that lead directly to the efficient use of resources for building construction and operation, attitudes that are fundamental to sustainability. Also intrinsic to Modern architecture is a systematic methodology that provides the armature for a design process that focuses on a sustainable future. Understanding these issues provides valuable guidelines and tools for contemporary planning and architecture. Additionally, a wider recognition of this aspect of Modernism will reduce general hostility toward Modernism, thereby facilitating the preservation and conservation of Modern architecture built examples.

By Carl Stein

MUCH of the material in this article will be very familiar to regular readers of the **docomomo** Journal; however, it may still have utility. It may include fresh presentations of interrelationships and juxtapositions between various aspects of the Modern Movement, and the arguments presented here may prove to be helpful in advocating for the preservation of relevant Modern buildings.

Concern for sustainable design and construction is often seen to be at odds with the Modern Movement in architecture. This seriously flawed view is in large part due to misunderstandings of both words “Modern” and “sustainable.” Ironically, many of the aspects of work of the Modern masters are now being “rediscovered” as being key elements in environmentally responsible building design; among them, the efficient use of materials, the passive and active exploitation of solar and wind patterns, and the incorporation of plant life into building design.

A further misapprehension is that historic preservation stands in opposition to both Modernism and sustainability, a position resulting not only from the misunderstandings mentioned above but also from a misreading of the prevailing attitude of the Moderns toward the appropriate use of history and its meaning in the architectural continuum. While some of the confusion regarding the interaction among sustainability, preservation and the Modern Movement is the result of well-meaning but ill-informed or shallow study, much can be traced to conscious, intentional misrepresentation intended either to advance competing architectural, planning and social attitudes or to directly further personal or corporate ends.

While Modernism does not, in itself, offer new design tools for building reuse and historic preservation, it does provide a very clear framework for the appropriate application of these tools.¹

Modernism has immense value as a problem solving tool. Recognition of the current crises that exist due both to global environmental degradation and to absolute limitations on essential resources, makes it essential that the misrepresentations and misunderstandings of Modernism, whether intentional or not, be corrected and that the Modern method be updated to fully incorporate current realizations regarding the state of the planet. However, in order for the framework of Modernism to serve the ends of sustainability, the meanings of “Modernism” and of “sustainability” must be properly understood. First and foremost, Modernism is a method and an attitude. It is not a style. This is clear in the great stylistic variety seen in the work of the members of CIAM (*Congrès Internationaux d'Architecture Moderne*), who may be seen as being representative of the best of the Modern Movement.²

Even the work of individual Modern architects shows considerable evolution over the course of their careers. Compare, for example, the iconic Villa Savoye by Le Corbusier from 1928 with his *Maisons Jaoul* from 1954 [figures 1, 2, 3].

Despite this obvious avoidance of narrow stylistic boundaries, a widely held misunderstanding is that Modernism is represented by the cookie-cutter curtain wall commercial structures that have populated our cities and suburbs since the 1950s. This not only leads to ignorance of the profoundly important historical advances that occurred in the first half of the twentieth century, it also creates a widespread hostility to the concept of Modernism, thereby greatly complicating efforts to preserve the surviving examples of serious Modernist building.

A review of the Modern Movement history makes this misplaced conflation of Modernism and certain stylistic elements, sometimes described as the international style, all the more surprising. In addition to the work itself, the writings of key practitioners of Modern architecture, insist on the absolute primacy of process over style. While, as noted above, some of the misunderstanding results from naivety and some from intentional misrepresentation for personal benefit, there are also many examples of confu-

< Figure 6. Bronze relief, **Le Corbusier**: a work of Purism, 1948.



sion on the part of some of our most thoughtful and influential historians and critics. For example, in 1976, Ada Louise Huxtable wrote in the *New York Times* a review strongly praising the early advocates of post-modernism as being as answer to the failures of "Modernism"³ [figures 4, 5].

Despite recognizing "the genius and influence of Mies van der Rohe" and praising the "sculptured concrete forms of Le Corbusier," specifically noting that the "Marseilles apartments and the chapel at Ronchamp are among the ranking prototypes of 20th century high-rise and symbolic construction" and despite commenting on the "prophetic humanism of Alvar Aalto" and "the early work of Walter Gropius," Ms. Huxtable then went on to repeat many of the old one-liners about Modernism, reinforcing the movement misunderstandings. She wrote

of the "puritanical pieties of Modernism," followed by a statement of her belief that the mannerism of the "new" work was "replacing the purism and functionalism of the 20th-century architectural revolution" [figure 6].

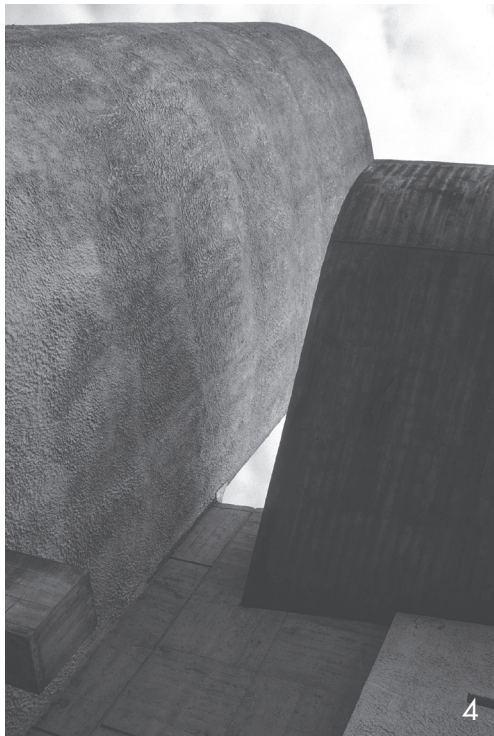
First, of course, purism had about as much to do with Puritanism as cubism had to do with cubes, which is to say virtually nothing. But more than that, the idea that Modernism called for an austere view of built space is belied both by the writings of the Moderns themselves and by their work. In fact, much of the work is lush and sensuous, in form, in surface and in subject.

One of the most misunderstood and misapplied statements is Le Corbusier's "A house is a machine for living in" from *Toward an Architecture* (*Vers Une Architecture*).⁴ While this is frequently quoted as being a call for a cold functionalism, in fact, nothing could be farther from the

truth. Also in *Toward an Architecture*, Le Corbusier writes the following:

My house is practical. Thank you, as I might thank the engineers of the railroad or the telephone company. You have not touched my heart.

But the walls rise against the sky in such an order that I am moved. I sense your intentions... It is architecture.⁵



And this is a far cry from cold utilitarianism. Clearly, the functions of “living” that the “machine” is intended to satisfy include the elevation of spirit, of joyousness. The program of architecture is not a simply efficient shelter but includes a primary criterion, a deeply enriched quality of life. Understanding the complex functions to be served by Modern architecture is essential to understand the interconnections between Modernism and sustainability, and it is essential to its clear definition.

Ms. Huxtable also brought up the common misunderstanding regarding Modernism’s view toward expressing structure. Speaking of the proto-post-modernists she wrote that, “it is no longer essential to reveal or express basic structure.” Compare this with what Le Corbusier wrote:

A commonplace among architects (the young ones): it is necessary to show construction...

Sorry! Emphasizing construction is fine for students at the Arts et métiers who want to show what they’re worth. The good Lord indeed emphasized wrists and ankles, but then there’s all the rest⁶ [figure 7].



Figure 1. Villa Savoye, **Le Corbusier**, 1928–31 (photo 1964).

Figure 2. Villa Savoye, **Le Corbusier**, 1928–31 (photo 2005).

Figure 3. Maison Jaoul, **Le Corbusier**, 1954–56 (photo 1964).

Figure 4. Chapel at Ronchamp, **Le Corbusier**, 1954 (photo 1964).

Figure 5. Seagram Building, **Mies van der Rohe**, detail, 1958 (photo 2011).

Figure 7. Barcelona Pavilion, **Mies van der Rohe**, detail, 1929. Note that the spatial, pictorial and informational content of the polished, cruciform column, provides architectural richness far greater than its simple function of roof support. This very sophisticated architecture is achieved with essentially the same resources as a simple column—highly sustainable (photo 2010).

This Modern formulation is far from minimalist, far from narrowly constructivist and far from puritanical. While the details of construction and structure are frequently elements in the overall realization of Modern architecture, they are not ends in themselves. And in the context of the efficient use of resources, consider the environmental benefits of having the basic components of a building add to the visual experience, intellectual enrichment or pure joy that the building offers.

The misunderstanding—or perhaps misrepresentation—of Modernism continued as Ms. Huxtable claimed that architecture “is one profession that went through the ‘history is irrelevant’ bit half a century ago.” Yet the Moderns themselves were profoundly concerned with history. Walter Gropius, in *The Scope of Total Architecture*, wrote:

Studies in the history of art and architecture, intellectual and analytical in character, make the student familiar with the conditions and reasons which have brought about the visual expression of the different periods...⁷

Far from a rejection of the history study, Gropius put forward a position explicitly calling for the study of history but in its integrative, analytical sense rather than as review of style.

Similarly, Le Corbusier, in describing how to study history from a Modern viewpoint writes:

One must go and see Pompeii, which is moving in its recititude. [The Romans] found the Corinthian more beautiful than the Doric, because more florid. Bring on the acanthus capitals, the entablatures decorated without much moderation or taste! But underneath was something Roman that we’re going to take a look at. In sum, they built superb chassis but designed dreadful coachwork...⁸ [figure 8].

The Scope of Total Architecture is explicit in defining Modern architecture as a methodology:

My intention is not to introduce a, so to speak, cut and dried “Modern Style” from Europe, but to introduce a method or approach which allows one to tackle a problem according to its particular conditions.⁹ (emphasis added)

Here, clearly and unambiguously, Gropius describes Modernism as a process rather than a style, yet despite this, and despite the fact that the means to approach sustainable design are inherent to the Modern process, the commonly held view is that there is a fundamental conflict between Modernism and sustainability. Rather, properly understood, the Modern process is Gropius’ “method or approach” for addressing the problem of sustainable planning and design “according to its particular conditions.” The bones of this Modern approach may be extrapolated from the numerous contemporaneous writings of its practitioners but is nowhere more clearly distilled than in the CIAM Grid, a matrix that places architecture



and planning concerns into four major categories—Living, Working, Care of the Body and the Spirit, and Circulation—and establishes cells at the intersections between these categories and each of the problems and/or opportunities inherent in the design process.¹⁰ Although the CIAM Grid is incredibly ambitious in its attempt to bring all of the issues affecting then-contemporary planning and design into a single matrix, what is perhaps most relevant to this discussion is its use of what would now be called multi-media notation within each of the matrix cells. By accommodating text, drawings and maps, photographs and other notations, the Grid supports the inclusion for evaluation of factors that go far beyond simple quantitative measurement. It specifically acknowledges the importance and incorporates the consideration of issues dealing with joyousness and elevation of intellect and spirit.

*...the walls rise against the sky in an order such that I am moved. I sense your intentions... It is architecture*¹¹ [figures 9a, 9b].

The corollary to this observation as related to sustainability is that success of any program depends on its ability to enhance quality of life.

*It is not the primary purpose of architecture to save energy. [A]ny building activity, by definition, requires the use of energy. It is, however, the responsibility of architects to carry out their work in a way that gains maximum results from the expenditure of precious, non-renewable resources.*¹²

This observation was made in 1991; however the Modernism of the first half of the 20th century evolved in a dramatically different context, or at least understanding of context; that is, one having limited understanding of the profound impacts of approaching the absolute limits on resource availability or of the rampant environmental degradation resulting from their overuse. Awareness of these conditions requires that new criteria should be introduced into the process, thus “Greening Modernism.”

*“Greening Modernism” references two conditions which are relevant to current global concerns regarding a sustainable future. The first is the existence of a set of fundamental principals and attitudes inherent to the Modern Movement as they relate to sustainability... The second condition is the need to upgrade the environmental performance of most of the existing building stock, much of which being in the modern style.*¹³

Additionally, “Greening Modernism” might also refer to the relatively recent recognition of the finiteness of many essential resources as an added “particular condition” in the Gropius view, a particular condition of great importance. This added awareness and inclusion as a primary criterion may be seen as greening the conceptual basis of Modernism. This, in turn, poses the question of when did this “particular concern” become part of the architectural world view, or for that matter, when should



Figure 8. Organizational rigor and details of the “chassis” at Pompeii.

Figure 9a. Chapel at Ronchamp / Figure 9b. Seagram building. Note that each of these buildings has walls that “rise against the sky in such an order that I am moved” yet each does so in a very different way.

it have? Although the concern for creating a built environment that functions in concert with nature can be found throughout the history of architecture and throughout the world, realization that there are absolute limits on resource availability and efforts to come to grips with the implications inherent to this realization are relatively new, particularly as applied to architectural design criteria.

In 1972, *The Limits to Growth* by Donatella Meadows and others was published, reporting the findings of the Club of Rome research project that had been funded by the Ford Foundation.¹⁴ These findings were remarkably prescient as to the conditions experienced today, some forty years later. The book was not an isolated call. A year earlier, in 1971, Barry Commoner's *The Closing Circle* presented many of the same observations and raised many of the same concerns.¹⁵ In 1975, E. F. Schumacher approached the same issues from the vantage point of economics in *Small is Beautiful*.¹⁶ Questions of sustainability and the built environment have been widely discussed in the public arena for at least forty years and, while this represents a significant segment of contemporary experience, it is the blink of an eye in the history of architecture. It is interesting to note that the period of essentially turning a blind eye to the finiteness of critical resources roughly coincides with the massive distortions of the Modern Movement.

One of the charges leveled at Modernism during these past three or four decades is that its attitudes favoring efficiency essentially are austerity measures which lead to a reduced quality of life. These changes equate more "stuff" with a higher standard of living. Here again, Modernism offers help. In order that quality of life issues be incorporated into the equations for evaluating sustainable progress, it is necessary to reassess how sustainability is measured which means, in turn, rethinking the definition of quality of life.

In terms of energy use, the important consideration is not the absolute energy performance of the building as an object, but rather its efficiency in meeting a programmatic goal with minimum energy consumption. The same may be said for all aspects of sustainable design.

Just as energy efficiency should not be measured in Btu's per square foot but rather in Btu's per programmatic goal solution, environmental impact—whether it is carbon footprint, consumption of water, occupation of land, use of non-renewable material, it should not be evaluated per unit of building but instead as it relates to satisfying human needs. This definition of sustainable design requires, in turn, a clarification of what is meant by human needs. To have a sustainable Modern architecture, it is essential to recognize that human needs supported by that architecture go far beyond the simple issues of shelter or utility. Architecture has the power to create spaces that calm

*or excite; that focus or expand fields of vision—literal and metaphorical; that offer intellectual clarity or pose demanding questions. Architecture can speak of privacy or community. It can profoundly impact the body, mind and spirit. The success in addressing all of these issues must be taken into account when viewing the value obtained from the expenditure of environmental capital.*¹⁷

It is here that Modernism, the movement born in the period of intense scientific and technological development, has particular relevance, especially as it relates to issues of quality of life. The basic laws that describe behavior of the physical world also provide understanding of the world of art and intellect. In particular, there is the concept of entropy whose internalization leads immediately to the realization of the self-destruction inherent in casual excess. This concept is helpful in appreciating why efficiency will actually enhance quality of life [figure 10].

Entropy is energy which is at the same level as its surroundings. As such, it is unavailable for application to useful ends. Within a closed system, the movement of energy from a higher to lower state not only reduces the amount of high-level energy but also raises the level of the surroundings—increases entropy, thus reducing the potential value of whatever high-level energy remains. In broader terms, entropy may describe any condition in which the value or importance of any resource is determined by its differentiation from its surroundings. Construction materials manufactured and assembled as a building are high-value resources.

*The same materials in a landfill become an increase in entropy. The homogenization of the cultural environment, the loss of genius loci, increases cultural entropy. The loss of environmental diversity increases environmental entropy.*¹⁸

Modernism, with its complexities, inclusiveness and nuances is not sympathetic to the currently popular sound bite mindset; however, it does provide the underpinnings for a holistic approach to planning and design processes necessary for a sustainable built environment. It does this by providing at least the outlines for the tools required to integrate the complex sets of issues that planners and architects must address as well as by defining an overall discipline that insists on inclusiveness [figure 11].

Interestingly, as the misunderstandings regarding the Modern process are corrected and the true importance of Modernism is more fully appreciated, the built works of this movement should face less antipathy, thereby making their preservation and continued utility all the more likely—a sustainable step in itself and, as with all architectural things, an integral part of a continuum that is iterative and cyclical.

Notes

1. *Greening Modernism*, C. Stein, 81.
2. CIAM, the *Congrès Internationaux d'Architecture Moderne* or International Congress of Modern Architecture, was established in 1928 and continued until 1959. Throughout this period, CIAM, meeting somewhat irregularly, sought to promote Modern architecture and to provide a compendium of the issues to be addressed. Members included, among others, Alvar Aalto, Hendrik Berlage, Victor Bourgeois, Le Corbusier, Lúcio Costa, Cornelius Van Eesteren, Sigfried Giedion, Walter Gropius, Walter Loos, Richard Neutra, Gerrit Rietveld, Josep Lluís Sert and Mart Stam.
3. "The Gospel According to Giedion and Gropius is Under Attack", A. L. Huxtable, *The New York Times*, June 27, 1976.
4. *Toward an Architecture*, Le Corbusier, 151. The reference here is to the 2007 translation published by The Getty Research Institute. The original 1927 English translation of *Vers une Architecture* was titled *Towards a New Architecture*. The addition of the word "New" into the title of the earlier translation conveys a very different sense of the book's intention.
5. *Toward an Architecture*, Le Corbusier, 195.
6. *Toward an Architecture*, Le Corbusier, 162.
7. *Scope of Total Architecture*, W. Gropius, 53.
8. *Toward a New Architecture*, 198.
9. *Scope of Total Architecture*, 3.
10. *The Charter of Athens*, Le Corbusier. Originally published anonymously in 1943 in occupied Paris, is both a summary of the work of the CIAM and a history of the organization.
11. *Toward an Architecture*, Le Corbusier, 195.
12. *Energy Conscious Architecture*, C. Stein, 1.
13. *Greening Modernism*, Carl Stein, 10.
14. *The Limits to Growth*, D. Meadows.
15. *The Closing Circle*, B. Commoner.
16. *Small is Beautiful*, E. F. Schumacher.
17. *Greening Modernism*, 160.
18. *Greening Modernism*, 120.



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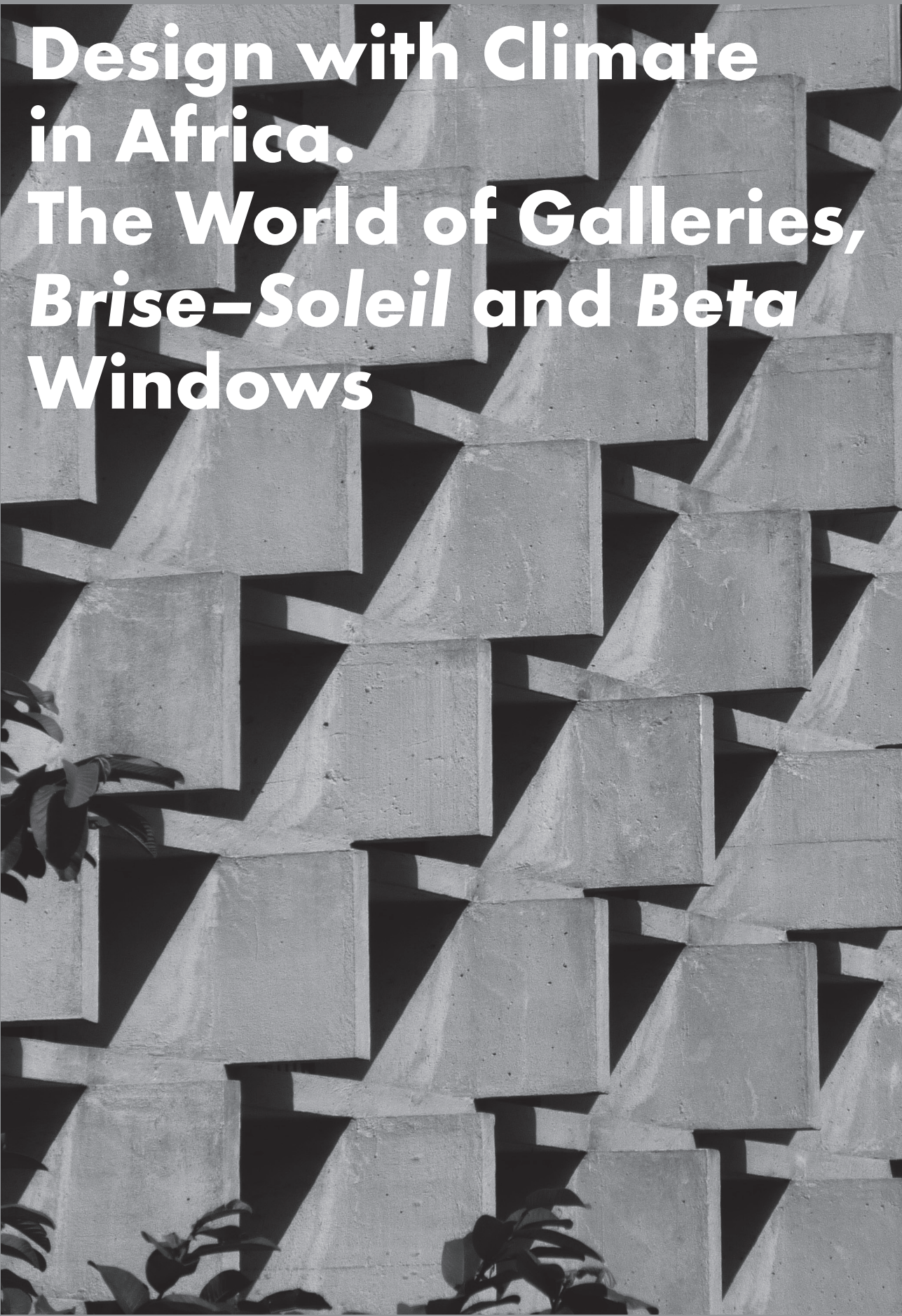
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Figure 10. Building material becoming entropic.

Figure 11. Surface, transparency and reflection at the Barcelona Pavilion. Great complexity and nuance in what initially appears to be a very simple building.



Design with Climate in Africa. The World of Galleries, *Brise-Soleil* and *Beta* Windows

IN the twenty-five years after World War II, Angola and Mozambique were fertile territories for the inception of new urban and architectural projects, in keeping with the principles of the Modern Movement. In the earliest works designed by the architects who moved there in the late 1940s, one can already witness a serious concern with the adjustment to the particularities of the hot and humid climate of the tropics. The Modern architectural idiom was particularly well suited to the local climate building requirements such as solar control and provision of adequate ventilation. Moreover, these architectural solutions were underpinned by sustainable procedures that ought to be re-established in the restoration of Modern buildings of the type presented here.

By João Vieira Caldas

SINCE the late 1990s, and in particular over the past decade, there has been a widespread interest in the study of modern architecture and urban planning in the Portuguese ex-colonies in Africa. This is especially the case with Angola and Mozambique, enormous terrains that witnessed a significant impulse toward development in the period between the end of World War II and the revolution that shook Portugal on 25 April 1974, leading to the independence of these countries the following year. This developmental strain took place against the backdrop of a form of colonialism overseen by a fascist-style political regime. Paradoxically, as has been noted by scholars in the field, young Portuguese architects experienced the African colonies as liberating (Magalhães, 2009; Tostões, Oliveira, 2010).

On the one hand, the African colonies of the southern hemisphere were geographically distant from the repressive control of the metropolis. On the other, these territories constituted a new world, whose dimensions and need to be inhabited sponsored a vast field of experimentation and innovation in the areas of urban planning and construction (Fernandes, 2002). Finally, the lexicon of Modern architecture seemed especially appropriate for dealing with the tropical climate.

The new architecture was to be constructed using industrialised building materials and processes, and these buildings were invariably supported by structures made of reinforced concrete. The challenges immediately raised in attempting to build in sub-Saharan Africa, is that of adaptation to the local climate. Obviously, in this context, the experience of construction in Brazil became an important reference point.

When the wave of migration of European-trained architects to Angola and Mozambique began, in the late 1940s, the experience of the adaptation of modern architecture to tropical climates had already been launched in Rio de Janeiro some ten years earlier, with the construction of the Ministry of Education and Health (1936–1945), immediately followed by diverse experiments in

Brazil. This whole process had already been disseminated in Portugal by *Brazil Builds*¹ and continued to receive attention through the exhibition of Brazilian architecture at the *Instituto Superior Técnico* in Lisbon in 1949, as well as the exhibition that accompanied the Third UIA Congress, also in Lisbon, in 1953.

While it is true that what mobilised these architects were the grand ideas of the Modern Movement,² such ideas had certainly been tempered by the experience of Brazil. Actually, the necessary means for controlling adverse climatic conditions are already present in many different types of architectural structures, from office buildings to social housing blocks, ever since Modern architects arrived in Angola and Mozambique.

As examples of the application of systems of climate adaptation, I have chosen four high school buildings: two in Angola (one in Luanda and one in Lobito) and two in Mozambique (both in Maputo). They form part of a series of public service facilities that, until now, have not been subject to the economic pressures of capital investments and real estate speculation. Indeed, none of these buildings is situated at the economic hub of its respective city.

Oddly, the oldest of the four examples, the building that is currently the Josina Machel Secondary School in Maputo (formerly the National Salazar School), in a way serves as a bridge between the typically colonial structures and the modern buildings of the 1950s and 1960s, both in terms of methods of construction and response to the climate.

This school was designed by José Costa e Silva in 1939, working from Portugal, and built between 1945 and 1952, the year in which the first projects of the new generation of architects began to appear in Africa.³ The organisation and arrangement of the pavilion-like spaces of the enormous school building, with a monumentality rigorously planned along a symmetrical axis, is of a rationality still linked to the *beaux-arts* system. But the use of an overall reinforced concrete structure, whose technical and aesthetic implications are keenly understood by the



Figure 1. **José Costa e Silva**, Josina Machel Secondary School, 1939–1952, Maputo, Mozambique. Covered galleries around the building.

Figure 2. **José Costa e Silva**, Josina Machel Secondary School, Maputo, Mozambique, 1939–1952. Ventilated roofing with two slabs.

Figure 3a. **F. Castro Rodrigues**, Comandante Valodia Secondary School, Lobito, Angola, 1966–1967. The shorter building.

Figure 3b. **F. Castro Rodrigues**, Comandante Valodia Secondary School, Lobito, Angola, 1966–1967. Classroom with an open fixed grid.

Photos by Ana Tostões/EWV, 2011.

architect, serve as evidence of a different kind of rationality—a modern rationality—in which forms are practically reduced “to their structural essence” (Ferreira, 2008).

The system of wide, covered galleries wrapping around all the pavilions on all three floors immediately leaps into view. In its modernist expression, with the ample grid formed by the elegant pillars cutting across the horizontal slabs, it suggests an affinity with the porches/galleries that almost ubiquitously surrounded colonial buildings [figure 1].

In effect, these external galleries cling to the longer sides of all the pavilions, giving access, shading and ventilating, on two opposite sides, both to the administrative areas and the classrooms (or even the areas of the gym-

nasium/swimming pool or communal gathering halls). The width of the galleries offer protection against both light and heat, allowing the opening of wide windows on both sides of the rooms. Even so, on the side of the room where the sunlight is harshest, the bottom halves of the windows are protected by wooden Venetian blinds. The upper half is made of moveable, tilting parts, always permitting cross ventilation.

However, the most coherently modern outcome of the use of a structure entirely made of reinforced concrete is the use of roofing with almost flat and impermeable slabs. This option in the roofing over the classrooms on the top floor needed the duplication of the slabs above it in such a way as to facilitate the flow of air between the two levels [figure 2]. In contrast, the galleries are covered in single slabs that, in combination with the columns, more clearly express the modernist ethos of their function.

With the 'new wave' of architects who settled in Angola and Mozambique, working far from the censorious gaze of the central authorities, the precepts of modernism were applied in a way that bears no reminiscence of the architecture of the colonial past, and that makes no concessions to nationalist official taste imported from the metropolis.

Reinforced concrete definitively became the principal material and procedure employed. Adaptation to the climate relied on the use of galleries, and on the introduction of *brise-soleil* (whether in the form of vertical or horizontal fins, movable or fixed, whether as pre-fabricated concrete or ceramic grids) and the so-called *Beta* windows.

The galleries, however, now have little in common with the system used at the Josina Machel School in Maputo. They no longer wrap around the whole building like porches, but rather, now extend along one of the long sides of the building. In accordance with the modernist emphasis on horizontality and on the constructive potential of reinforced concrete, the slabs are no longer traversed rhythmically with the supporting columns, but rather cantilevered.

The *brise-soleil*, made of fins that are movable around a central axis, were innovatively used (though horizontally) on the northern façade of the Ministry of Education and Health in Rio de Janeiro. After that, they were exhaustively employed, especially vertically, in the large public buildings of Brasilia. But in Brazil, other forms of creating shade were also explored, namely the fixed grids made of prefabricated ceramic or concrete units.⁴

Vasco Vieira da Costa took this further, and, as Le Corbusier had done in Chandigarh's High Court Building, brought together the concept of the grid with that of the louvers, designing countless variations of large scale

grids with fixed sunshades of reinforced strips of concrete running in both directions (horizontal and vertical), especially when the project demanded combining solar protection with ventilation requirements.

Beta windows is a commercial designation of a type of window with a slim, almost invisible iron frame, fitted with narrow, horizontal, turning slats of glass that allow the user to regulate fairly precisely the amount of air to be circulated, and the angle and speed at which it flows indoors. These windows are still sold in Portugal today under the same brand name, though now mounted in aluminium frames.

But one of the principle means of "designing with climate" consists in choosing the form and orientation of the building in tandem with ventilation devices. Exposure to the low angles of sunlight from the eastern and western sides was avoided by designing blocks with a rectangular plan displayed on the east/west axis, with the areas facing those cardinal points closed off. Cross ventilation was facilitated by turning the longest sides of the building in the direction of the predominant winds. But as it was not always possible to reconcile the best solar protection with the most efficient wind exposure, sometimes an intermediate position was used, what Vasco Vieira da Costa called a *compromise solution* (Quintã, 2007).

The openings were thus made on the long northern and southern walls, where the sunrays fell more vertically (owing to the proximity of the Equator) in such a way that, ideally, the side of the building most exposed to the predominant winds would also be protected from the sun by *brise-soleil*, frequently in combination with *Beta* windows for ventilation. On the less windy side, protected from the sun by a gallery, the use of the *Beta* windows facilitated cross ventilation. These processes of protection against the sun and encouraging ventilation were generically applied to buildings of diverse functions, but were particularly well suited to large apartment blocks as well as schools.

The two school buildings I have chosen from Angola exemplify different solutions for the placement of the classroom blocks.

For what was the Lobito School (1966–1967), the architect, F. Castro Rodrigues chose to design two longitudinal, three-storey blocks, each of a different length, sequentially disposed, though slightly out of phase, used exclusively as classrooms.

Both of these blocks are built on a northwest-southeast orientation and elevated on columns, with the classrooms always on the upper floors. These are accessed via the broad galleries that also serve as protection from direct sunlight on the side where it hits hardest. The classrooms are now very dilapidated—all the glass from the original



Figure 4a. **F. Castro Rodrigues**, Comandante Valodia Secondary School, Lobito, Angola, 1966–1967. The largest block with the amphitheatres below. Photo by Ana Tostões/EWV, 2011.

Figure 4b. **F. Castro Rodrigues**, Comandante Valodia Secondary School, Lobito, Angola, 1966–1967. Amphitheatre: distance between the grid and the façade surface. Photo by Ana Magalhães/EWV, 2011.

Figure 5. **Vasco Vieira da Costa**, ICRA (former Pio XII Institute), Luanda, 1968. Fixed brise-soleil. Photo by João Vieira Caldas/EWV 2011.



windows has disappeared—but one can still see that all the rooms on the gallery side were provided with ample Beta windows running along the walls. The façade on the opposite side essentially consists of a permanently open fixed grid, permitting the free flow of ventilation, but not the control of airflow, complemented by a strip of Beta windows close to the ceiling [figures 3a, 3b].

On the shorter building, the ground floor is almost entirely used as a covered area for recreation. In the largest block, the space between pillars at ground level is only open at its ends, and at the opening created by the central staircase. The rest of the space is designed in such a way as to ensure that the main body of the upper two floors appears to be suspended above the constructions at ground level. On this level, the amphitheatres stand out, bound on the gallery side by a wall pierced only by the classroom doors. However, this wall does not rise all the way up to the ceiling, leaving a strip completely open. The opposite façade has the same kind of fixed grid as the upper floors, but here, it stands away from the building, creating the sense of an outdoor amphitheatre (a design made popular with cinemas built in Angolan cities in the 1950s and 60s). Indeed, this distance established between the plane of the grid on the bottom floor and the surface of the façade on the upper floors has no cover at all, thus compensating in light for the darkness of the opposite wall [figures 4a, 4b].

In the case of the old Pio XII Institute in Luanda (now the Institute of Religious Studies of Angola), Vasco Vieira da Costa also amassed the classrooms in two rectangular blocks on two storeys, although these are only raised from the ground at the height of a small ventilation box. In order to achieve the most suitable orientation, the architect had to employ a *compromise solution*, building the two blocks parallel to one another and at a 29° angle to the east/west axis (Quintã, 2007). He designed a third block, smaller and raised on columns, in order to link the two main blocks. The open ground floor of this bridging block functions as a covered passageway between the two classroom blocks. The 'closed' upper floor is traversed by a corridor that leads from both sides to the administrative offices and staff rooms.

Vieira da Costa decided to compensate partially for the 'compromised' orientation of the three constituent blocks of this building using three methods of creating shade. For the classroom blocks, aligned in front of the windows on the south-western façade is a fixed *brise-soleil* composed of continuous horizontal concrete strips, traversed by smaller, vertical concrete fins in alternating positions and projecting out of the external surface of the façade [figure 5].

On the opposite side, facing the garden and the rec-

reation areas, a 'box' formed by the extensions of the concrete slabs and the closed off side façades, casts a shadow over the open corridors leading into the classrooms [figure 6]. The linking section, exposed primarily on the southeast/northwest side, is protected on both sides by vertical *brise-soleil*, movable from the inside [figures 7a, 7b, 7c].

The system of ventilation is based on the substantial use of Beta windows, whose glass, in this building, has remained almost intact in the strip of windows running under the ceiling on the walls of the classrooms facing the galleries. They practically replace the side walls in the bridging block, behind the *brise-soleil*. Furthermore, this block contains Beta windows close to the ceiling on the walls that separate the central corridor from the offices, thus enabling transversal ventilation.

Finally, the Polana Secondary School (originally the Dona Ana Portugal School) in Maputo was a project dating from the end of the colonial regime (1970), designed by João José Tinoco and José Forjaz. The solution here, however, is not radically different from that employed at Pio XII Institute, except for the larger number and functional diversity of pavilions, as well as in the architectural idiom, which, in Maputo, is clearly brutalist.

The four pavilions containing the schoolrooms are again conceived as long rectangles with an east/west orientation, traversed by a wide covered passage, whose roofing slab permits it to function as an open linking gallery on the first floor [figure 8].

The classroom pavilions are large, three-storey blocks with sloping roofs, where exposed concrete is the principle material used for the finish. As in the two previous examples, the classrooms are aligned along the length of one of the longer façades. They are protected from the sun by *brise-soleil* in the form of vertical fins attached to structural pillars, and therefore in line with the axis of the building's structural frames. The surfaces between each pair of consecutive pillars are filled with large, square Beta windows [figure 9].

The opposite façade is protected by the cantilevered galleries giving onto the classrooms, interrupted, near the linking passage between the pavilions, by the abutting volumes of the staircases [figure 10]. Also on the side of the galleries, the rooms are lit and ventilated by smaller Beta windows. These more than suffice to create a cross current of air with the large windows of the opposite wall.

In summary in the systems for creating shade and ventilation in Modern and pre-Modern architecture in Angola and Mozambique, natural and sustainable procedures were deployed. But these procedures were associated with the logic of colonialist development. With independence, in 1975, and with the ensuing civil wars, a large



number of these buildings—especially those designed for habitation—stopped being repaired, were inadequately used and indeed, were subjected to the direct effects combat.

The end of the wars, especially in Angola, gave rise to economic growth that, in Luanda, expressed itself in the type of urban development that is frequently seen in Asia. Large buildings dedicated to services began to pop up at a hallucinatory pace, replacing the ‘old blocks’ of the Modern Movement and, with increasing density, occupying the ample breathing spaces of the city.

This growth brought in its wake the tyranny of air conditioning systems, which became widely used, currently extending to individual homes and apartments, besides the big hotels and office and service blocks. Air conditioning is now used not only to correct inadequate systems of shading and ventilation, but also, and above all, to substitute those that had worked properly.

In the school buildings of today, most of which belong to the state, there is little margin for ‘improvement’. Of the four examples cited here, only the old Pio XII Institute is in good repair (although there have already been changes made to the frames of some of the windows in the classroom blocks), but this establishment belongs to the Catholic Church.

Owing to their interesting architectural features and the proven efficacy of their systems of shading and ventilation, these buildings deserve exemplary rehabilitation work, including the conservation or re-installation of the natural and sustainable systems of dealing with the climate that were used in their construction.

Figure 6. **Vasco Vieira da Costa**, ICRA (former Pio XII Institute), Luanda, Angola, 1968. Open corridors of the classrooms. Photo by João Vieira Caldas/EWV 2011.

Figure 7a. **Vasco Vieira da Costa**, ICRA (former Pio XII Institute), Luanda, Angola, 1968. Movable *brise-soleil*. Photo by João Vieira Caldas/EWV 2011.

Figure 7b. **Vasco Vieira da Costa**, ICRA (former Pio XII Institute), Luanda, Angola, 1968. Detail of movable *brise-soleil*. Photo by João Vieira Caldas/EWV 2011.

Figure 7c. **Vasco Vieira da Costa**, ICRA (former Pio XII Institute), Luanda, Angola, 1968. Lever of movable *brise-soleil*. Photo by João Vieira Caldas/EWV 2011.

Figure 8. **João José Tinoco and José Forjaz**, Polana Secondary School, Maputo, Mozambique, 1970. Linking gallery. Photo by Maria Manuel Oliveira/EWV, 2010.

Figure 9. **João José Tinoco and José Forjaz**, Polana Secondary School, Maputo, Mozambique, 1970. Fixed *brise-soleil* and square Beta windows. Photo by Vincenzo Riso/EWV, 2010.

Figure 10. **João José Tinoco and José Forjaz**, Polana Secondary School, Maputo, Mozambique, 1970. View to the cantilevered galleries from the linking gallery. Photo by Vincenzo Riso/EWV, 2010.

Notes

1. Philip L. Goodwin, *Brazil Builds, architecture new and old 1652–1942*, New York, The Museum of Modern Art, 1943.
2. For example, Vasco Vieira da Costa and Fernão Simões de Carvalho worked with Le Corbusier in Paris before moving to Angola (the former between 1946 and 1948, and the latter between 1956 and 1959).
3. 1952 was the year in which the now-demolished market of Kinaxixe—the first work to be designed and built in Luanda by Vasco Vieira da Costa—was completed.
4. These were frequently used in the Portuguese mainland in the 1950s, though usually only to provide the necessary airing for the areas next to the kitchens, dedicated to hanging out laundry.

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Building Physics and its Performance in Modern Movement Architecture

24

THE science of Building Physics was developed in Germany from 1880–1940 but its performance in Modern Movement architecture is considered immature and in aspects problematic. Still, some international pioneers found theoretical and practical ways to catch the theme.

By Jos Tomlow

A famous architect reached such a level of enthusiasm (...) that he asserted: 'In the future, one will build in the far North exactly as along the Mediterranean Sea. In few years, his demand has been fulfilled; Architecture has suffered such a defeat, that she will recover only very slowly. Had this been just an aesthetic mistake, then it would probably not have been fatal to a similar degree. But Nature—in this case the climate—will not withhold its revenge, for the fact that she has been so badly ignored.'

Bruno Taut in 1936¹

BUILDING SCIENCE—*Bauphysik*, in German—is perhaps regarded as a neglected aspect of architectural historiography of the Modern Movement. The innovative side of early modern period architecture includes the design parts such as flat roofs, thin walls, glass curtain walls including shaded screens. To accomplish this new building, materials and systems had to be developed. Some technical questions regarding their application and overall performance are analyzed in this article.

Early Developments in Building Physics

Building Physics is a discipline of building technology which analyzes building materials and systems, specifically in regard to the research of transmission of heat, sound, humidity and air.

One of the key notions in the discipline of Building Physics is the analysis of heat transmission, since it is a quantitative criterion for building quality. The analysis and control of temperature in buildings is often referred to by the *k*-value on heat transmission, also known as *U*-value. The *k*-value is defined by: energy loss—in W/m^2K —of $1^\circ C$ (or $1^\circ K$ = Kelvin) through a $1 m^2$ wall or ceiling part during one hour. A low *k*-value implies that heat insulation properties are good and basically one should feel comfortable in the concerning room. When adequate air ventilation is provided, energy may be saved for heating. Empiric results on heat transmission were offered by Jean Baptiste Joseph Fourier and Jean Claude Eugène Péclet already in early 19th century in France. Technicians who worked at large energy plants sought ways to control heat loss of the machinery and of the structures involved. Consequently a group of industrialists took the initiative to research on new insulation materials, like such based on

cork. In 1918, the *Forschungsheim für Wärmewirtschaft* near Munich was established as a private research institution, by Prof. Oskar C.W.H. Knoblauch (1862–1946) and became regarded as a singular source for data in the analysis of heat transmission.

Interior air quality and study of degrees of proper air ventilation throughout a building is an important factor of Building Science. Typically interior public spaces such as assembly halls consume large quantities of fresh air in short time. Industrial hygienist Max von Pettenkofer discovered around 1850 in Munich that CO_2 (carbonic acid) is comprised of each individual's outward breath. Pettenkofer proved that the CO_2 quantity is a major factor that must be monitored and measured as part of the quality of used air.

Progressive political forces demanded increased social and medical conditions for those in working class and other social welfare programs. Cholera outbreaks (e.g. Berlin 1831/1832, 1,426 killed; Munich 1854, 3,000; Hamburg 1892, 8,605) and other epidemics which grew from unsanitized conditions where people concentrated (i.e. barracks, prisons, boarding schools), where answered by improvements in general hygienic standards. This discussion was subsequently integrated in the Building Physics approach, defining proper technical standards.

In Berlin, Hermann Rietschel (1847–1914) developed heating and ventilation systems commercially. His contribution to Building Physics is significant due to his scientific and experimental work as a professor on ventilation and heating (1885) at the *Königliche Technische Hochschule* in Berlin. Similarly Friedrich Wilhelm Hermann Fischer (1840–1915) taught courses on heating and ventilation technology at the *Technische Hochschule* in Hannover starting 1876.

In 1907, intellectuals from industry and business founded the *Deutscher Werkbund* e.V. organization with notable members like the architects Peter Behrens, Hermann Muthesius and *Bauhaus* founder Walter Gropius. They recommended industrial standardization throughout Germany as a mean to establish rational working methods combined with guidelines for achieving quality control.

A rather early step towards standardization was the founding in 1917 of the German Norm (DIN: *Deutsche*

Industrie Norm). Following a ten year period, 3,000 German Norms or DIN standards were issued. These technical guidelines were recommended by authorities that set forth regulations from traditional local building codes (*Bauordnungen*). They consisted of a variety of guidelines for light and moisture equipments as well as for construction systems in wood, brick and stone. Still, in practice the standards often were not held, due to risky innovations and simply bad work.

Many building fairs were established in order to disseminate information to the general public about the aim of standardization and to stimulate further research and participation of industry experts. This enabled architects and builders to network with the industry as well as universities and municipal authorities.

By contrast, the four first CIAM meetings (*Congrès Internationaux d'Architecture Moderne*) from 1928 till 1933, were not yet focused on technical themes and lacked understanding the urge for the discipline Building Science.

Building Science and the Modern Movement

It is presumed that a good part of Building Science was known in academic circles circa 1918. However, the question remains on how this knowledge was disseminated to professionals throughout the modern building practice. During the early part of the 20th century, Building Physics theory was not as compelling to architects as they were in academic circles, due to an abundant use of mathematics. While the basic principles of Building Physics had been presented in writings by authors such

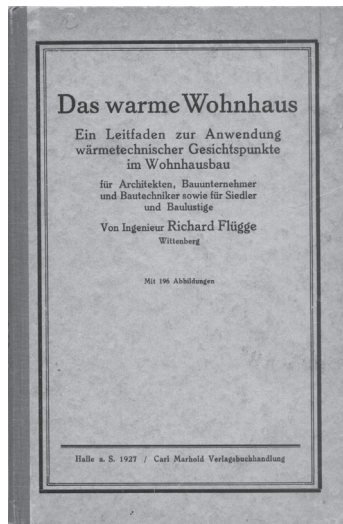


Figure 1. Cover of Flügge, R., *Das warme Wohnhaus - Ein Leitfaden zur Anwendung wärmetechnischer Gesichtspunkte im Wohnungsbau*. Halle, a.s. 1927.



Figure 2. Cover of Rasch, H. u. B., *Wie bauen?, Nr. 2: Materialien und Konstruktionen für industrielle Produktion*. Stuttgart, 1928.

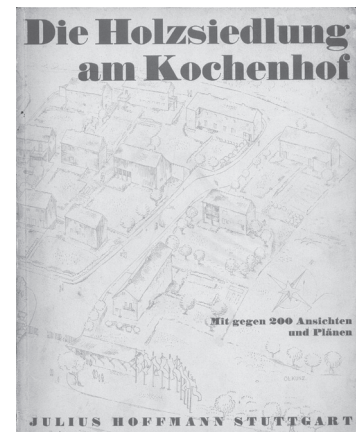


Figure 3. Cover of Schmitthenner, P., *Die Holzsziedlung am Kochenhof - Ausstellung Deutsches Holz für Hausbau und Wohnung*. Stuttgart, 1933, with: Reiher, H. *Wärme- und schalltechnische Untersuchungen*, pp. 6-8.



Figure 4. Cover of Limperg, K., *Thermotechnische dienst der warmtestichting. Naar warmer woningen*. Amsterdam, 1936.

Photos by HsZiGr / Jos Tomlow.

as Richard Flügge, Richard Schachner and Eduard Jobst Siedler, a systematic approach and design methodology based on Building Physics still had not been published, let alone been widely circulated around 1930.

Compared with the young *Bauhaus*, universities throughout Germany still followed the elitist tradition of scientific research for design development. Students were taught rather theoretical data knowledge than learning by practice. By comparison, the *Bauhaus* school, provided education and practical training based on new research of building material performance which had been made available through industrial applications. However, methodologically the *Bauhaus* school lacked much of the secure academic approach in its experiments. On the other hand very substantial was the work of Hannes Meyer on the scientific treatment of natural light, which became integrated into architectural design at the *Bauhaus* in Dessau.

Advertisement and product information contributes to Building Science

While hardly official books seem to exist for many aspects of new building materials and systems, information about historical developments can be traced through *grey literature*, like trade journals and advertisements during this period (roofing paper, insulation, steel windows and glass, stucco and tiles, including regulations for its installation). Eminently valuable are both books by the Rasch brothers entitled, *Wie bauen?* (How to build? 1927/1928) since these writings give specific information on the experimental houses of the *Werkbund Weissenhofsiedlung*, 1927 in Stuttgart or Konrad Wachsmann, *Holzhausbau – Technik und Gestaltung*, Berlin 1930 on wooden houses including photos of the building process.

The “Flat–Roof Discussion” and Conservative Criticism

The Modern Movement was often criticized due to observations which were primarily related to the discipline of Building Science. The argument which famously reoccurred was the design of the flat-roof, leading to publications by Walter Gropius and by contrast, on the conservative side by Paul Schultze-Naumburg, who strongly promoted pitched roofs.

Further public discussion aroused about the housing settlement designed by *Bauhaus* director Walter Gropius, the *Törten-Siedlung* with 256 houses, (1926–1929) in Dessau. Gropius presented passionate writings about design experimentation and supported a shift towards an industrialized building practice. In an editorial article in *Bauhütte* (Volume 12, 1929), a rebuttal of this project documented technical errors and problems associated with the *Törten-Siedlung* dwellings, including

photographs which profusely depicted cracks and evidence of moisture problems. Ironically, some information in the article was extracted from reports by the *Reichsforschungsgesellschaft für Wirtschaftlichkeit im Bau- und Wohnungswesen*, a state organization, who had supported the *Bauhaus* project and which provided a critical analysis of all technical related issues for future building projects. Problematic solutions in the construction of the *Törten-Siedlung* included roof water drainage through the use of concealed rain pipes and a profusion of thermal bridges at the steel windows. In this controversial debate often ideological arguments seemed to win over pragmatic reasoning.

Another relevant dispute between conservatives and progressives is related to the *Kochenhof*-Settlement. Initially proposed by Modern Movement architects Bodo Rasch and Richard Döcker a new settlement in Stuttgart should follow the *Weissenhof* settlement, but this time with wood housing. They and others, like Konrad Wachsmann, had already designed plans for such a settlement. After public discussion, shortly after the start of the Hitler dictatorship in 1933, conservative Paul Schmitthenner and city planner Heinz Wetzel managed to implement this project, with different designers. The *Kochenhof* settlement did illustrate one “progressive” feature which was not included in the design rules suggested for the *Weissenhof* settlement of 1927 by Mies van der Rohe. It was required that contributing architects for the design of *Kochenhof* had to provide structural solutions in wood that complied with defined standards in acoustic and thermal insulation as set out by a Stuttgart University laboratory (see references).

Modern Architects Promoting Building Science

Few key figures were influential in the introduction of Building Physics into Modern Movement architecture. Some architects like Szymon Syrkus from Poland, Johannes Bernardus van Loghem and Koen Limperg from Holland wrote on Building Physics and used it in their own work. Andreas Bugge from Norway defined his own Building Science research.

Szymon Syrkus was the Polish representative in CIAM. Assisted by his wife Helena, he was oriented towards a clear and functionalist interpretation of Building Physics, including tests on differentiated wall systems for steel frame skeletons for residential use. Syrkus presented an invited lecture on exterior walls at the fourth CIAM meeting in 1933 which was published in Holland (see references).

Some architects—plausibly called *Organic Moderns*—while inspired by innovation of the Modern Movement, also were determined to address design to the climate issue. They found a practical balance and understanding of building technology while continuing to design with a



Figure 5. *Haus Schminke* in Löbau, Saxony, 1929-1933, by **Hans Scharoun**, from north east. Photo by Friedegard Eichler HsZiGr.

fresh experimental approach. Both Hans Scharoun and Bruno Taut arguably bypassed many abstract positions of their colleagues presented during that time. Taut's publications show a mature ability to combine a huge building practice with creative writing on functional architecture. His book on the Japanese house deals with the impact of—a foreign—climate on building. To the problem of flat roofs, Bruno Taut had adopted a traditional detail, which avoided the typical hidden gutters behind an attica of the 'white cube' building type. His roofs, for example in the *Hufeisensiedlung* in Britz, Berlin, tend to slope in a pronounced small angle (approx. 2°) to one side, with the gutter cantilevering in front of one façade. The other sides show walls ending in an attic, crowned by exposed bricks. Thus a certain abstract overall shape remains.

Hans Scharoun, with his state of the art design of *Haus Schminke*, took into account the science of Building Physics and complied with the seasonal climate in Saxony through modern and innovative structural and functional design solutions.

Case study: Haus Schminke by Hans Scharoun (1929–1933)

The family house was designed and built 1930–1933 for the Anker noodle manufacturer Fritz Schminke, his wife Charlotte and their children, three girls and one boy. All aspects were discussed with the Schminkes in an open, friendly manner, often in letters. Photos by Alice Kerling, showing the Schminke house in 1933, are a beautiful documentation. The main builder was the local *Baumeister* Walter Vetter, who also contributed to the final design. The building was restored by *Werkstatt für Architektur und Denkmalpflege* Pitz & Hoh (1998–2000), with financial support by the *Wüstenrot Foundation*. Since 2009 the house, open for activities, has been operated by the charitable foundation *Stiftung Haus Schminke*, on initiative of the city of Löbau and Hess AG Form + Licht, a leading firm for urban light design.

As the following shows *Haus Schminke* was treated during the restoration with the goal of maximum repair of existing substances, taking a certain energy gap in winter into account.

In the Building Physics analysis of the recent restoration of *Haus Schminke*, Dr. Klaus Graupner states: "Like other buildings of the classic Modern Movement, the *Haus Schminke* has—from today's viewpoint—a deficient heat insulation and holds numerous technical details which are even worse in terms of building science (thermal bridges etc.)." However, surprisingly, Graupner continues: "the historic building *Haus Schminke* did function well from the building science aspect and no climate-conditioned severe damages could be traced."²

Description

Haus Schminke is designed along a navigational compass: one direction points in a long west–east direction with the kitchen at the west, the entrance with annex the children's space to the south, and the dining space to the north. The oblique lines of the building plan are parallel to the street, with an orientation of the winter garden to the south east. Both children bedrooms are oriented south, and the parents' bedroom is oriented to the south and east.

The garden offers a lively view from multiple locations throughout the house. For example, the dining table is connected to the garden through a hole in the wall filled with one big glass pane. The interior of the house seems extend into the garden by a continuous glass wall system including nine doors on three levels.

The living space itself is spacious enhanced by the non-rectangular plan and oblique shapes in a vertical direction, like the stairs in the hall and outside the winter garden. The metal stairs and balconies draw upon naval architecture, which became a common feature in the work of Hans Scharoun, who grew up in Bremerhaven. The house was equipped with operable windows which easily allow the possibility for cross ventilation, also in the vast cellar area.

Thus, by current standards today, the building is functionally well suited during mild weather months. However, given that there are huge glass areas throughout the walls, the question on how the building performs over the long cold season from October to March in the Saxony region arises. The heating system includes a sophisticated use of radiators which are equally spaced directly in front of a parapet wall and adjacent to sitting areas. It was laid out by engineer Alois Ranzi and its concept could be used entirely, including many parts like radiators, after the restoration, what is a very rare achievement.

The unique design for heating of the winter garden integrates unobstructed views between the house interior spaces and the exterior garden. Deepened recessed areas surrounded by plants and an indoor fish pond were combined with compact radiators and pipe coils. In other parts of the winter garden, convector elements appear beneath the floor. Through a flat metal grid, cold air travels from the high storey glass panes onto these floor areas and the hot pipe coils transform the air temperature into a more comfortable heat level. The shape of the interior border of this grid is curved, simulating the natural shapes of the adjacent garden and in the same time allowing person's entrance to clean their shoes from dust.

For colder times appropriate measures were found to create warm spaces within the house. Huge sliding doors were made partly in glass and could enclose the living

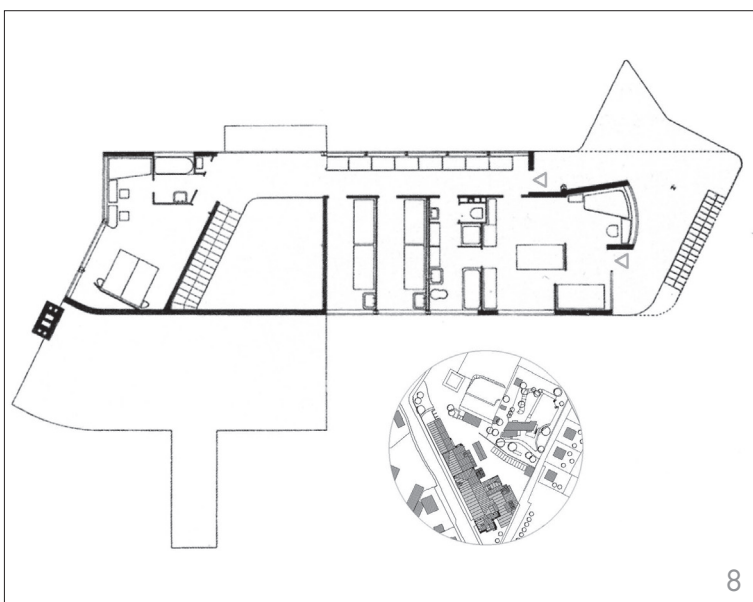
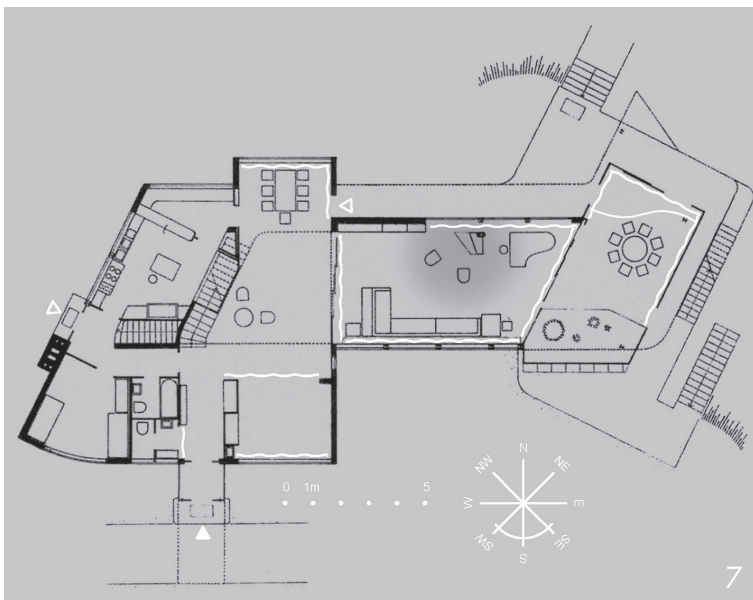
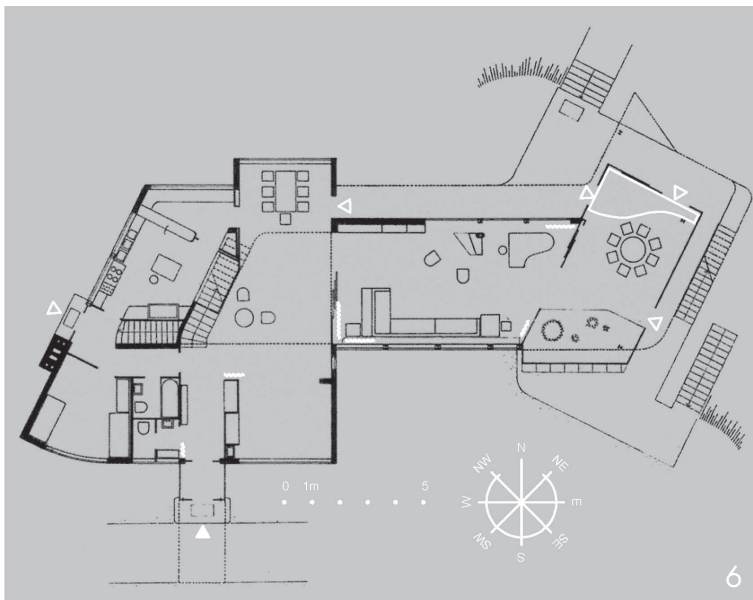


Figure 6. First floor plan of *Haus Schminke* during the warm season, with indication of exterior doors and curtains drawn back. Redrawn by Jan Fallgatter Hochschule Zittau/Görlitz. Original plan printed with kind permission by Löbau city authorities.

Figure 7. First floor plan of *Haus Schminke* during the cold season, showing central fireplace (dark spot) and main curtain locations as well as closed sliding doors. Redrawn by Jan Fallgatter, HsZiGr. Original plan printed with kind permission by Löbau city authorities.

Figure 8. Second floor plan of *Haus Schminke*. Inset: site plan of Schminke house and garden, adjacent to the Anker noodle firm Redrawn by Jan Fallgatter, HsZiGr. Inset plan by Martin Meßer, HsZiGr. Original plan printed with kind permission by Löbau city authorities.

Figure 9. *Haus Schminke*. Living room with view to winter garden through sliding doors showing curtains. In small distance in front of the piano was the fireplace; compare plan. Photo by Jens Freudenberg, HsZiGr.

Figure 10. *Haus Schminke*. Sliding doors between high hall and living space. Photo by Jens Freudenberg, HsZiGr.

Figure 11. *Haus Schminke*. Winter garden with removed grid element over under-floor heating Photo by Jens Freudenberg, HsZiGr.

room (approx. 60 m²) from the hallway space and from the winter garden. Thus it prevents heat from dissipating up into the second floor and away from the main living spaces on the main floor. An interesting parallel may be observed with the *Schröder House* by Gerrit Rietveld in Utrecht (Holland) from 1925, where sliding doors reduced draft effects in winter. Also the normally open stairway could be closed with window elements. By art critics this is mostly interpreted only in a functional sense instead of its effect on building physics. Interior wooden boards served in front of high placed windows as additional insulation in winter. Rietveld had prepared intelligent store places for these boards in summer time.

In order to enhance heat insulation additional devices were installed at glass areas in Schminke house. Exterior Venetian blinds with rolling shutters constructed of thin laths ensure that a standing air layer (3 cm) provides an insulation effect. On the interior, heavy drapes were perhaps even more effective in also providing insulation. These curtains in bias fabric (*Diagonalstoff*) were designed and woven by Otti Berger from Berlin with different colours.

Most surprisingly, however, in the original living room, a free standing small fireplace with slender chimney provided fast heat. It was turned away from the nearby piano, thus not exposing it to direct heat radiation. Thus a perfect concept for a cosy living space had been realised.

From a Building Physics point of view, the original design of *Haus Schminke* is sensible, that is, if one agrees with the comfort level accepted by its original inhabitants. In the 19th century, a building like *Haus Schminke* did not exist for various technical reasons. Its design grew out of concepts brought on by the discipline of Building Physics within the experimentation of the Modern Movement and with great care on how to orient a building in respect to sun and daylight.

Notes

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The Dutch author wishes to address words of gratitude to all those many friends and colleagues who contributed to this research.

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Modern and Green: Heritage, Energy, Economy

32



BUILT between 1963 and 1971, the Lignon satellite precinct in Geneva (Georges Addor, Dominique Julliard, Louis Payot, Jacques Bolliger) is regarded as the most spectacular housing development in post-war Switzerland.

For some, it is an energy-guzzling black hole; for others, an historical monument. Either way, the Lignon has been in the spotlight. Faced with new imperatives to reduce energy consumption, a pilot project in the area of “conservation and thermal improvement” of the Lignon façades has been carried out by the Laboratory for Techniques and Preservation of Modern Architecture at the *École Polytechnique Fédérale* of Lausanne. The aim of this study is to introduce measures that will allow us to conserve the outer skin of the existing façades, while respecting energy standards, thereby guaranteeing the consistent level of intervention, across all 100,000 square meters of curtain walling, that the site deserves.

By Franz Graf and Giulia Marino

Built Heritage and Energy Conservation

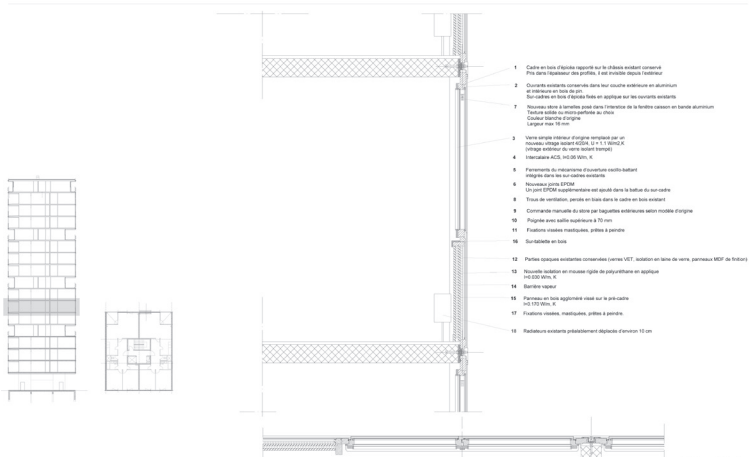
STATISTICS gathered by the Federal Bureau of Energy are revealing existing buildings account for some 40% of Switzerland’s total energy consumption. On this evidence, improvements on energy performance in the building sector have been seen as a serious priority. There has been much talk about how we can potentially reduce consumption and CO₂ emissions in buildings. In contrast, research has not yet come up with effective solutions to address the problem in relation to more “energy-hungry” sectors like transport. This explains the decidedly firm policies that exist in building rehabilitation, with ever more draconian rules, codes, and quality standards—such as the Minergie label—delivered by private organisations with the backing of major players in the building industry.

Under Switzerland’s “2000 Watts Society” strategy, annual energy consumption targets for buildings after rehabilitation have shifted rapidly, not to say dramatically—permissible heating requirements falling threefold between 1988 and 2009.¹ There have been significant impacts on existing buildings. Architecture of the second half of the 20th century, especially the one dating from the two decades that preceded the oil crises of the 1970s, has been a prime target. The specifics of construction (i.e. the material identity) of buildings of that era, widely regarded as leaky and poorly insulated, have made them especially vulnerable. Moreover, getting heritage recognition for these buildings has been no easy task; as a result, radical changes that show little regard for their architectural value and scant appreciation of the real potential afforded by adapting and altering them, have become all too common. Replacing envelopes, or adding external linings or wrapping them in insulation have been the order of the day. Contemporary heritage, far

from being treated as a ‘resource’, has fallen victim to an unmitigated preference for introducing drastic measures for thermal improvement, regardless of a site’s value as historical document and without adequate efforts to evaluate a building’s actual performance.

For structures protected under heritage law—and for these only—the *Recommendations on Improving Energy Consumption in Historic Monuments*, drawn up jointly by the Federal Commission on Monuments and the Federal Bureau of Energy in 2009, recognise that “heritage and energy are both legitimate issues; they share essentially the same concerns and seek the same outcomes: supporting sustainable development by preserving non-replaceable natural and cultural resources”.² This important statement suggests that we need to develop “options and means that allow us to balance, on a case by case basis, the often diverging public interests that apply in these two areas, and to find constructive ways of resolving them”.³ This calls for a synthetic analysis that transcends what are widely seen as irreconcilable points of view. The research conducted by the Laboratory for the Techniques and Preservation of Modern Architecture at the *École Polytechnique Fédérale* of Lausanne on the envelopes of the *Cité du Lignon* in Geneva, a 1960s-era housing complex of recognised heritage value, has set out to do precisely this.

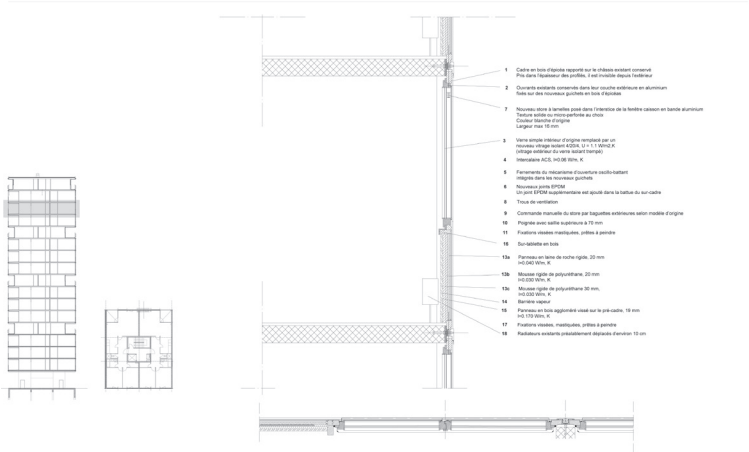
Over three years, from May 2008 to May 2011, the aim of the research was to define an *ad hoc* strategy for intervention, tailored to specific building needs, in order to see where improvements are needed and identify potential actions. The project on thermal improvements to curtain walling at the Lignon estate that came out of the research, was based on a scrupulous appraisal of these interests, facilitating the preservation of modern heritage by conserving existing material identity but also by saving energy. We show that by putting different measures in



VA - B01

Genève, mai 2010.

Immeuble type - n° 22 av. du Lignon
Coupe partielle 'C2' sur fenêtre courante
Echelle 1/20



VA - C01

Immeuble type - n° 22 av. du Lignon
Coupe partielle 'C2' sur fenêtre courante
Echelle 1:20



Genève, mai 2010

Immeuble type - n° 22 av. du Lignon
Coupe partielle 'C2' sur fenêtre courante
Echelle 1:20

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Phase C: TABLEAU DE SYNTHÈSE

EMAGNATIUM
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place, the conservation of existing envelopes can be assured in compliance with energy standards. By a method of evaluation that genuinely attempts to assess the issue using multiple criteria, based on exhaustive knowledge of the built object, its materiality and intrinsic characteristics, the study has yielded encouraging results that we hope will stimulate further efforts. We hope that, by focusing on a site as exceptional as the Lignon—which we will return to in more detail in the second part of this article—this kind of research may be of wider benefit to contemporary heritage and may go some way to addressing the negligence of recent years.

La Cité du Lignon, Geneva

Built between 1963 and 1971, the Cité du Lignon scheme was part of the Canton's strategy to tackle the population boom of the 1960s. It was an ambitious programme: a housing precinct—or “satellite city to use the vocabulary favoured at the time—for 10,000 people; 2,700 apartments (a disparate blend of residential forms, from subsidised rented units to condominium ownership), including extensive community facilities. The Geneva architecture firm led by Georges Addor was commissioned to design it.⁴

The Lignon was an exceptional scheme on several accounts: firstly, in terms of the layout. At the *Meyrin satellite city*⁵—the first of Switzerland's satellite housing estates—the same architects tested an alternative to the orthogonal grid-based urban plan with a discontinuous juxtaposition of the towers and ranges then favoured for new residential districts. At the Lignon, the principle is radically different: a free-standing block of 11 to 15 storeys forms a jagged, continuous line over one kilometre in length, defined by the perimeter and gradient of the plot; a pair of towers (of 26 and 30 floors respectively) at the far end of the plot conclude the arrangement and, together with community facilities occupying the central part of the site, completed the redevelopment of a site that would boast a building density of one square meter of floor space to one square meter of land.

As Eugène Beaudouin had suggested in 1955, the architects firmly rejected the idea of “splitting up unbuilt spaces with blocks facing one another, limiting outlook

and casting shadows over each other”.⁶ With a layout derived from a single continuous volume, George Addor in the 1960s allied himself with a strain of thought that openly rejected the strict application of Modernist doctrine. The project for the new town of Toulouse le Mirail, by Candilis, Josic and Woods, was certainly a point of reference, as shown by the earliest sketches for the Lignon, from 1962, where the “biological” model introduced by Alison and Peter Smithson (notably for the *Berlin Hauptstadt* of 1958) is plainly visible.⁷

The Rationalisation of Construction

As Werner Heerde, engineer with the firm of Weisz, in charge of the Lignon project, put it: “10,000 m³ of concrete + 10,000 m³ of concrete + 10,000 m³ of concrete doesn't just make 30,000 m³ of concrete: it also makes a unit that responds to new laws and demands a new approach”.⁸

As well as the site layout, which, as we have seen, broke with convention and underlined the scheme's architectural modernity, this pioneering project also possesses remarkable technical and constructive features. The notions of industrialized building and rationalized structural systems—capital themes during the post-war decades of the *Trente Glorieuses*—were in fact central to the realization. Faced with building on such a huge scale, the systems, components and details—everything from the structure of reinforced concrete leaves (the first use in Switzerland of the industrialised building process known as “tunnel formwork”⁹), to prefabricated curtain wall design—were devised so as to simplify the construction process.

If the load bearing frame cannot strictly be described as prefabricated (but rather as industrialised construction), the 125,000 square meters of façade curtain walling at the Cité du Lignon are perfectly in line with the principles of prefabrication, just as the architects claimed.¹⁰

They consist of large format panels (2.80 x 2.40 and 2.80 x 1.80 meters), one full storey high, comprising a pinewood interior frame and aluminium exterior panel. The infill comprises alternating fixed, opaque elements (tempered glass with interior insulation) and glazed, opening (box-type) panels, the wooden inner and metal outer frames being separated.¹¹

Figure 1. EPFL-ENAC-IA-TSAM, defining possible levels of intervention, OPTION B – REHABILITATION window panel cross section, 1:20.

Figure 2. EPFL-ENAC-IA-TSAM, defining possible levels of intervention, OPTION C – REFURBISHMENT window panel cross section, 1:20.

Figure 3. EPFL-ENAC-IA-TSAM, guidance table: cost estimates/levels of intervention/heating needs, June 2009.

Figure 4. Cité du Lignon, façade panel assembly. Photo by Ferronerie Genevoise SA. Figures 5, 6. Cité du Lignon. Photo by Claudio Merlini.

Figure 7. Prototype of the OPTION C – REFURBISHMENT, May 2010. Photo by Claudio Merlini.

On such a large urban canvas, a search for volumetric and plastic development of continuous façades plays a primary role. The smooth exterior surface, accentuated by aluminium joinery, is enhanced by the subtle brilliance of glazing and modulated by alternating transparent and opaque infill elements.¹²

Legal Protection and the Project Thermal Improvements to Exterior Envelopes

"Le Lignon is an event; it is a Modern-age *Place des Vosges* or *Place Vendôme*. [...] In the repertory of Modern urban planning, the Lignon is the chapter on housing, [...] a classic both of architecture and of urbanism"¹³, wrote Pierre-A. Emery in 1969. Presented as Switzerland's most important post-war housing scheme, the Lignon has been widely seen by critics as remarkable on several levels: town planning, architectural, technical and social. An exceptional scheme both in scale and originality, the *Cité du Lignon* has been widely discussed, in Switzerland and abroad, mostly in glowing terms. The object of a number of sociological studies since the day it opened, the Lignon, described as "a well-loved giant",¹⁴ by the local press, is indeed much appreciated by its residents, who value its living environment.

The Cantonal heritage authorities also acknowledge the merit of Addor and Julliard's creation, and the Lignon is safeguarded by a Conservation Plan approved in May 2009,¹⁵ the aim of which is to put in place "specific measures aimed at preserving the architectural unity of the buildings, the planning design and the landscape quality of exterior spaces".¹⁶

Although the Lignon's heritage value has been legally recognised, a total conservation strategy is needed. With no clear legal framework on the nature of interventions and faced with unauthorized replacement of features such as PVC windows in place of wood/metal frames, the Canton of Geneva and the consortium representing the building's owners commissioned the TSAM Laboratory in May 2008 to prepare an *Architectural and Energy Study of the Envelopes*.¹⁷

Different Levels of Intervention and Synthesis of the Issues Involved

Based on an exhaustive survey and diagnostic assessment of envelope constituents,¹⁸ and integrating an analysis of the thermal behaviour of a specimen block, four intervention options have been identified for standard Lignon façades. They have been ranked according to their impact on the material character of the building (i.e. conservation impact) and studied in terms of architectural and technical implications in the context of Conservation Plan stipulations (i.e. visual and

physic-chemical impact on the original façade fabric).

They range from simple maintenance (option A),¹⁹ to replacement of curtain walling with a replica (option D),²⁰ with intermediate solutions that include repair (option B)²¹ and refurbishment (option C).²²

To compare multiple criteria within these different options a guidance table was produced using three types of data: on the horizontal axis are descriptions of works to be carried out and life-cycle estimates. On the vertical axis, we show a summary assessment of costs²³ and energy needs (including an estimate of the heating cost savings).²⁴ The three variables, *heritage*, *economy* and *energy* are therefore easily visible at a glance. Looking at the table, which we see as a decision-making tool to assist building owners, one immediately rejects proposition D, façade replacement, for which the high overall cost cannot be justified in terms of any reduction in heating needs (which, at an annual consumption level of 207MJ/m², are above the legal limits prescribed under the new Swiss standard, SIA 380/1). Options A, B, and C are however retained: as well as ensuring acceptable conservation of the original façades, they offer a palette of possible interventions, all fully compatible with one another, from which owners can choose according to their financial means.

Trials and Specifications

During development of these options, an initial feasibility test showed clearly that standard solutions (off-the-shelf Modern replacement windows) should be rejected, none being suitable in the context. Instead, a bespoke solution, applied over 100,000 m² of façade and designed on an *ad hoc* basis, has to be preferred in order to meet the stipulations of the Conservation Plan. To this end, prototypes of the A, B and C options were planned for the complete exterior envelope of a specimen apartment, i.e. standard storey façades and a walkway front.²⁵ Designs for façade detailing and assembly, and final selection of materials in terms of installation and thermal properties (tested not only by simulation but under real conditions) were developed with a façades engineer and specialist contractor. From this, a set of standard methods to be used for each of the solutions, together with specifications giving detailed descriptions of the intervention and basic working guidelines, could be drawn up.

The Canton's heritage and energy authorities signed up in advance to these models and developed a simpli-

Figure 8. *Cité du Lignon*. Photo by Big, ca. 1975. (Archives Addor et Julliard, Geneva – AJ).

Figure 9. *Cité du Lignon*. Photo by Claudio Merlini.



fied consent procedure. This allowed timely planning of works—essential at this scale—according to the means of building owners, and guaranteed an overall consistency in the works carried out, preserving the architectural unity of the Lignon site and its 125,000 m² of façade envelopes.

Le Lignon: Historic Monument or Run-of-the-mill Product?

“Voracious”, “energy black-hole”, “ecological monster”, the Lignon precinct has been called all manner of things in recent years, and widely denounced as a disaster in terms of sustainable development. Radical renovation of the site to bring it into compliance with current standards has been dismissed as fanciful. After three years of research, our study has produced encouraging results. A 70% improvement in overall energy consumption in relation to annual figures of 475 MJ/m² (it is important to bear in mind that the building’s consumption is now on a par with average consumption across the Canton) is now possible. That allows us to get close to, if not to actually within, legal limits (as is possible with the most radical options now available, using ‘ultra high performance’ materials like vacuum insulation, aero gels, ‘Heat Mirror’ glazing, etc.).²⁶

We feel it is vital to emphasize that this can be done without circumventing current laws, even though the Lignon does enjoy a measure of protection in the form of a Conservation Plan. Off-setting energy consumption as demanded by local authorities can then become part of an energy saving strategy that, even though it may not always be enough to achieve statutory targets, nonetheless can yield excellent results broadly within legal limits.

The *Cité du Lignon* is exceptional in scale, originality and architectural quality. Its value as a monument is legally recognized through the adoption of a Conservation Plan for the site. It has merited nothing less than an exhaustive investigation, a pilot study spread over a fairly long period so that the most appropriate solutions for energy use mitigation can be established, fully respecting original material identity and taking proper account of the financial resources available to the various owners. Our study affords an opportunity to look more widely at large-scale contemporary heritage and its future. The convergence of heritage, economic constraints and energy issues call for a global strategy, for specially designed, forward-looking preventive conservation tools to enable consistent legal frameworks to be developed. In terms of method, but also in terms of results, our pilot study could be a valuable precedent, applicable to a broader corpus of similar objects, not least to more routine examples of post-war building stock.

Notes

1. Refer to Swiss standards SIA 380/1, 1988 and 2009 version, for this shift.
2. Office Fédéral de l’Energie/Commission Fédérale des Monuments Historiques, *Recommandations pour l’amélioration du bilan énergétique des monuments historiques*, Berne, July 2009.
3. Ibid.
4. Architects Georges Addor and Dominique Julliard, who ran the firm, assisted in the design and execution phases by architects Jacques Bolliger and Louis Payot, the principal collaborators, along with Werner Francesco, Willy Rutz, Werner Wetz and Slobodan Vasiljevic. Heinz Weisz was project civil engineer, with Werner Heerde, project supervisor and Claude Budry, assistant. The remarkable exterior landscaping was by Walter Brugger.
5. Georges Addor, Jacques Bolliger and Louis Payot, architects, 1958–1964.
6. Beaudoin, Eugène, “De la composition des plans-masse des groupes d’habitations”, *Forum*, n° 3, March 1955, 61–68: 68.
7. Interviews with assistants working in Addor’s office, architects Ping-An Chu (5 May 2011) and Werner Francesco (4 June 2011).
8. Heerde, Werner, “Industrialisation des grands ensembles locatifs”, in *Bulletin Technique de la Suisse Romande*, n° 4, 24 February 1968, 47–52: 50.
9. Used experimentally in France since the end of the 1950s, “tunnel formwork” was in a sense the logical descendant of table and shutter systems. It was based on using metal elements that allowed floors and thin walls to be cast simultaneously. Cf. Heerde, Werner, “Réduction important des délais d’exécution du gros œuvre dans le bâtiment—Utilisation d’un nouveau système de coffrage mis au point en France”, in *Bulletin Technique de la Suisse Romande*, n° 13, 24 June 1972, 221–224.
10. Development of the façade components was undertaken by the Geneva firms of Mangola SA (wood parts) and Ferronnerie genevoise SA (metal parts), working in close partnership. The innovative panel design and project scale attracted the support of AluSuisse, who followed developments closely and tested the panels’ bending resistance (under their own weight and under wind and suction effects), water tightness and stability in the wind tunnel at their Zurich research facility. Cf. Vögtlin, Rudolf, “Façades en bois et aluminium de la cité satellite ‘Le Lignon’ à Genève”, *Aluminium Suisse*, n° 17, March 1967, 59–65.
11. The fruitful lessons Addor’s practice learned during the *Cité Meyrin* commission some years before were repeated here with the same constructional system and materials. An unusual choice for a residential scheme (there are only a few examples internationally), their solution went further at *Cité du Lignon* in terms of façade continuity, identical on both the building’s orientations.
12. Vasiljevic, Dobrila and Slobodan, “Grille dimensionnelle binaire du Lignon”, *Werk*, n° 5, May 1969, 322.
13. Émery, Pierre A., “La Cité du Lignon, Genève”, *Architecture, Formes, Fonctions*, n° 15, 1969, 248–253: 248.
14. Bezaguet, Laurence, “Site hors norme aimé des siens, Le Lignon devient un Monument”, *Tribune de Genève*, 14 May 2009.
15. Canton de Genève, DCTI, Office du Patrimoine et des Sites, Service des Monuments et des Sites, *Le Lignon—Commune de Vernier, Plan de site n° 29430–540, rationale*, 5 August 2004. Decree, Conseil d’Etat 13 May 2009.
16. Ibid. Among the protection measures envisaged by the Cantonal law on protection of monuments and sites, the Plan de site is the one best suited to the Lignon. Owing to the scale and architectural character of the site, with its 7,000 inhabitants (and large number of owners) “rather than add the site to the National Inventory, a plan de site [Area Conservation Plan] in fact offers better scope for protecting the ensemble, given that buildings and landscape form an integrated whole”.
17. The study was commissioned by the DCTI/Office du patrimoine et des sites/Service des monuments et des sites, the DT/Service de

l'énergie-ScanE/ Energétique du bâtiment and the Comité Central du Lignon, representing the interests of owners. Partners working with the EPFL-ENAC-TSAM were the Groupe Energie de l'Université de Genève, and the firms of Sorane rationalisation énergétique SA and BCS-façades

18. The building, effectively a 15-storey row, was redrawn at 1:50 and 1:20, showing plans, sections and frontage elevations, with later modifications colour coded according to a dedicated scheme (yellow-demolitions, red-additions). The standard curtain wall façade was then illustrated at a scale of 1:5 in vertical and horizontal cross section, at three representative points: opening panel, opaque panel and loggia. Its components were illustrated diagrammatically, with full descriptions.
19. Option A: improving air-and water-tightness of the façade by replacing waterproof caulking around existing panels and windows as well as the incorporation of pressure joints (not present in the original).
20. Option D: exact replacement of curtain wall façade panels with replicas in timber and metal (full floor height), as well as loggia façades (joinery and glazing).
21. Option B: improvements to average thermal values by works to the inside face, notably fitting of insulation materials to the opaque units (spandrel panels and top panels), plus reglazing of standard plain interior window panels and loggias using secondary glazed panels fitted with a cover strips and modified wooden stops.
22. Option C: conservation (as in B) of the outer layer of the existing façade, and replacing the inner layer with new insulated glazing for opening lights and renewal of insulation (replaced with a more efficient insulating material) in opaque panels.
23. Costings for each option were produced in collaboration with specialist contractors. Four of the firms consulted estimated more economically from an architects' specification produced during the phase of definition of the nature of works. A total figure and an average ratio per m² for the cost of the various interventions features on the left-hand vertical axis. Site constraints were also costed out.
24. An assessment of thermal performance of the specimen block in its original state and simulations for the four options listed were made using EnerCad software. This software is recognised by the Federal Energy Bureau as a tool for calculating heat justification in buildings.
25. Envelopes at walkway level, as well as ground-floor entrance halls, were included in an addendum to the project on curtain walling. Carried out between May 2010 and May 2011, this last phase of study enabled a final calculation to be made of thermal performance and levels of consumption for a specimen building.
26. Using Superglass or similar glass products, annual heating consumption levels (97 MJ/m²/year) are below the legal limit set by Swiss standard SIA 380/1 ver. 2009 (102 MJ/m²/year). Cheap quality standard insulated glazing units deliver an overall value slightly above the SIA (111 MJ/m²/year). In an overall refurbishment context, using solar energy installations to cover 30% of hot water needs for a household would yield a weighted consumption of 208 MJ/m²/year, which is lower than the level needed to obtain the Minergie label (216 MJ/m²/year).

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Sustainability and Modernism: Design Research at Cornell NYC

40



SUSTAINABILITY is now replacing Modernism as the main discourse for socio-economic, technological, architectural and urban development. However, the architectural legacy of Modernism remains an inherent part of our built environment. While some tenets of Modernism align with principles of sustainable design, many are in conflict, thus creating both a tension and an opportunity for creative reinvention of existing buildings and neighborhoods. *Greening Manhattan's Modernist Legacy* was a seminar taught at Cornell University's school of architecture that investigated these questions. The seminar explored an analytical approach to retrofitting Modernbuildings that prioritized environmental responsibility while critically reinterpreting the Modern aesthetic.

By Ilana Judah and Daniel Kaplan

IT can be argued that many Modern buildings are incompatible with environmental values, and are unsustainable over the long term. This presents a quandary for both preservationists and architects who seek to improve the state of our planet, yet deeply value the contribution of the Modern legacy.

Despite this perception, the Modern Movement and the current imperative for sustainable design have numerous commonalities. Indeed, many of the values touted by sustainable design are fundamentally rooted in Modern ideals. Modernism sought to re-imagine social and organizational principles through a new vision for cities and buildings. The built environment was foreseen as a place that was efficient, egalitarian and healthy. Space was democratized, with access to light, air and nature albeit often through a controlled indoor climate. Architects such as Le Corbusier saw the importance of liberating cities from the pollution and disease of the Middle Ages and Industrial Revolution [figure 1]. Construction processes favored efficiency of materials and fabrication and shunned superfluous adornment.

Modernism was also the era of the renowned environmentalist and designer R. Buckminster Fuller, who was seemingly clairvoyant in his projections of population growth and planetary limitations. Eco-Utopias such as the Biosphere 2 Project by Space Biosphere Ventures, and Arcosanti by architect Paolo Soleri evolved from Fuller's science fiction-like warnings about the looming challenges to the human race [figure 2].

While many lessons have been learned from the great architects and designers of that period, the utopian promises of Modernism have been dispelled. Today, buildings consume 40 percent of energy in the United States, and upwards of 70 percent in high-density urban areas such as New York City¹. Those constructed after the World

War II are noted to be the highest consumers on average². Moreover, cities and suburbs developed during the post-war era have favored sprawl, decentralization, and the predominance of the automobile over all other forms of transportation. In addition to increased energy consumption, hermetically sealed buildings that rely almost exclusively on mechanical conditioning have in some instances resulted in problematic indoor air quality (sick building syndrome) and unreliable thermal comfort.

Global climate change, population growth, increasing urbanization, and augmented severity of drought and storms are all evidence that we are at the cusp of an environmental crisis. In this context, what then is the place and role of our Modern icons? Do they merit being demolished, are they merely vestiges of an optimistic yet wasteful era, or are there valuable lessons we can glean from their conception and construction? Most importantly, can we re-evaluate and reinvent them to be responsible citizens of a sustainable society?

These issues and questions spawned the development of a design seminar for the New York program at Cornell University's School of Architecture. Entitled *Greening Manhattan's Modernist Legacy*, the course sought to reveal the synergies between Sustainability and Modernism, and draw upon their incongruities to stimulate innovative design solutions.

The seminar was an introduction to students on the preservation of Modern buildings, as well an initiation into an environmentally integrated methodology when approaching an architectural problem. While not a comprehensive design studio, it encouraged students to develop an iterative design process informed by both quantitative and qualitative analysis, clear problem definition, creative resolution of the defined problem, followed by post-design testing and analysis.

Students were tasked with selecting and studying an existing Modern high-rise in New York City, and proposing a specific intervention to improve one aspect of the

< Figure 1. **Le Corbusier** sketch for La Ville Radieuse. Image from *Fondation Le Corbusier*, Paris.



Figure 2. **R. Buckminster Fuller**, Shoji Sadao Dome over Manhattan, ca. 1960. Silver gelatine print, 34.9 x 46.7 cm. Courtesy of The Estate of R. Buckminster Fuller.

Figure 3. Visibility and incident solar radiation analysis for the Seagram Building to determine potential retrofit strategies. **Yeung Shin**, architecture student at Cornell University. 2011. Courtesy of Cornell University.

Figure 4a. Jacob K. Javits Convention Center – Existing Building. **Pei Cobb Freed Architects**, 1986, New York, NY. Photo by FXFOWLE Architects.

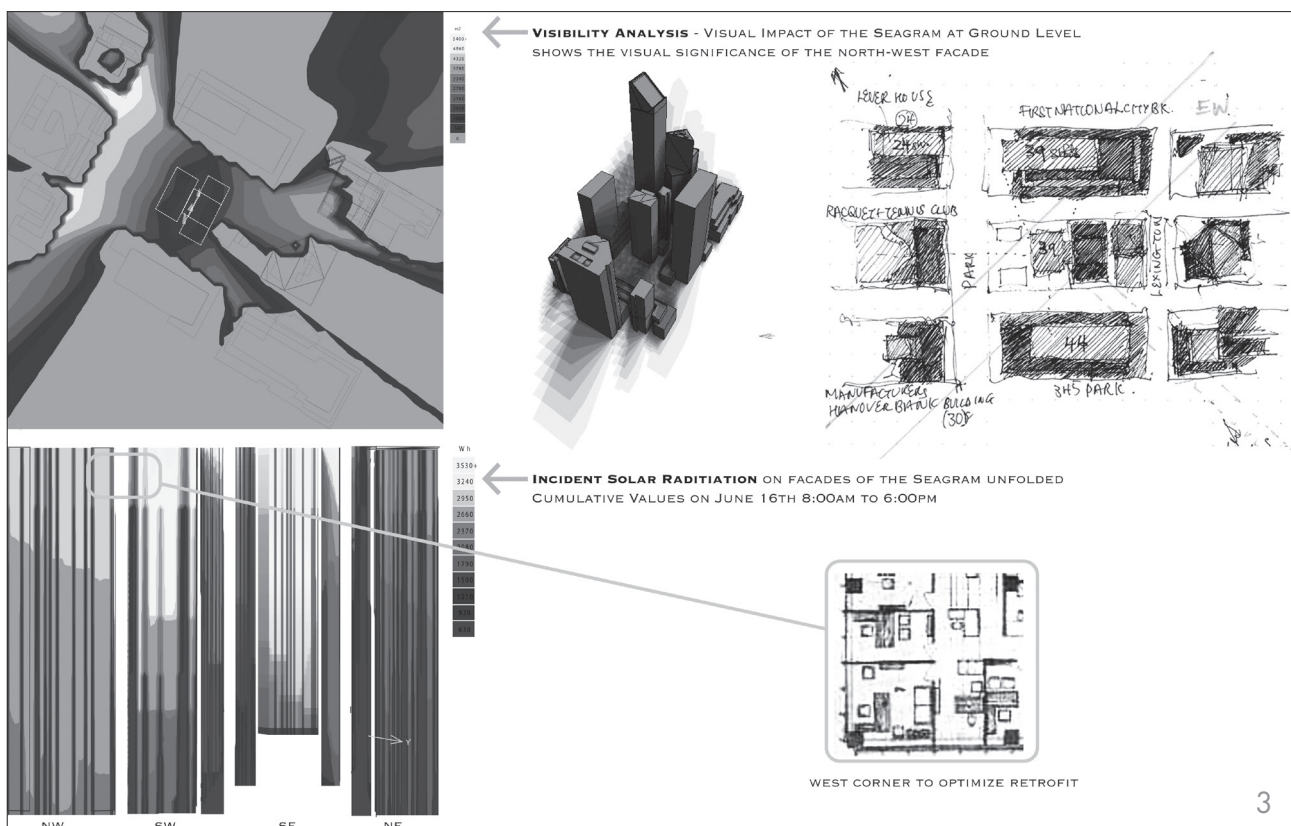
Figure 4b. Rendering of proposed renovation for the Jacob K. Javits Convention Center. FXFOWLE | **Epstein Architects**, 2010. Courtesy of FXFOWLE Architects.

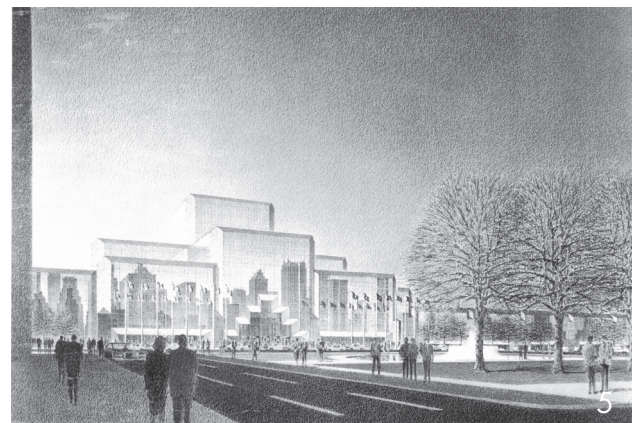
Figure 5. Rendering of proposed design for the Jacob K. Javits Convention Center. **Pei Cobb Freed Architects**, ca. 1980. Courtesy of FXFOWLE Architects.

building's environmental performance. Buildings selected were of significant renown, including the Ford Foundation (Roche Dinkeloo, 1967), the Seagram Building (Mies van der Rohe, 1958) [figure 3], One Liberty Plaza (Skidmore Owings & Merrill, 1973), the WR Grace Building (Skidmore Owings & Merrill, 1973), and the CBS Building (Eero Saarinen, 1965). Throughout the semester, critical thinking was emphasized with respect to establishing the correct balance between environmental performance and architectural integrity. A pure restoration approach was not required, but a clear argument and justification of the proposed intervention on the existing building was essential.

While the trend towards retrofitting existing buildings can help support the mandate of preservationists, there are legitimate concerns about the manner in which a retrofit can respect the integrity of the original architecture, while simultaneously improving performance. This is particularly challenging in Modern buildings, which, for the first time, introduced vast expanses of glazing and non-thermally broken curtain walls.

The seminar introduced the principles of Modern preservation to students, particularly how the approach differs somewhat from the preservation of buildings of earlier eras. Here, conserving the vision of the original architect becomes significant in addition to the preser-





vation of the structure itself.³ Advancements in building materials and technologies since the date of the original construction also reveal a complex dilemma involving authenticity, intent and performance. Many Modern buildings incorporated technologies that were early in their development, such as curtain wall systems, which have now seen significant performance and aesthetic improvements. Is it more justifiable to replace a system in-kind, or more appropriate to upgrade as per the design intent of the architect?

Students had the opportunity to explore several project case studies, including a visit to the Jacob K. Javits Convention Center, designed by Pei Cobb Freed Architects and currently being renovated by FXFOWLE in collaboration with Epstein [figure 4]. Though originally built in the 1980s and not purely Modern, the process by which the architects of the renovation replaced the original curtain wall is a pertinent example of an approach to retrofitting Modern buildings. As revealed in the original renderings, Pei Cobb Freed's vision for the space frame structure was

one of greater transparency and visual connection of the interior to the surrounding city [figure 5]. However, due to the energy code requirements and available technologies at the time, the glass selected was much more opaque in appearance in order to meet the necessary shading coefficients. FXFOWLE determined that adhering to the original idea of the project as a 'Crystal Palace' was more appropriate and would better add to the value of the building, both architecturally and within the greater urban context.

Other projects presented demonstrated instances where Modern buildings were designed with careful consideration of environmental factors, but where subsequent alterations had obfuscated these elements. Atelier Ten presented their study for the restoration of Crown Hall at the Illinois Institute of Technology as an example [figure 6]. Their analysis revealed that Mies van der Rohe

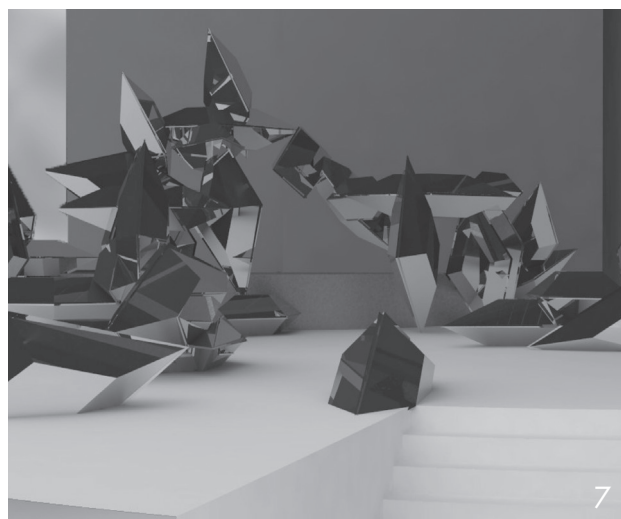
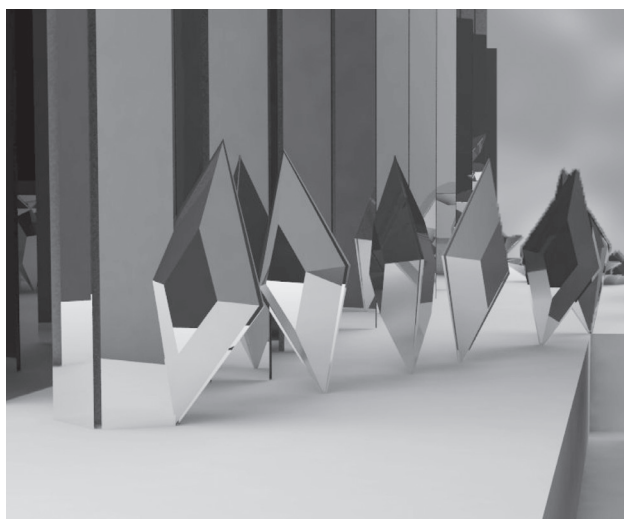
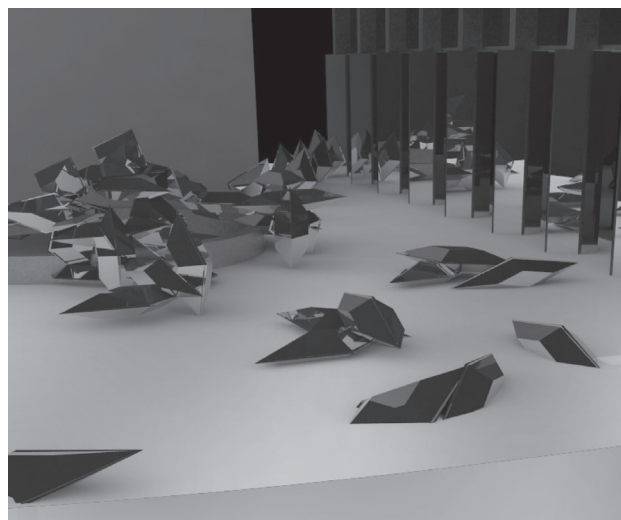
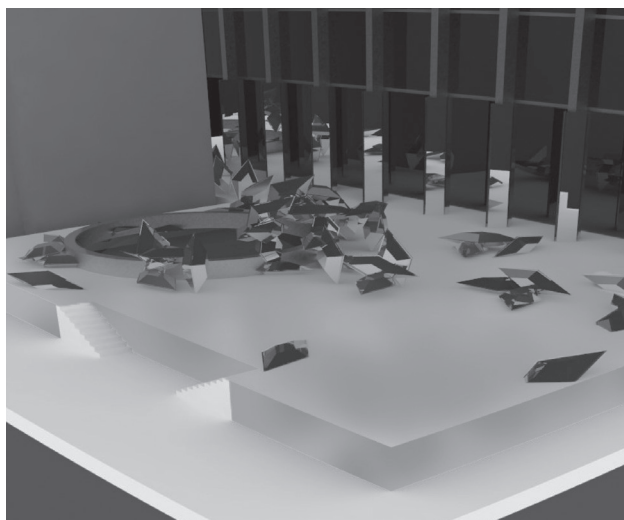
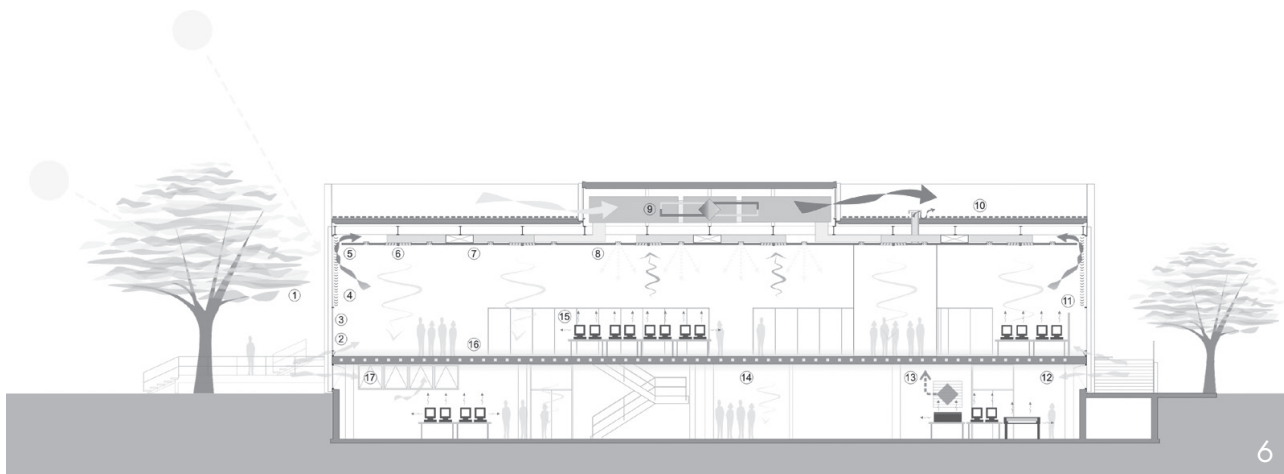


Figure 6. Crown Hall Environmental Section, Proposed Improvement Measures. **Atelier Ten**, 2004.

Figure 7. Design for improving thermal comfort on the exterior plaza at One Chase Manhattan Bank, New York City. Goal was to expand daylight and thermal comfort to permit lunchtime use of the plaza during the Spring. **Lauren Jordan**, architecture student at Cornell University, 2011. Courtesy of Cornell University.

Figure 8. Daylighting studies for One Liberty Plaza using Radiance software. **Daniel Marino**, architecture student at Cornell University, 2011. Courtesy of Cornell University.

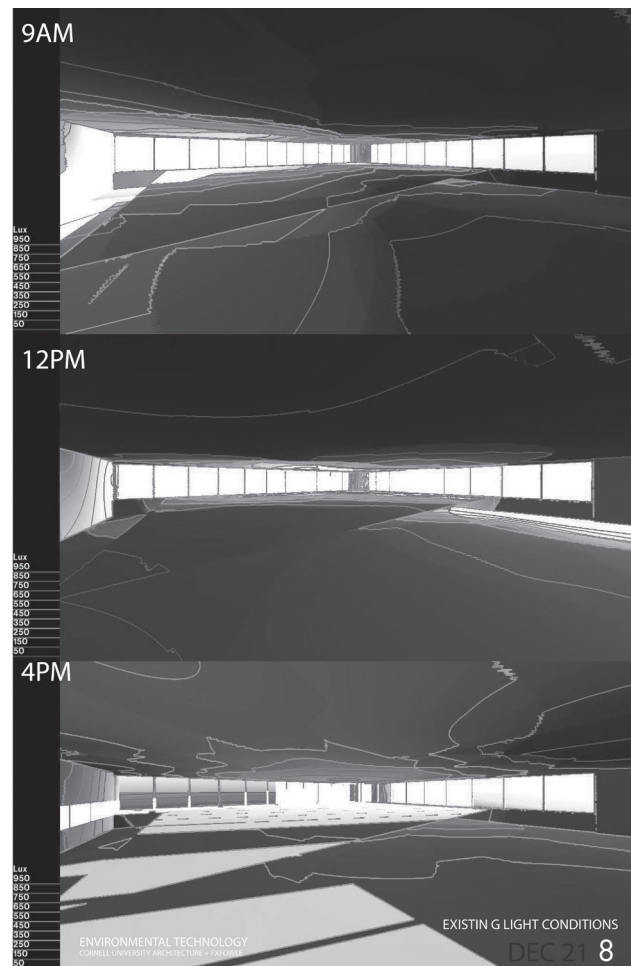
incorporated several passive strategies into the design of the school of architecture. For example, the original site plan incorporated a significant density of trees along the south façade, providing shading and reducing solar gain. Unfortunately, many of the trees were removed over the decades. Operable hopper windows at the base of the main floor and roof vents allowed for natural ventilation, and a careful distribution of clear and frosted glazing coupled with operable blinds helped harvest daylight and control glare. Over time, many of these elements stopped functioning as originally intended due to increased student population and the advent of computers in the design studio.

Investigation of these case studies informed students of the issues inherent to retrofitting Modern buildings, and helped guide them in the development of their respective projects. They were first tasked with visiting their project site and creating a qualitative study that included environmental, architectural and urbanistic observations. This was followed by an analysis of the original building's history, program and parti, as well as an exploration of building tectonics.

Once this initial study was complete, students then focused on a specific area of interest, and developed an appropriate problem statement that set both environmental and architectural objectives. Many of the students chose to look at the question of harvesting daylight and controlling glare, while others studied reducing mechanical heating and cooling loads through passive design strategies. One student chose to study how to improve thermal comfort on the exterior plaza of One Chase Manhattan Bank with the objective of transforming it from a minimally occupied podium to an active public space [figure 7].

Building performance modeling was a fundamental component of the retrofit studies. Using software such as Eco-Tect and Radiance [figure 8], students created a baseline model of their existing building, which included the surrounding context, local climate data, material properties and programmatic assumptions. Once baseline performance had been determined and understood in relation to their qualitative observations, students set specific performance goals. For example, in the case of the Ford Foundation, the student's goal was to increase the number of hours of passive thermal comfort in the atrium to reduce dependence on artificial heating and cooling [figure 9].

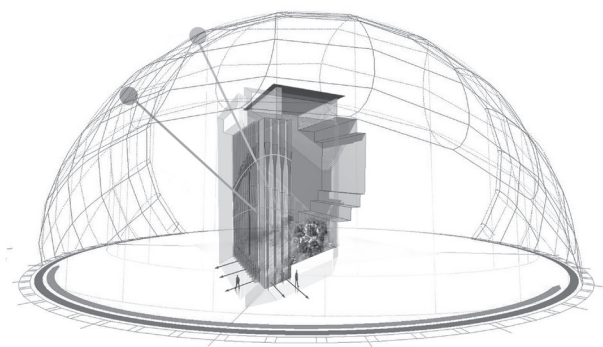
Multiple design solutions were tested against the proposed performance and architectural goals. Students were encouraged to use performance-modeling tools in conjunction with other media to understand the differences in information revealed by each. Full-scale mock-ups



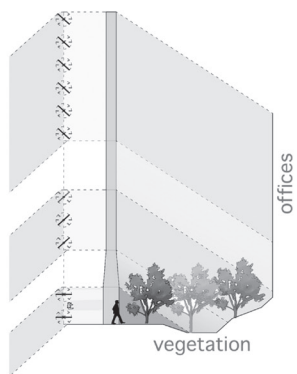
and dynamic daylight simulations [figure 10] exposed behavior that was not directly apparent from the numerical outputs of computer simulations. Students were also encouraged to oscillate their analysis between macro scale urban context to the micro scale of the curtain wall detail to hone their understanding of performance and preservation issues.

The students developed some very innovative solutions that yielded significant environmental benefits. In the case of the Ford Foundation proposal, a combination of re-glazing, shading and zoning reduced the number of hours the atrium required mechanical conditioning by almost 50%. In the WR Grace Building study, the student's proposed glazing retrofit yielded daylighting increases on a typical office floor from very low levels (under 100 lux) to a usable range (175–550 lux) fifteen feet from the perimeter [figure 11].

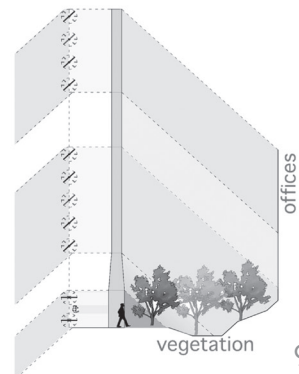
The students took various positions towards preservation of the building's original architecture. In cases such as the Seagram Building there was a clear intent to keep the original façade intact and intervene solely from the interior. In other instances such as the WR Grace Building there was a desire to conserve the original parti while



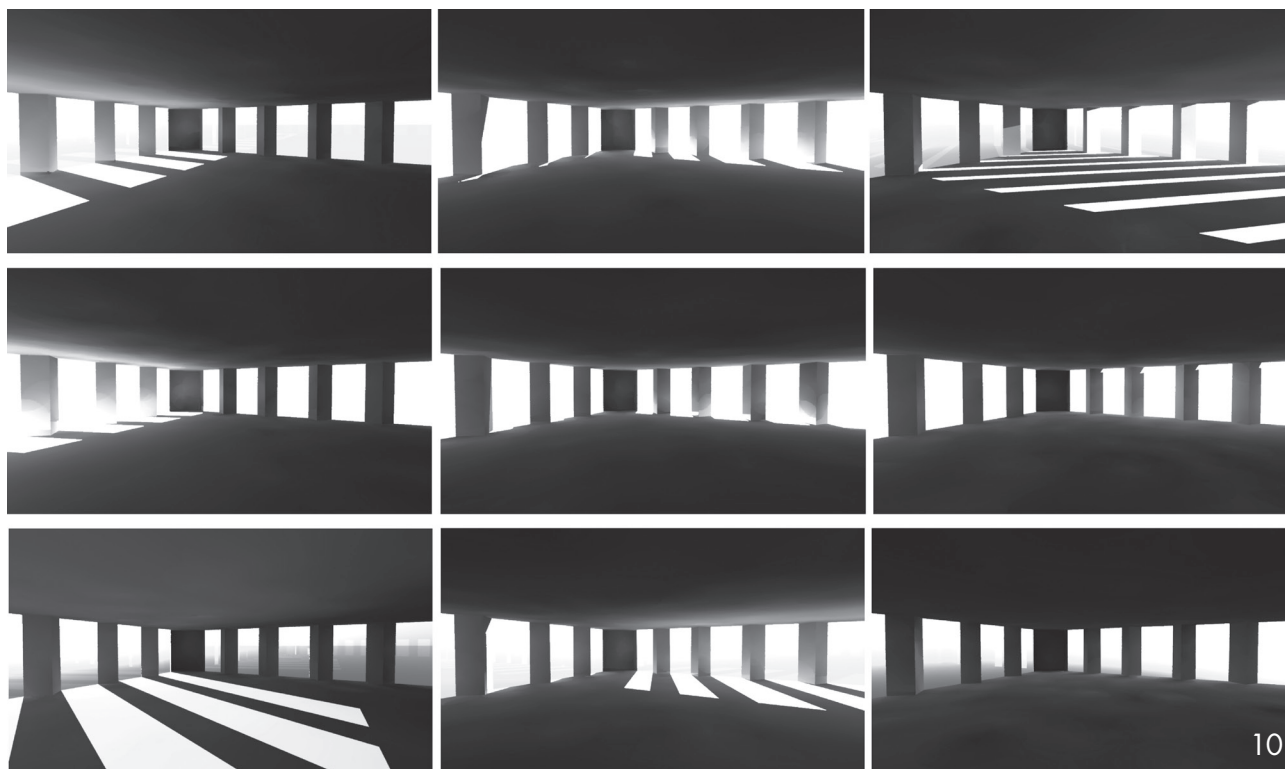
Summer condition



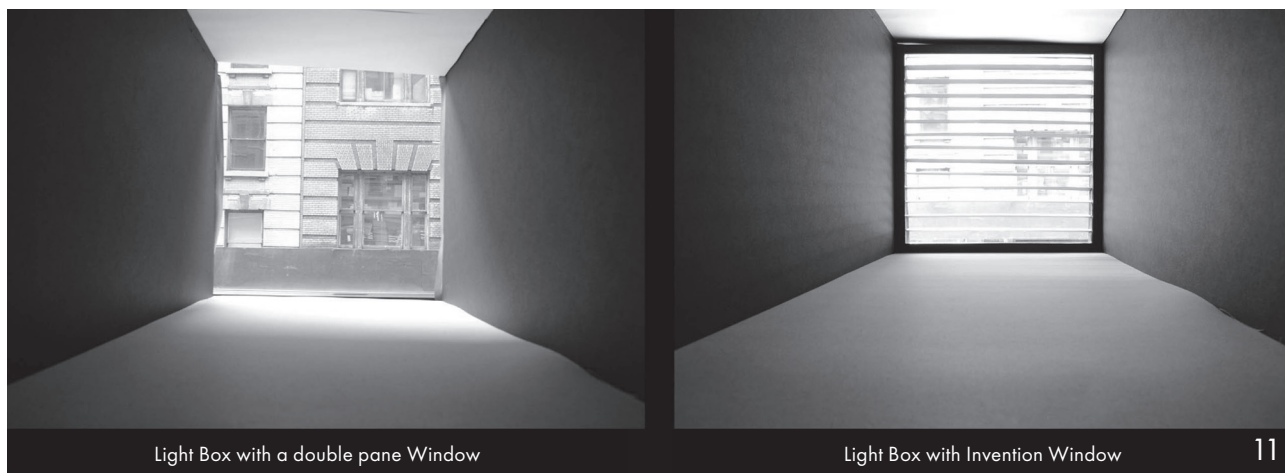
Winter condition



9



10



Light Box with a double pane Window

Light Box with Invention Window

11

at the same time reinvent façade components to improve performance. A third approach, seen in the UN Plaza buildings [figure 12] saw a reinterpretation of the building where the proposed intervention expressed itself as a clear and distinct overlay.

The design solutions developed by the students demonstrate a variety of objectives and approaches, all of which point to the delicate relationship between respecting the architectural and cultural value of a Modernist icon and responding to increasingly urgent environmental imperatives. In attempting to reconcile them, returning to the underlying ideals of Modernism provides a mean-

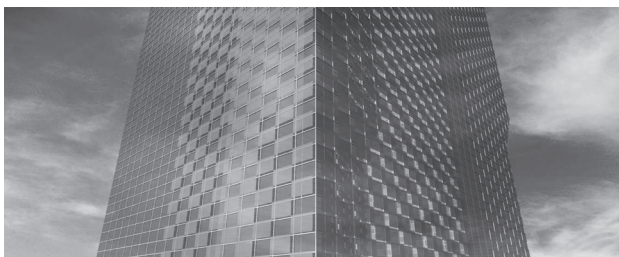
ingful framework that goes beyond the question of preserving aesthetics to one that revisits fundamental values. Ultimately, a successful retrofit intervention not only addresses both issues, but goes beyond to provide a critical reinterpretation of the Modernism within a contemporary context.

Notes

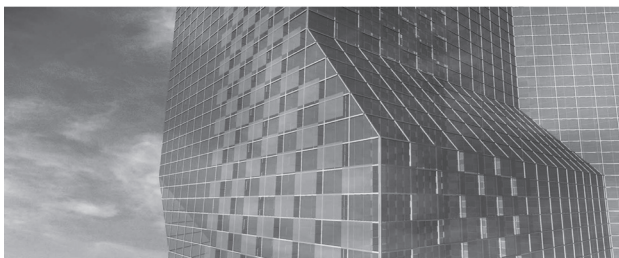
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South-West Corner Render – Option 1



North-East Corner Render – Option 1

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Figure 9. Study for increasing passive comfort hours in the atrium of the Ford Foundation, New York City. Goal was to eliminate need for artificial conditioning in the atrium using multiple strategies such as dynamic shading. **Nicolas Martin**, architecture student at Cornell University. 2011. Courtesy of Cornell University.

Figure 10. Dynamic daylight simulations of a typical floor of the CBS Building, New York City. Goal was to achieve even daylight and minimize glare on a typical office floor. **David Temidara**, architecture student at Cornell University. 2011. Courtesy of Cornell University.

Figure 11. Mock-up and daylight model of proposed façade component for the WR Grace Building. **Alicia Trujillo**, architecture student at Cornell University. 2011. Goal was to maximize the usable daylight on a typical office floor and reduce reflection and glare onto the park. Courtesy of Cornell University.

Figure 12. Study for incorporating operable windows at One and Two UN Plaza, New York City. Goal was to minimize artificial cooling during the spring and autumn seasons through the use of natural ventilation. **Vincent Lim**, architecture student at Cornell University. 2011. Courtesy of Cornell University.

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The Tugendhat House: Between Craftmanship and Technological Innovation. Preservation as Sustainable Building Policy*

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THE architecture of the Modern Movement is today often seen as synonymous with technical innovation and experimental techniques. This view is supported by the Dessau *Bauhaus* itself and its programmatic “break” with tradition.¹ Technical inadequacies and shortcomings, particularly from the perspective of today’s energy standards, serve as an argument to formulate criteria specific for preserving the architecture of the Modern Movement, different from “normal” and more generally accepted preservation principles.²

Are the materials and techniques of modern architecture really as innovative as they are alleged? The Tugendhat House in Brno, listed as an UNESCO World Heritage since 2001, and other structures of classical modernism, as for example, the *Bauhaus* in Dessau (1925–26) and the pavilions of the Brno fair grounds (1926–28), may serve as evidence that not everything was technical innovation, but that rather the traditional craft techniques in the Modern Movement have played a major role.³ Modern preservation is not limited to the presentation of the artistic idea, but sees the monument as a comprehensive resource of cultural activities and their material expression. Generally, the preservation of monuments can be seen as a paradigmatic form of a sustainable building policy.

By Ivo Hammer

Bauhaus between Craft and Industry

IN 1922, Walter Gropius summarized the functionalist concept of the *Bauhaus* with the words “best economy, best technology, best form”.⁴ As early as 1911 he postulated the end of craftsmanship in construction: “Instead of individual craft work industrial organization and the division of labor has arrived.”⁵ He idealized the machine production “as a tool to take away from mankind heavy physical work and to serve the power of his hand in order to give shape to his creative impulses.”⁶ But the saving measures and the utilitarian ways of thinking associated with the ‘normalization’ and standardization typing—in December 1917, the Standards Committee of German Industry was established—was an affront to many ‘*Bauhauslers*’.⁷ The contradiction between the ‘best economy’ and ‘best shape’, between exchange value and use value inherent to the prevailing economic system, led to technical solutions in construction that were in fact not ‘timeless’ nor always ‘permanent’. In 1929, Sigfried Giedion, the first Secretary General of the CIAM, formulated his polemic against the traditional “house with thick walls,” against the “house for eternity”.⁸ His argument sounds more like a confirmation of the intended transience of goods under capitalist conditions than a plea for the “best economy”.⁹ Gropius’ utopia concerning the amalgamation of economic efficiency and technical and aesthetic quality can not be achieved under the prevailing socio-economic conditions.

The Tugendhat House: Innovation and Tradition of Craftsmanship

The Tugendhat Villa in Brno, built 1928–30, about the same time as the famous Barcelona Pavilion of 1929, which survives only as a copy from 1986, is a major work of Ludwig Mies van der Rohe [figures 1, 2]. In 2001 it was listed by UNESCO as a World Heritage site and was identified as “an outstanding example of the international style in the Modern Movement in architecture as it developed in Europe in the 1920s.”¹⁰ Its particular value, the World Heritage listing reasoned, is in the “application of innovative spatial and aesthetic concepts that aim to satisfy new lifestyle needs by taking advantage of the opportunities afforded by modern industrial production.”

The Tugendhat House is known to be the first detached residence in the history of architecture to have a support structure that consists of a steel skeleton making an open floor plan possible [figure 6]. Steel-frame structures in itself were not new and were introduced already in the late 19th century in larger commercial and industrial buildings and in 1927 Ludwig Mies van der Rohe himself had already built his apartment block in the Stuttgart *Weißenhofsiedlung* as a prototype with a steel structure. This design was associated with high material costs and high planning effort but it certainly contributed to a speeding up of the construction process itself. Had the frame been made of reinforced concrete, which was preferred, for example, by Le Corbusier, thin columns would not have been possible.¹¹ In the interior the shiny chromed brass cladding plates on the supports create a “dematerialization effect that negates its static function as much as possible.”¹²

And yet, despite all fabricated perfection, the traces of

< Figure 6. Tugendhat House. Steel frame seen during construction. Photo by Fritz Tugendhat, 1929.



Figure 1. Tugendhat House, Brno, 1928–30 by **Ludwig Mies van der Rohe** and **Lilly Reich**. View from the south with the garden. The lower portion of the house is covered with vegetation. Photo by Fritz Tugendhat, circa 1935. (Repro: Dieter Reifahrt 2008).

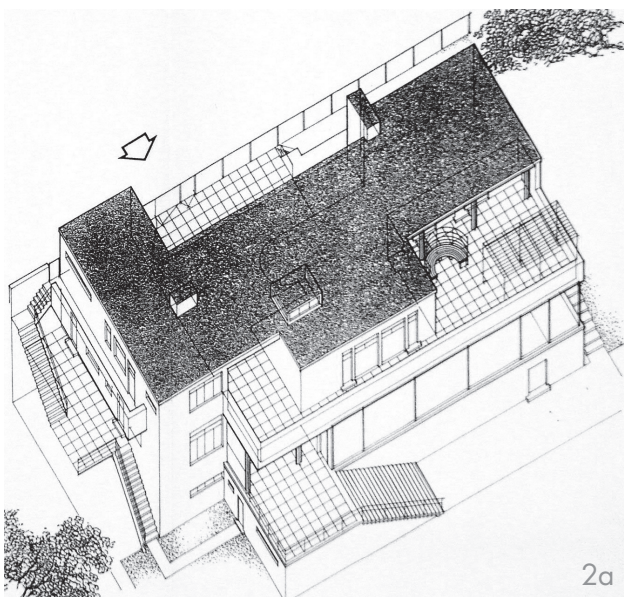


Figure 2a. Tugendhat House, Brno, 1928–30 by **Ludwig Mies van der Rohe** and **Lilly Reich**. Axonometric projection from 1982 (ex: architectural history study Karel Ksandr and team, 2001, digitalized 2003).

Figure 2b. Tugendhat House, Brno, 1928–30 by **Ludwig Mies van der Rohe** and **Lilly Reich**. First and second floor plans, prepared for the scientific conservation investigation of 2005. Courtesy of OMNIA projekt.

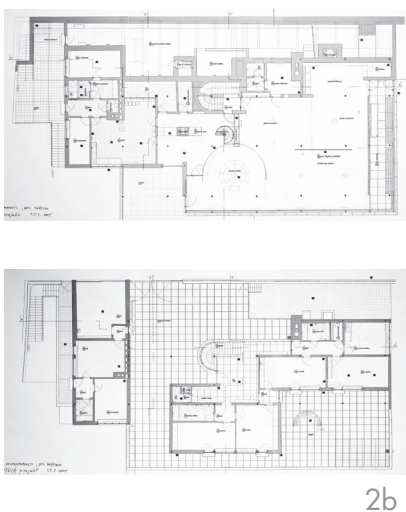


Figure 4. Fairgrounds, Pavilion of Arts and Crafts School in Prague by **Pavel Janák** (1927–28). South wall, detail, fragment of the original façade plaster, which was smoothed out with a wooden board, and covered with yellowish lime wash. Photo by HAWK Hildesheim 2005.

Figure 5. Tugendhat House, Brno, 1928–30, showing the semi-circular dining area with walls covered with a veneer of Makassar ebony and the storage shelf of greenish Verde Tinos marble. The cross-shaped steel leg of the round table, with chrome-plated and polished cladding of brass, is fixed in the concrete screed, the Xylolith floor is covered with whitish linoleum, the buffet also veneered with Makassar ebony. The Brno chairs in chrome plated tube steel, are upholstered with whitish vellum upholstery. Photo by Fritz Tugendhat, 1931.



the craftsmanship and its textures are visible in all parts. This includes those materials and surfaces that give the appearance of a machine aesthetic, a “*Mechanofaktur*”,¹³ such as the polished plate glass, in the tradition of the *Bauhaus* seen by art critics as the epitome of the ideal of industrially produced surface with no traces of handwork (traces which I may call with the *Bauhaus* term: *facture*).¹⁴ The large, almost 15 square meters, partially retractable glass walls of the façade, which are now destroyed, had—as a photo of 1972 shows—a hardly visible ripple, made apparent in this oblique view by the slightly vibrant effects of the landscape [figure 7]. The rounded cladding of the pillars of the interior shows—despite the industrial production of the brass plates and its chrome plating—an irregularity, which is probably due to the bending operation, the mounting and the mirror finish, creating a lively mirror effect [figure 8]. The metal parts of the façade were painted with a complex multi-layer oil technique in a blue-gray tint, which comes near to the hue of the oxidized lead shielding the base of the window frame. The final clear coating of this blue-gray paint (probably consisting of cellulose acetate) was unusual and certainly not technically necessary. It reinforces the impression of shiny metal.¹⁵ Due to the use of traditional application methods of the metal paint and its resulting effect, this gloss was certainly not completely uniform. The textural qualities that can be experienced directly by touching these surfaces can hardly—if at all—be represented photographically. The manufacture of wall panels and doors veneered with fine woods is difficult to capture photographically, not only because the original lacquer polish has been sanded off in 1982–85 and the pattern of the wood grain is so dominant, but also because the craft work is so highly precise and well-fitting. We can perceive visually some of the ripple of the surface generated by the material and the manufacturing process only when using extreme raking light, whereas the sensitive finger tip can easily detect the surface texture when touching it [figures 9, 10].¹⁶ The same applies to the stone surfaces, the travertine and the onyx marble wall [figure 11].

The steel skeleton—a technological innovation for a detached residential house—and the concrete floors in conjunction with the traditional infill of bricks (and the Torfoleum insulation)—coated with highly hydraulic lime-cement plaster have its drawback due to the different coefficients of thermal expansion and contraction of the materials used. The crack between the ceiling structure and the façade did—according to the evidence of the photos from 1931—appear soon after completion and was repaired—in vain—immediately afterwards with lime paint using the original technique [figure 12].¹⁷

Key parts of the Tugendhat House are executed in tra-

ditional craft techniques, albeit at a particularly high level of quality:

- The smoothly polished, but not glossy pieces of travertine: baseboards, the threads for the garden stairs and the coping of the parapet of the upper terrace, and, in the interior, the floor and the wall shelves in the foyer, the spiral staircase and the floor, shelves and the basin of the conservatory.¹⁸
- In the very flat ground and polished wall made from five plates of onyx marble (consisting of aragonite), the slight unevenness is hardly noticeable even with tactile examination, but the small irregularities can be perceived on the conservatory mirrored on the surface of the onyx wall [figure 11].
- The wall panels of the foyer, the doors and the wall cabinets in the master bedroom are all veneered with rosewood, while the inside of the doors of the children’s room and the nurses’ room are veneered with Zebrano, and the semicircular wall of the dining area and the library with Makassar ebony. These exotic veneers were also used for the exposed surfaces of the pieces of furniture but the interior is veneered in maple. The surfaces of the veneers were lacquered and polished. The interior of the furniture was coated with a rubber gum (acacia or cherry) and (probably originally) waterproofed with nitro-cellulose lacquer.¹⁹ According to recent analyses on original furniture in the possession of the Tugendhat family the exterior surface of the veneers had a finish consisting of nitro-cellulose.²⁰ However, the exterior lacquer has mainly been renewed in 1985.
- The multi-layered coating of metal parts, such as window frames, doors, railings and fences is industrial oil paint, blue-gray on the exterior and cream white interior on the inside.
- The multilayered coating of the interior wooden elements (all doors and frames, as far as they are not veneered, closets in the pantry, window shelves, boxes for the blinds, etc.), at least in part, are as carefully crafted with a lacquer with glossy surface, also cream white. This surface treatment is reflected in some furniture, as e.g. the vitrine at the north side and the bank at the south side of the onyx wall.

The wall and ceiling surfaces are executed with a quite exceptional precision taking advantage of traditional techniques. The ceiling on the interior is suspended, which was common since the introduction of concrete ceilings at the end of the 19th century. A traditional support of the plaster consisting of (prefabricated) mats of reeds and of Rabitz netting is suspended from the concrete floor with rebars at a distance of about 40 cm. The plaster itself is comprised of lime and some gypsum. Due to the sus-

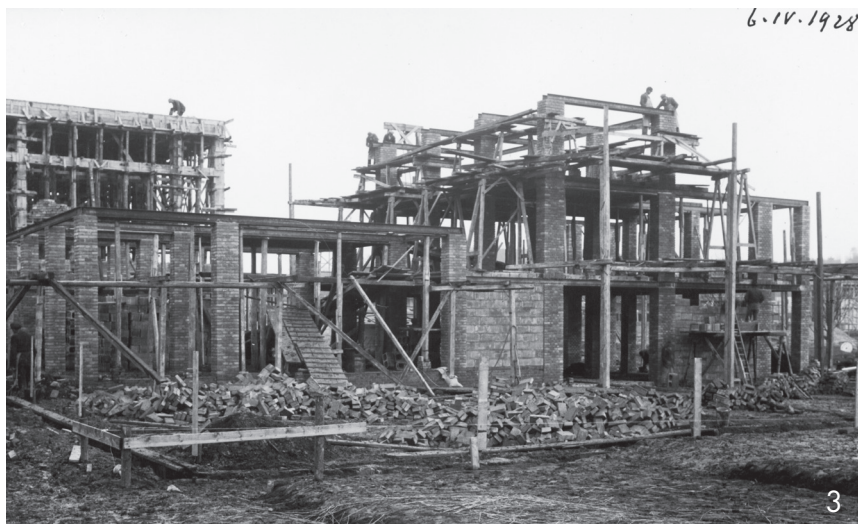


Figure 3. Fairgrounds, Pavilion of Arts and Crafts School in Prague by **Pavel Janák** during construction (1927–28). Brick-clad concrete base, hollow block brick wall, wood chip board, steel girders. Photo by the National Technical Museum in Prague.

Figure 7. Tugendhat House. The main living room when in use as an orthopedic therapy room for the children's hospital. The only remaining window pane of polished plate glass was very flat, irregularities were hardly noticeable even in the oblique view. The glass panel was allegedly destroyed in the wake of the renewal in 1985. Photo courtesy of Mogens S. Koch, Copenhagen, 1972.

pension and the flexible reeds there is both an excellent thermal insulation and a mechanical elasticity and thus durability. To date, the ceilings are largely in good condition and do not show cracks. Even for the surfaces of the walls and ceiling of the interior, the architects resorted to a technique called *stucco lustro*, used since ancient times in substantial buildings as in villas by Andrea Palladio, and again in the 19th century, as, for example, in the architecture of Friedrich Schinkel.²¹ The *stucco lustro* of the Tugendhat House had a rather mat than glossy finish, similar to the famous 'Marmorino' e.g. of the *Teatro Olimpico* of Andrea Palladio. In the period in which the Tugendhat family lived there, from 1930–38, the walls were not covered with paint, but cleaned only by rubber gum (bread) [figure 13, 15].

The flooring consisted of Xylolith,²² and the cream white linoleum,²³ which was laid without being glued down, so the surface was quite uneven and changed, slightly, with temperature and moisture.

The support for the plaster façade of the Tugendhat House are brick walls and—like in the interior—(prefabricated) mats of reeds and of Rabitz netting suspended on rebar from the concrete floor in about 40 cm distance [figure 14]. The base coat (*arriccio*) consists of a mixed on-site lime–cement mortar of about 2.5 cm thickness, with a sand grain size of 0–30 mm (!) and a mixing ratio of about 2.5:1, with a part of crushed brick. The lime–cement mortar of fine plaster (*intonaco*) contains sand of the same color as in the base coat, with an average grain size of about 2.5 to 5 mm, with a proportion of mica, clay and fine crushed bricks. It has a mixing ratio of approximately 1:3, and is thus “leaner” than the base coat. Differences in the particle size of various plaster samples suggest a mortar mixed on site as usual. The surface of the plaster was smoothed out with a wooden board, so that



a certain roughness was formed by the grit of the sand of the mortar. The final thin wash consisting of slaked lime and fine particles of yellow sand added the coloring effect.²⁴ The whitewash probably contained ochre and zinc (Lithopone) and additional pigmentation. The analysis of the whitewash did not bring quite solid evidence of a proportion of casein and potassium silicate. Technologically, we can see a link to handcrafted tradition with elements of modern experimentation, similar to the façades of the Masters Houses in Dessau.²⁵

The whitewash was applied to the compacted but still wet plaster, and indeed was so thin that the natural color of the embedded sand grains contributed to the color effect of the surface [figures 13a, 13b]. The difference in

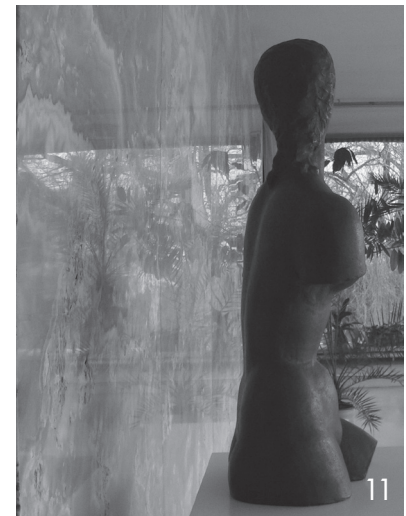


Figure 8. Tugendhat House. Main living space, showing the detail of the polished chrome cladding of the cross-shaped steel columns. In the mirror, the subtle unevenness of the surface of the metal caused by the craft fabrication process is clearly visible. Photo by Dieter Reifahrt, 2008.

Figure 9. Detail of the dining room buffet from the Tugendhat House, now in private ownership in Vienna. The shadow of a straight line in the reflection of the surface shows a slight ripple caused by the properties of the material and also by the manufacturing process. Photo Ivo Hammer, 2010.

Figure 10. Tugendhat House. Main living space with the, semi circular Makassar ebony wall reflecting the light of the big glass walls and giving an image of nature on the outside. The slight irregularities of the surface of the veneer are perceptible. Photo by Fritz Tugendhat, ca. 1931, detail.

Figure 11. Tugendhat House. Main living room, detail of the wall of onyx marble. In the reflection of the architecture small deviations are shown, which are indicative of the manufacturing process. Photo by Dieter Reifahrt, 2008, detail.

materials and surfaces between the local craft tradition, as we could see investigating e. g. the pavilion displayed at the Brno exhibition grounds from 1928 by Pavel Janák, and the Tugendhat House is the allusion of the color of the façade to the yellowish-white tone of the travertine used for the dado, the window sills and the thresholds [figures 4, 13a, 13b].²⁶ The plastered walls of the façade of the Tugendhat House were not white but had a subtle yellowish color.

In summary, we can see that the precise and sensitive craft production and processing of all elements, even the technically innovative components, played a significant role in the appearance of the surfaces of the Tugendhat House. The aesthetic consequences of the hand work, i.e.

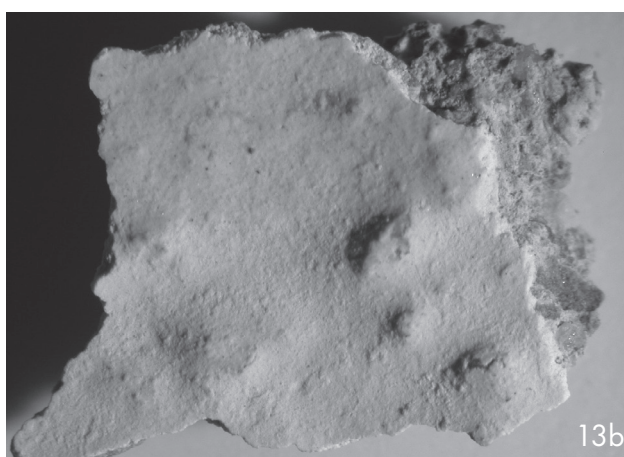


Figure 12. Tugendhat House. Detail of the east façade of the bedroom of Grete Tugendhat. Shortly after the building was completed, cracking of the plaster took place at the intersection of the concrete ceiling and the brick wall caused by different thermal movements of the materials, a built-in draw back created by the combining innovative and traditional techniques. Photo by de Sandalo, detail, with original retouche, ca. 1931.

Figure 13. Tugendhat House. Upper terrace, façade, detail. 13a. The image width corresponds to about 10 cm. 13b. The image width corresponds to about 17 mm. The yellowish-white lime wash on the grated wall is so thin that the color of the sand grains play a role in the overall color of the mortar. Photos by HAWK, Hammer (a) and Hitzler (b).

Fig. 14. Tugendhat House. Fritz Tugendhat bedroom. Opening in the ceiling, where light fixture has been removed. The prefabricated cane mat is suspended from the concrete floor structure above and supported by a wire mesh.

Figure 15. Tugendhat House. The main living room, looking southeast. The reflections of the wall surface convey an impression of the Stucco Lustro surface. Photo by de Sandalo, 1931st.

the facade, are noticeable in all elements, though not readily visible. At the same time it also became clear that the craft tradition was alive in the methods of production and was also used. It is noteworthy that the German architect had taken up the kind of facade plaster and local craft traditions of the Brno trade fair area. Formal innovation does not necessarily mean that the underlying basis of craft tradition is abandoned. The Tugendhat House may serve as example of a good, valuable architecture, which represents not only *innovative spatial and aesthetic concepts that aim to satisfy new lifestyle needs*, but also has been implemented materially in a careful and perfect manner. This material realization using traditional methods and materials was a long-term success, at least as long as the building was used and maintained. The tradition of small-scale repairs was alive up to the sixties of the 20th century. The plastered and painted facade e.g. was maintained several times with lime wash. We found up to 5 layers of paint. Not until the 1981–85 renovation were the traditional repair techniques abandoned and was the facade painted with a cement slurry and a color containing artificial resin, not compatible with the physics of the existing system.

The traditional techniques of repair were abandoned not only in the Czech Republic. In the second half of the 20th century the international trend has enforced the use of modern materials developed in the laboratory, instead of using traditional materials. Traditional craft intelligence was replaced by intelligent design of laboratory products that are easy to use following standardized procedures and that satisfy the warranty standards and their short-term durability requirements. Long-term considerations, such as the ability for future repairs, were not considered. The era of plastics in architecture began including the use of synthetic resins and corresponding composites in the construction of floors, ceilings, windows, tile, wall coatings, thermal insulation, etc.²⁷ The damage caused by the use of materials that are not repairable and are not compatible with the chemical and physical properties of the historic architecture, are not only economic—they also generate losses of irreplaceable historical fabric of our cultural heritage.

Ecology and Building Preservation

Is there a connection between the protection of the environment and the preservation of our cultural heritage?

The ecological relevance of construction must be assessed not merely on the basis of such individual technical parameters as the efficiency in terms of thermal insulation, the recycling rate of construction materials, the technical values in the operation of a building.

The energy balance in the production and use of build-

ings is only appropriate to the reality when the environmental impact is assessed through the entire process of use of resources, construction, maintenance and adaptation to changing needs, recycling and renewal.

The prevailing practice of building is the demolition of existing buildings and new construction. The most common motivation is the expected return on investment through a more intensive use of the land, lower planning costs, rapid construction and of short-term gain in energy use. As far as ecological criteria for new buildings in general play a role, they refer mainly to short-term savings in the use of energy and greater densities. Even with existing buildings the prevailing emphasis is on short-term energy gains by subsequent thermal insulation of facades, roofs, windows and doors. Ecological considerations are reduced to technical solutions for energy savings. Holistic criteria, which proceed from the long-term balancing of the resources used and long-term balance of environmental impact, are abandoned. Moreover, longer-term strategies that seek to maintain the value of cultural or social needs are considered very rarely in practice.²⁸

We know today that “only the intensive conservation and optimum use of existing buildings can lead in the medium term to a cleaner environment.”²⁹ More than four fifths of the European building stock is older than 40 years, only about “1% of the existing building stock is newly constructed each year.”³⁰

A sensitive environment policy, which is saving the resources and is long-term-thinking with regards to energy must move towards an intelligent management of our building stock and must take into account all the social dimensions as a responsibility for the future, economy as well as ecology and cultural sustainability.

The care of a monument can be seen—if interpreted properly—almost as a paradigmatic strategy of conservation and use of building stock which applies to long-term environmental thinking,³¹ for example regarding:

- The intelligent use, well-based on cultural needs,
- The efficient maintenance compatible with the historic fabric,
- The avoidance of energy consumption by new construction and the consideration of long-term energy balance,
- The repair capacity of the old building materials and techniques used,
- The reuse of materials in the reconstruction and adaptation to new uses,
- The separability and harmless disposability of materials no longer used,
- The long lifespan of building structures and surfaces that are periodically maintained.

Especially in architectural circles, it is recommended to

this day that retaining the 'original intent' of the architect, even at the cost of the destruction of the authenticity of the monument as a historical source—is justified in light of the programmatic break with tradition of *Bauhaus* modernism, a paradoxical use of categories of historicism of the 19th century and its puristic understanding of historic architecture—which lead to the 'vandalism of architects' apostrophized by William Morris in 1877 in his Manifesto.

Cultural Heritage and Technology Transfer

Resources have always both a cultural and material nature. In this sense we understand building monuments, not only as spiritual messages, which are called cultural heritage (almost as a kind of software), but also as a resource of technical solutions (so to speak a sort of hardware). In the materiality of the architectural monument its historical, artistic and cultural aspects are incorporated. A prerequisite for the knowledge of these properties is the study of its materiality and its technological and historical interpretation, and professional responsibility of conservators/restorers.

It's not just about strategies to preserve cultural values. It is also about avoiding an unnecessary expenditure of energy, not only on one aspect such as the thermal insulation, but in the overall view of the ecological balance. Preservation of buildings by means of intensive maintenance and optimum use of existing buildings as a vision for a sustainable building policy that benefits the environment, are also strategic goals of monument care. A society-sensitive monument care provides not only for the protection of individual objects, but also addresses well-understood social needs, and can thus contribute with ideas to realize these larger ecological goals.

Even where a new building is inevitable, monuments do offer suggestions for solutions to technical, aesthetic, and overall social problems. In these monuments are accumulated the experience of many years or even millennia, that have demonstrated that they passed their 'weathering test' and have already proved their cultural appropriateness. Why should we not use these resources of knowledge?

* Revised version of: Hammer, Ivo, "Handwerkliche Tradition und technologische Erneuerung: Das Haus Tugendhat als Resource", *Europäisches Symposium Deutschland-Tschechien-Belgien 90 Jahre Bauhaus—neue Herausforderungen durch die Europäische Energiepolitik* (European Symposium Germany-Czech Republic-Belgium 90 Years of Bauhaus—New challenges posed by the European Energy Policy, organized by European Information Centre in the Thuringia State Chancellery in cooperation with the Thuringian Ministry of Construction, State Development and Transport (27./28.10.2009 Bad Langensalza), Gotha 2010 (ISBN 978-3-939182-22-1).

Notes

1. See e.g. Gropius, Walter, "Glasbau", *Die Bauzeitung* Nr. 23 (1926), S. 159–162. Ludwig Mies van der Rohe, in 1924, states that the industrialization of the building is a question of material. He writes of an industrially produced "light material" solid, weather-resistant, soundproof and heat safe, see Ruchniewitz, S., 2008, "Zur Theorie des Materials in der Klassischen Moderne. Überlegungen anhand der Architektur von Ludwig Mies van der Rohe", diploma dissertation HAWK University of Applied Arts and Sciences, examiners: Ivo Hammer and Thomas Danzl, Vienna Bundesdenkmalamt.
2. See e. g. Stiller, Adolf, "Bemühungen um das Ursprüngliche", *Das Haus Tugendhat. Ludwig Mies van der Rohe, Brunn 1930*, Salzburg, Architektur im Ringturm V, 1999, p. 13. Stiller asks for a new understanding of the "original"; for a critical approach see: Hammer, Ivo, "The Original Intention—Intention of the Original? Remarks on the Importance of Materiality Regarding the Preservation of the Tugendhat House and Other Buildings of Modernism", in Heuvel, Dirk van den, Mesman, Maarten, Quist, Wido and Lemmens, Bert (eds.), *The Challenge of Change. Dealing with the Legacy of the Modern Movement, Proceedings of the 10th International docomomo Conference, Amsterdam 2008*, S. 369–374; Grunsky, Eberhard "Ist die Moderne konservierbar?", in *Konservierung der Moderne?/Conservation of Modern Architecture? Über den Umgang mit den Zeugnissen der Architekturgeschichte des 20. Jahrhunderts*, Leipzig 31.10.–2.11.1996, ICOMOS Hefte des Deutschen Nationalkomitees XXIV, München 1998, S. 27–38) insists on the validity of the criteria of monument care on MM architecture.
3. Scientific conservation investigation of materials and surfaces of the Tugendhat House executed by conservators/restorers by HAWK University of Applied Sciences and Arts, Hildesheim, directed by Ivo Hammer, in cooperation with Universities in Vienna (Angewandte), Pardubice, Brno (BUT), Bratislava (Academy of Sciences), Dresden (HfBK) and Cologne (CICS). Results published in Cerná, Iveta and Hammer, Ivo (Hrsg.), *Materiality (Sborník příspěvků mezinárodního symposia o ochrane památek moderní architektury / Proceedings of the International Symposium on the Preservation of Modern Movement Architecture/Akten des internationalen Symposiums zur Erhaltung der Architektur des Neuen Bauens*, Brno/Brünn 27.–29.04.2006), Muzeum města Brna/Museum of the City of Brno and Hornemann Institut of HAWK in Hildesheim 2008 (ISBN 978-8-0865-4954-5).
4. "Walter Gropius an Bauunternehmer Westrum", Hannover 27.11.1922, Staatsarchiv Weimar/Staatliches Bauhaus, quoted according to Hüter, Karl-Heinz, *Das Bauhaus in Weimar*, Berlin/DDR 1976, Dokument 57, 240.
5. Lecture by Walter Gropius on 10 April 1911 in the Volkswang Museum in Hagen, in Propst, Hartmut and Schädlich, Christian, *Walter Gropius, Band 3*, Berlin, *Ausgewählte Schriften*, 1987, p. 30; see also Wagner, Monika, "Immaterial Materials of the Tugendhat House within the context for the aesthetics of materials of the time" (also Czech, German summary), *Materiality*, 2008, op. cit. 26–32.
6. Gropius, Walter, "Meine Konzeption des Bauhausgedankens", *Architektur, Wege zu einer optischen Kultur*, Frankfurt am Main/Hamburg 1956, 18, quoted according to Karl-Heinz Hüter, 1976, op. cit.
7. Adolf Behne writes in 1920 (in: Arbeitsrat für Kunst (ed.), *Ruf zum Bauen*, Berlin): "Nein, wir können uns nicht daran beteiligen, für unsere Menschen Höhlen und Zellen zu bauen, Massenquartiere und Menschenställe. Wir wären doch nur Werkzeuge der Schmuggler und Ausbeuter" (No, we cannot participate in it, to build for our people caves and cells, mass accommodation and stables for men. We were only tools of the smugglers and exploiters. Transl. I.H.).
8. CIAM: Congrès International d'Architecture Moderne; see: Siegfried Giedion, *Befreites Wohnen*, Zurich 1929.
9. See Wolfgang Fritz Haug, *Die Kulturelle Unterscheidung*, 2011, somewhat a conclusion of his research on materialistic interpretation of culture, 40 years after the publishing of his famous "Critique of Commodity Aesthetics" (Kritik der Warenästhetik).

10. See <http://whc.unesco.org/en/list/1052/>.
11. Wolf Tegethoff, "The Tugendhat House. A Modern Residence in Turbulent Times", Hammer-Tugendhat, Daniela and Tegethoff, Wolf (eds.), *Ludwig Mies van der Rohe. The Tugendhat House*, Vienna-New York 2000, p. 43-97. See also Kierdorf, Alexander and Hilsdorf, Hubert K., "Zur Geschichte des Bauens mit Beton", in Hassler, Uta (ed.), *Was der Architekt vom Stahlbeton wissen sollte*, Zurich 2010, 11-52.
12. Wolf Tegethoff, op. cit., 15.
13. Wagner, Monika, "Materialien des 'Immateriellen', "Das Haus Tugendhat im Kontext zeitgenössischer Materialästhetik" (Engl, Tschech.), *Materiality, Akten des Internationalen Symposiums zur Erhaltung der Architektur des Neuen Bauens*, Brunn 17.-29.4.2006, Museum der Stadt Brunn (www.spilberk.cz) und HAWK, Hornemann Institut (www.hornemann-institut.de) 2008, S. 26-32.
14. Wagner, Monika, 2008, op. cit. p. 30. As to the influence of industrial production on the aesthetic of craft work, the imitation of machine aesthetic and the suppression of the traces of hand work in the surfaces of 19th century façade plastering see: Ivo Hammer, "Historische Verputze. Befunde und Erhaltung", in *Restauratorenblätter* 4, Wien (Österr. Sektion des IIC, Arsenal 15/4, 1030 Wien) 1980, 86-97.
15. Bayerova, Tatjana and Griesser-Stermscheg, Martina "Metal Surfaces in the Tugendhat House. Research and Findings", in: *Materiality* (op. cit., 2008), S. 176-184.
16. The sensitivity of the finger tips is higher than the resolution of the human eye: in one finger there are 250 receptors for cold, 17 for warm, 850 for pain near the surface, 441 pain in the depth, 1,233 for pressure, 471 for contact, 284 for vibration, 744 for position of the joints (Vester, Frederick, *Unsere Welt-ein vernetztes System*, Stuttgart, 1978, München 1998), 28.
17. According to the investigations of HAWK Hildesheim in 2004 there was no trace of Patina between the original surface and the repair.
18. Bayer, Karol, Staffen, Zdenek, Novotny, Jiri and Tislova, Renata, "Investigation of Stone Elements in the Tugendhat House", in *Materiality* (op. cit., 2008), 194-201.
19. Blohm, Inga, Kaspar, Vanessa, Lauterwald, Kirsten, Silke, Trochim and Thörner, Nicole "Wooden Built-In Elements in the Tugendhat House. Conservation/Restoration Research, including History and Proposals for their Maintenance", in *Materiality* (op. cit., 2008), 186-192.
20. Analysis of Tatjana Bayerova and Karol Bayer, Litomyšl, in the frame of CIC, report of 15.02.2011; surface of the Makassar buffet, sample taken from the veneer hidden by the middle drawer. On one sample, taken from the inner part of the foot of the bed of Grete Tugendhat (rose wood) an oil resin paint was found, which might not be original.
21. Koller, Manfred, "Wandmalerei der Neuzeit", in *Reclams Handbuch der künstlerischen Techniken Band 2*, Stuttgart 1990, 213-398. There are few other eminent examples of Modern Movement houses with highly elaborated interior wall surfaces using stucco lustro technique: the Wittgenstein House (1926/28) by Ludwig Wittgenstein and Paul Engelmann, Kundmannngasse 19, Vienna 3rd district (see Leitner, Bernhard, *Das Wittgenstein Haus*, Ostfildern-Ruit, 2000) and the Villa Lala Gans in Kronberg near Frankfurt/Main by Peter Behrens (1928-31) (see Gans Angela von, and Groening, Monika, *Die Familie Gans 1350-1963. Ursprung und Schicksal einer widerentdeckten Gelehrten und Wirtschaftsdynastie*, Heidelberg et.al (verlag regionalkultur) 2006, 240-245 (notice Axel Werner).and "Haus K. in O." (House of Philipp F. Reemtsma in Othmarschen) by Martin Elsaesser (1930-32 ca.) (http://de.wikipedia.org/wiki/Haus_K._in_O_.).
22. Screed of magnesium chloride cement with saw dust; Sorel cement (Steinholz in German).
23. Linoleum is a floor covering made from renewable materials such as solidified linseed oil (linoxyn), ground cork dust and mineral fillers such as calcium carbonate, most commonly on a burlap or canvas backing; pigments are often added to the materials. It has been invented in 1860 by Frederick Walton., see: <http://de.wikipedia.org/wiki/Linoleum>.
24. Microscope investigations of HAWK Hildesheim revealed that the siliceous particles of the aggregate had a shape and colour of the grains similar to the sand of the sandpit of Bratice, 20 km south of Brno. The content of fine siliceous particles (silt, 0,002 mm bis 0,063 mm) accelerate the setting of the lime hydrate due to its hydraulic effect, see: Hammer, Ivo, "Buildings on the fair grounds of Brno (1928) designed by Emil Kralik and Pavel Janak. Investigation of the materiality of Modern Movement buildings", in *Materiality, Proceedings of the international symposium on the preservation of Modern Movement architecture*, Brno, 17.-29.4.2006, Museum of the City of Brno, www.spilberk.cz und HAWK, Hornemann Institut www.hornemann-institut.de 2008, 136-144 (German texts attached on CD).
25. See Danzl, Thomas, "Konservierung, Restaurierung und Rekonstruktion von Architekturoberflächen am Meisterhaus Muche/Schlemmer", in Gebessler, August (Hrsg.), *Gropius. Meisterhaus Muche/Schlemmer. Die Geschichte einer Instandsetzung*, Ludwigsburg/Stuttgart + Zürich 2003, 152-181.
26. We have to take into account, that the actual hue of the travertine is changed by dirt and gypsum crust, and additionally by oil paints in the interior, see Hammer, Ivo, "The Project of Conservation/Restoration Research at Tugendhat House. Materials and Surfaces of the Rendered Façades, Interior Walls and Painted Wood", in *Materiality* (op. cit., 2008), 164-174.
27. Hammer, Ivo, "Kalk in Wien. Zur Erhaltung der Materialität bei der Reparatur historischer Architekturoberflächen", *Restaur. Zeitschrift für Kunsttechniken, Restaurierung und Museumsfragen*, 6, September 2002, 114-125.
28. In a separate essay I'll try to discuss the impact of the recast of the DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 May 2010 on the energy performance of buildings on cultural Heritage in general and on MM architecture particularly.
29. Kohler, Nikolaus, "Ökobilanzierung von Gebäuden und Gebäudebeständen", in *Berichte zur Denkmalpflege in Niedersachsen* 3/1998, S. 112-116 and Hassler, Uta, "Der Bestand als Ressource, ebenda", S. 117-121; see also Wohlleben, Marion and Meyer, Hans-Rudolf (eds.), *Nachhaltigkeit und Denkmalpflege. Beiträge zu einer Kultur der Umsicht (Sustainability and Monument Care. Contribution to a Culture of Precaution, transl. by I.H.)*, Zurich 2003.
30. Hassler, Uta op. cit., 121.
31. It's about exemplary strategies to maintain the value of the building stock, not the "universal management" of the whole world by monument care, as Uta Hassler is stating in her introduction to: *Das Denkmal als Alltast. Auf dem Weg in die Reparaturgesellschaft* (The monument as a burden of the past. On the way to the repairing society, transl. by I.H.), ICOMOS Hefte des Deutschen Nationalkomitees XXI, Munich, 1996, 11.33

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The author wishes to thank Theodore Prudon for linguistic help.

Inherited Toxicity: An Expanded Concept of Sustainability for Preservation

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SUSTAINABILITY is a concept that has been accepted as a foundation for professional practice, and toxicity of materials is gaining concern. While the topic of material toxicity is generally addressed with regard to new materials, the built environment represents a history of embedded toxins. However, this aspect of 'inherited toxicity' is scarcely addressed. Considering the toxic potential associated with 20th century building materials, this will grow more critical for the preservation field to address in coming years.

In response to the increasing regulation of copper in both Europe and the US, the case study at Frank Lloyd Wright's Price Tower (1956) is an exploration of whether or not an acute environmental impact from the building's exterior copper elements exists, the results of which are assessed based on an expanded toxicology of copper.

By Amy Swift

WITH the general increase in universal environmental concerns, preservationists are now called on to not only serve as custodians of history, but to serve additionally as stewards of the environment. Concurrent with the general tides of an enlightening environmentalism, material toxicity is an issue that is gaining attention. While much of the toxicity research and advocacy today focuses on the regulation of the production of new materials,¹ 'inherited toxicity' refers to the embodied material hazards already present in the built world, and their potential to impact human and environmental health. In regards to preservation, the term refers to the hereditary condition in which toxic or hazardous materials are embedded in historic buildings or sites and left to the current generation to manage. Inherited toxicity poses significant consequences, yet is often overshadowed by energy concerns when the topic of sustainability is discussed.

At the beginning of the 20th century there were less than one hundred chemically different materials used in common building construction, but by the end of the century there were over 50,000, a number that continues to grow today with industry advancements.² Considering only 6 percent of the existing building stock in the United States was constructed prior to 1920, much of the built world is comprised of these chemically varied modern industrial materials.³ But the concept of inherited toxicity is not exclusive to 20th century materials. Although these materials may serve to exasperate the issue, materials that have been used for centuries may also hold a toxic potential, highlighting the relevance of the topic to preservationists involved with any building vintage. Lead and asbestos are materials that are already heavily regulated internationally, and the general difficulties these materials present to preservation projects are often a topic of discussion within the profession. But there are potentially

many other materials that pose similar concerns, including heavy metals and many commonly used plastics and foams. As awareness of the embedded risks associated with in-situ materiality develops, regulation is likely to follow. Therefore, it will only grow more critical for preservationists to examine and adapt their practice in coming years.

This adaptation may happen in two ways. Preservation can either simply comply with expanding regulation as it has done with lead and asbestos, or it can opt for a more proactive approach. The preservation field as it stands has an extensive knowledge of building materials and has the potential to guide suitable regulation and treatment guidelines of such materials. Yet, to date, there has been little official effort by the national and international preservation constituencies to address the concerns of embodied toxins. The US NPS Guiding Principles for Sustainable Design (1993) is one of the few doctrines that approach the subject, stating:

In some instances toxic materials... are inherited. Toxic materials that exist in many historic buildings must be removed and properly disposed of. Unfortunately, some of the inherited toxic materials are significant features of historic structures or sites... The problem of inherited toxins will need to be addressed in all proposed management and development projects in the future.⁴

This brief and vaguely outlined passage is the only instance where inherited toxicity is explicitly addressed in preservation guidelines, and indeed, nearly two decades after this directive was penned, the position on inherited toxins has hardly been developed, either theoretically or in practice, beyond a black-and-white adherence to regulation. This is perhaps not entirely surprising considering the inherent ideological conflict between material authenticity and these environmental health concerns.

Further, there is a dearth of research on materials that are being targeted for regulation within the context of architecture. This lack of appropriate knowledge stands out as a gap in understanding.

Frank Lloyd Wright's Price Tower was used as a case study in order to explore the potential of an acute environmental impact from the building's exterior copper elements. This study also outlines a proactive environmental method of material research that identifies and addresses the risks associated with embodied hazards. By using this method to develop an empirical research base and a suitable response, the preservation community has the opportunity to contribute to the current sustainability discourse as it stands.

Copper: A Hazardous Material?

Copper is a naturally occurring material and is considered to have a number of sustainable qualities, such as durability and ease of recyclability. However, copper is considered a heavy metal and aquatic toxicant whose urban runoff sources are becoming increasingly regulated in Europe, California, and other coastal US states. While much of the regulation is targeted at antifouling paints and copper brake pads in the US, there is precedent for the regulation of architectural copper in both Europe and Palo Alto, CA. Both of these regulations address historic properties differently: in Palo Alto there are exemptions granted to landmarks and buildings contributing to historic districts, while in Europe there are no exemptions granted to historic properties.

In Europe this means that mitigation is deemed necessary during all relevant restoration projects, putting material authenticity, and ultimately historic integrity, at risk while adding potential costs and complications to restoration projects. On the other hand, by offering an exemption to historic properties, as is the case in Palo Alto, any potential environmental contamination would be allowed to persist, underscoring the intrinsic ethical dilemma in not addressing these risks. By moving beyond a simple response to regulation to a progressive place-based understanding of material hazards, the preservation community can begin to build up a comprehensive material management model that considers both historic and environmental concerns.

Significance of Case Study

No other public studies measuring architectural copper runoff relative to acute impacts on historic sites were found during this research. Since architectural copper in urban runoff is a non-point source pollutant, the studies performed to date observe cumulative copper levels in municipal effluence and are therefore unable to isolate

the individual impacts associated with specific buildings. On the other end of the spectrum, the studies that measure copper released into runoff over time by architectural applications utilize simulated weathering and deal more specifically with rates of copper release as opposed to the potential impact of such releases. In short, acute site-specific environmental impacts of architectural copper are untested and therefore largely speculative.

The Price Tower designed by Frank Lloyd Wright (1956) was chosen as an ideal case study to test for the acute impacts of copper runoff onto a site. It was important to choose a landmarked historic building, whose material integrity was reliant upon major copper elements integral to its design. This is an instance where preservation and environmental goals exist in conflict; whereas the replacement of a potentially hazardous architectural element would severely jeopardize the historical integrity of the structure.

Price Tower: Historic Significance

Frank Lloyd Wright is commonly known for his Prairie Style designs using long, low horizontal lines, but his many unrealized towers were equally as stunning. Built during the city's petroleum boom era for Harold C. Price, Sr. of the H.C. Price Company,⁵ the multi-use Price Tower in Bartlesville, Oklahoma, stands as the only fully realized conception of Wright's planning model for Broadacre City.⁶ After 1930 Wright began to promote his notion that a tower's rightful place was in the country where its vertical expression and formal beauty were liberated from the visual cacophony of the city. Wright believed, "as trees crowded in the forest have no chance to become themselves (as they could if they stood alone) so the skyscraper needs to be freestanding in the countryside to become a human asset."⁷

It was serendipitous then that in 1952 Price contracted Wright to build a tower embodying this nascent expression of decentralized urbanism in the Midwestern petroleum boom town of Bartlesville, home to just 22,000.⁸ Wright based the design for Price Tower on his unrealized St. Mark's-on-the-Bouwerie housing project in New York City designed in 1929 [figure 3]. The St. Mark's Tower design was reinterpreted to accommodate a new mixed-use program reflective of the Broadacre model for development. The Bartlesville city center at that time was still largely tree-lined with views of rolling hills beyond, lending an apt setting for the deep-green louvered tower to rise over the horizon of the one and two-story downtown development; a metaphor for "the tree that escaped the crowded forest [figures 1, 2]."⁹

The cantilevered structure departed from the traditional rectilinear cage of the typical urban tower, relying in-

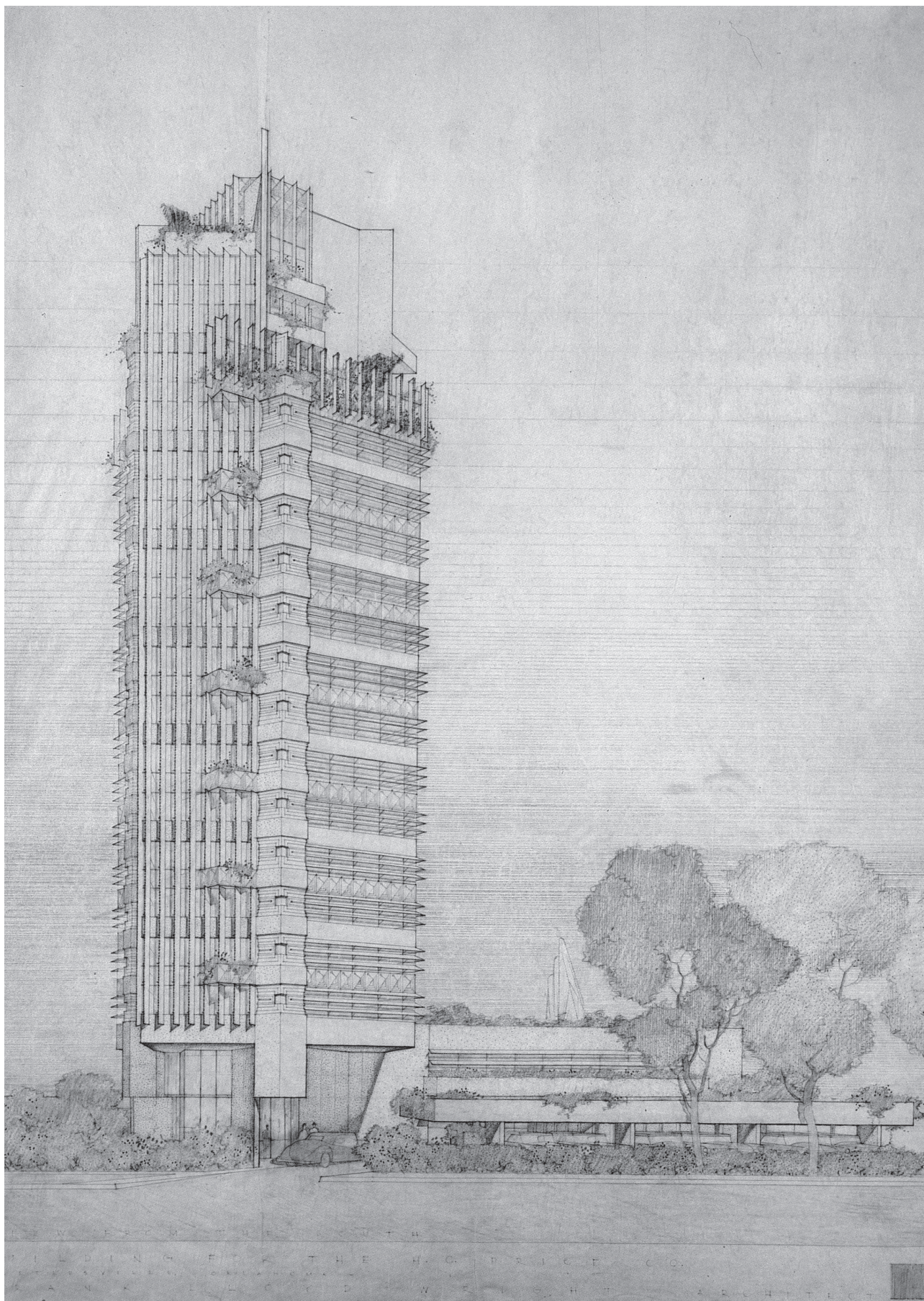
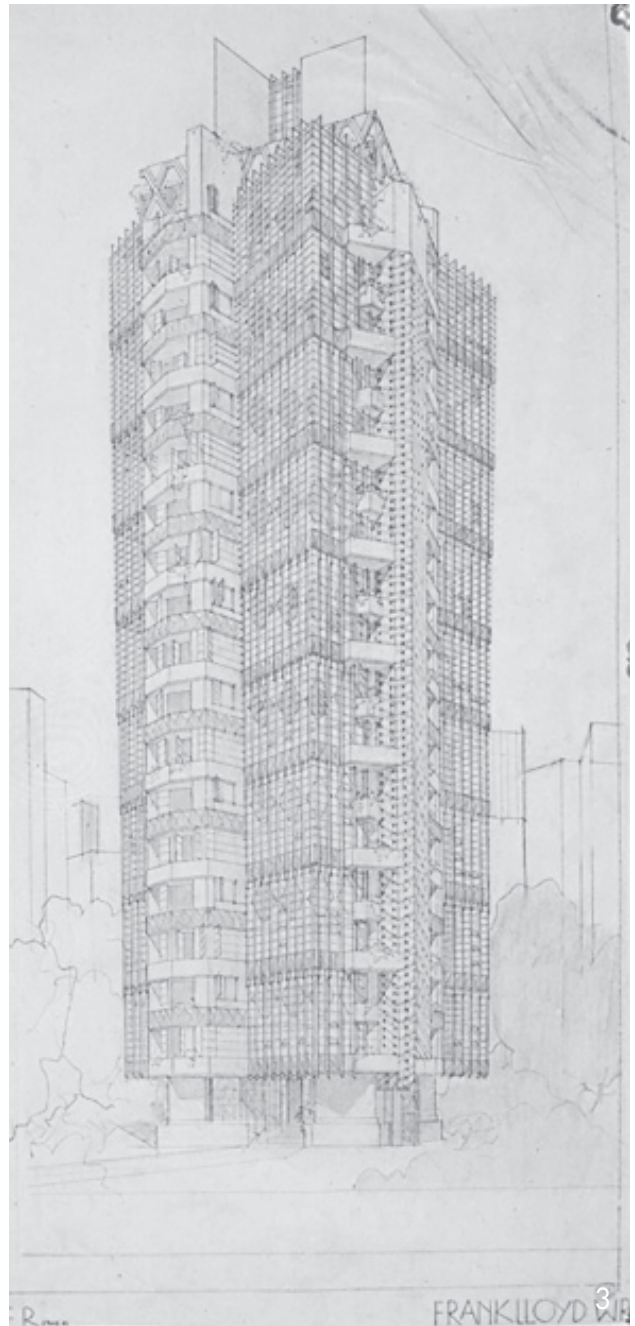


Figure 1. Price Tower, Bartlesville, Oklahoma, 1952–1956. Perspective drawing, 30 September 1952. Pencil and color pencil on tracing paper, 43x34. FLWF 5215.004. Copyright © 2011 The Frank Lloyd Wright Foundation, Taliesin West, Scottsdale, AZ.



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Figure 2. Image of tower taken January 29, 2011.
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Figure 3. Perspective view of the St. Mark's Tower, New York City, revised project, 1929. FLWF 2905.041.
Copyright © 2011 The Frank Lloyd Wright Foundation, Taliesin West, Scottsdale, AZ.

Figure 4. Still image of a film made by **Joe Price** of **Frank Lloyd Wright** using a prairie flower to explain the 'taproot' construction method of the Price Tower. PTAC 2004.15.

stead on a deep core foundation that works to anchor the vertical spine from which the floor slabs are suspended. Wright referred to the core as a 'taproot' structure, comparing the building's nature to that of a living organism fed by the soil [figure 4]. All four elevations of the 16-storey tower are designed with its own unique variation of vertical and horizontal louvers, and decorative copper panels. In constructing the tower, copper sheets were first pressed into master dies [figure 5], and then placed into formwork before the concrete slabs were poured. After the concrete cured, workers removed the forms [figure 6] and patinated the fresh copper using an acid bath.¹⁰ The resulting green copper elements [figures 7, 8] combined with the singularity of the tower certainly render the project the ultimate metaphor. Thus patinated copper is an essential element to the building's nature.

In 2007 the tower was placed on the National Register of Historic Places, 51 years after its completion. It is also included as part of a serial nomination that has been submitted to the UNESCO World Heritage List for outstanding works by Frank Lloyd Wright, including such iconic structures as Fallingwater, the SC Johnson and Sons buildings, the Guggenheim, and the Robie House.¹¹ The building underwent an extensive renovation in 2003, during which the copper panels were not in need of any major repair.¹² In sum, there can be no objection raised as to the architectural significance and overall integrity of the tower and its copper elements.

Soil Testing for Copper

Since testing for copper in runoff from the site's gutters and hardscapes is costlier and requires a more arduous sampling process than soil testing, it was decided to first perform exploratory testing of the soil in order to gauge if further runoff testing would be necessary. Copper (Cu) testing in soil is common in agricultural sciences, and is performed in order to monitor the effect of cropping practices on soil fertility. Soil tests can also be used to identify if Cu or other nutrients are present at levels that may be toxic to plants or other organisms. Cu is a difficult nutrient to test because thresholds tend to be comparably lower than other micronutrients. The element is highly immobile, but different chemical speciations of copper result in varying levels of mobility and must be considered when assessing the risk to surface water and groundwater contamination.¹³

Methodology

The testing location was chosen where runoff drains directly into the soil from the north and west façades. These façades receive the prevailing winds, which is an important factor as these façades receive the highest volume of

rain impinging the surface, resulting in elevated volumes of runoff. Also important to note is that the panels were originally patinated on site, so these layers of patina are brittle and much less stable in their formation than a naturally formed patina, resulting in increased loss of patina product to runoff. With all of these factors combined, if Cu toxicity was to be found in the soil, the chosen sampling site was the most likely place.¹⁴

Samples were collected on a visit to the site on January 29, 2011, and represent both a control and experimental set. The control samples represent a measure of the naturally occurring levels of copper in the soil and were taken from the south lawn of the property. This area of the site does not receive runoff from the building or from any other perceivable source (refer to samples SW-1, SW-2, and SW-3 in figures 10, 11). The experimental samples were taken from directly under the cantilevered southwest corner of the louvered façade where heightened copper levels were most likely to be found (refer to samples A-3, A2-3, B-2, B-3, C-2, and C-3 in figures 10, 12). Cu from both the control and experimental samples was measured to assess if there was any significant increase in Cu content in the soil as a result of the building runoff.

Procedure

Surface vegetation was first removed with a clean trowel. All samples were dug from a depth of 0-6" at distances of 5' or 10' apart, collected, tagged, and mapped.¹⁵ To prevent cross-contamination, between each sample collection the trowel was cleaned in a clean water bath, dried with a clean towel, and new rubber gloves were applied. The samples were double-bagged separately and stored at room temperature before being sent to the University of Minnesota's Research Analytical Laboratory,¹⁶ which specializes in soil testing.

Testing

Each sample underwent two testing procedures:

1. The DTPA (diethylenetriamine pentaacetic acid) extract test is the most commonly used chelating test for extracting Cu from soil. The test is designed to simultaneously extract Zinc (Zn), Iron (Fe), Magnesium (Mn), and Copper (Cu).¹⁷ The results can be used to estimate the readily available Cu levels in soils, and are best suited to determine Cu deficient, near-neutral, and calcareous soils.¹⁸
2. The microwave digestion test is a hot nitric acid leach of the soil done under pressure in a Teflon vessel. This method comes closest to being a measure of the total copper in the soil, as it is able to measure the chemically bound copper that is missed by the DTPA test.



Results

The results of the testing show that there is a clear increase in Cu content in the experimental samples collected from under the building's eaves as compared to the control samples. Of the 6 experimental samples collected, toxic levels of Cu over 100 ppm were found at two sites. The control samples collected in the SW lawn show a range of copper content from 4.8–6.0 ppm and 15.7–21.0 ppm in the DTPA and microwave digestion tests, respectively. The values found in the experimental group are clearly elevated but vary greatly, indicating a sporadic method of accumulation from the runoff. Samples range from 14.1–80.1 ppm and 40.9–120.6 ppm in the DTPA and microwave digestion tests, respectively. The B-2 experimental sample was collected from underneath the cover of the building away from the influence of the runoff, and therefore shows levels similar to the control samples.

Sample Name	DTPA-Cu* (ppm)	1N HNO3-Cu** (ppm)
A2-3	14.1	40.9
A-3	28.7	70.2
B-2	4.9	14.5
B-3	80.1	120.6
C-2	69.3	102.8
C-3	49.8	84.5
SW-1	4.8	5.7
SW-2	5.1	16.6
SE-3	6.0	21.0

*DTPA Extract Test. **Microwave Digestion Test.



Figure 5. Wood framework (shown upside down) crafted with relief pattern for the ornamental copper panels, which were set inside the framework before concrete slabs were poured. Photo by Joe Price, PTAC 2003.16.122.

Figure 6. Workers setting copper panels inside wood framework before concrete was poured against the inner surface of copper. The outer surface of the copper set against the formwork was then patinated with an acid bath when the formwork was removed. PTAC 2003.16.157.

Figure 7. Image of the copper detailing taken April 30, 2011. Copyright © Mark Hertzberg.

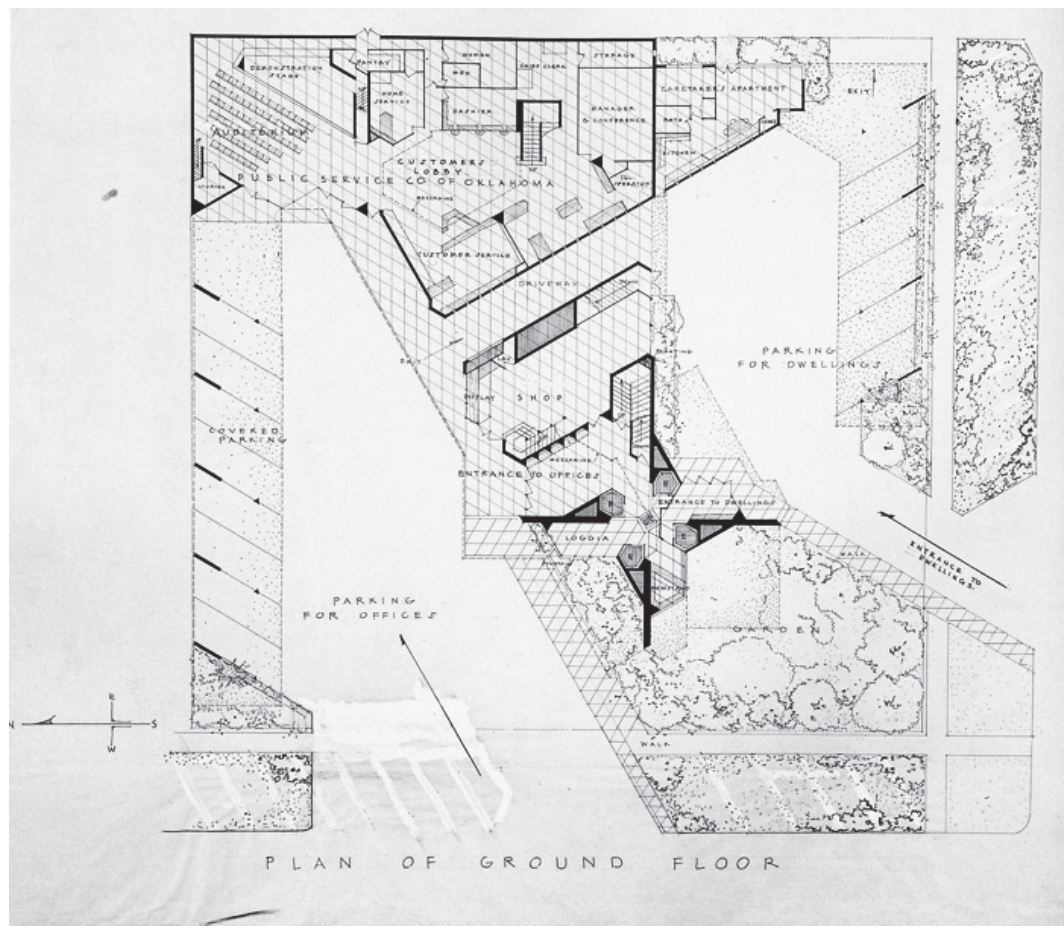
Figure 8. Image of the copper detailing taken January 29, 2011. Copyright © 2011 Amy N. Swift.

Figure 9. Ground floor plan and site plan reflecting final parking changes. Driveway between retail shop and Public Service Co. was subsequently enclosed. Ink on tracing paper, 28x36, FLWF 5215.014. Copyright © 2011 The Frank Lloyd Wright Foundation, Taliesin West, Scottsdale, AZ.

Figure 10. Graphic showing the location of both control and experimental testing sites on the Price Tower property. Amy N. Swift, 2011.

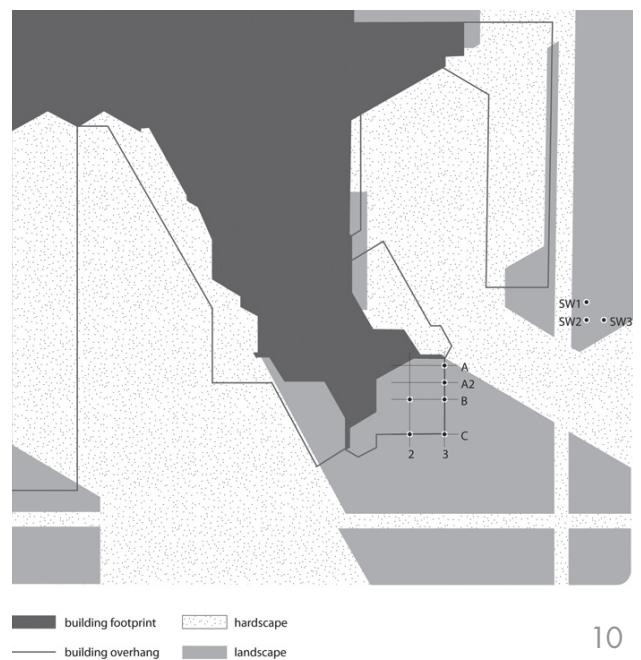
Figure 11. Image of west lawn taken January 29, 2011. Copyright © 2011 Amy N. Swift.

Figure 12. Image of northwest lawn under tower, taken January 29, 2011. Copyright © 2011 Amy N. Swift.



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Discussion

The differences between the DTPA and microwave digestion tests are worth noting. While the microwave digestion test comes closest to measuring the actual levels of Cu in the soil, the DTPA values reflect the readily available, or mobile 'free radical,' particles that are considered bioavailable. According to the ecotoxicology of Cu in soil,¹⁹ the bioavailable forms of Cu are what should be considered when assessing risk. Although two of the samples tested using the microwave digestion method show heightened levels of total Cu in the soil over 100 ppm, the bioavailable forms are well within normal limits.

The exterior copper cladding was originally patinated on site using an acid bath, the primary components of which are traditionally copper sulfate, sulfuric acid, and hydrochloric acid.²⁰ Although no testing of the patina was performed through this study, the components of the acid bath make certain copper compounds more likely than others to develop on the surface. Following this line of reasoning, the main constituents comprising the green patina are likely bronchantite and atacamite. In consideration of Bartlesville historically being a heavy industrial region, antlerite may also make up a portion of the patina product. As these compounds are both sulfur and chloride derivatives, the resultant chemical speciation in the runoff would be copper sulfate and copper chloride compounds, which are readily adsorbed in soil.²¹ This would explain why the dilution effects seem to be quite low and Cu contamination is so high in some samples. It also explains the relatively low levels of bioavailable Cu found in the soil. In other words, although the characteristics of the Cu found in the building runoff render it likely to build up to heightened levels in the soil, it is unlikely to migrate into the groundwater or effect living systems in the soil. This is evidenced by the grass that is still able to grow in the areas with elevated copper levels. Since Cu is a bigger hazard to aquatic life than it is in soil, the heightened and acute findings appear inconsequential. However, this points to the necessity of further study of the runoff from the site's gutters and hardscapes.

Conclusion

The case study at Price Tower highlights the importance of understanding the nature of the risks associated with a material when interpreting the results of field testing. In the case of copper, contamination of aquatic systems is the greatest risk. Although the soil contamination tested at high levels in acute locations on site, the relatively stable Cu species present a low level risk of migration into groundwater. It is therefore necessary to consider the chemical speciation, infiltration, and dilution effects when interpreting results. By understanding the types of

Cu compounds that have likely developed over the metal, the stability of the Cu in the soil can be assessed and supported by findings in the field. In the case of Price Tower, if the chemical speciation of the patina product had been a more mobile compound, the toxic levels of Cu would have posed a greater risk to migration, and ultimately a greater risk to groundwater contamination.

The copper cladding installed on the façade is not exclusive to the north and west façades that drain into the soil. Runoff from other copper features installed on the building drain to gutters and hardscapes that are then channeled into the stormwater system. With the runoff from the north and west façades having exhibited an acute site impact, it is probable that runoff from other copper features on the building may also contain heightened levels of copper. Since the runoff that drains into stormwater collection effects aquatic systems, it has a much higher associated risk and should be considered for further testing to gauge if on-site mitigation should be implemented.

The historic significance of the Price Tower should be considered while interpreting the results of this case study. As a National Register listed and potential UNESCO World Heritage Site, the historic significance of the building and its copper elements is unwavering. Thus, if deleterious levels of Cu are indeed found through the future testing that this study suggests, mitigation strategies should preclude removal of the significant copper elements and instead focus on alternative strategies, including on-site passive or mechanical strategies.

Lessons for a Future Preservation

The most important conclusion that can be made from the case study at Price Tower is that buildings have a direct impact on their surrounding environment beyond their carbon footprint. The study performed at Price Tower focuses on a material that has been used in building construction for centuries, highlighting the relevance of the issue to the preservation field as a whole. But materials used in modern construction will invariably present a bevy of new and unanticipated problems that have yet to be identified. In recognizing this reality, preservationists must proceed with caution in handling these materials, and should ultimately be asking themselves how this will potentially change the profession in the future. Preservationists are poised to generate a worthwhile and necessary addition to the sustainability dialogue by asking the right questions. What are the risks associated with a given material? What are the appropriate mitigation strategies? How should potential conflicts between authenticity and sustainability concerns be rightfully resolved? By readying preservation to readily adapt both in theory and in practice to these inherent conflicts, the

discipline will be better equipped to manage our modern heritage in the name of sustainability.

Notes

1. The Radical Transparency movement focuses on implementing a non-proprietary, open book regulation system of chemical production with regard to new building material production and installation methods. Its reach also extends into consumer products.
2. National Building Technologies website, Chemical and Particulate Pollutants. http://www.natural-building.co.uk/chemical_pollutants.html. Accessed June 2, 2011.
3. Elefante, Carl, "The Greenest Building is... One that is Already Built", *Forum Journal*, Summer, Vol. 21, No. 4, 2007, p. 26–38.
4. National Park Service (1993). Guiding Principles for Sustainable Design. http://www.nps.gov/dsc/d_publications/d_1_gpsd.htm. Accessed February 15, 2011.
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9. Alofsin, Anthony, "Pinwheel on the Prairie: An Overview of the Price Tower," *Prairie Skyscraper: Frank Lloyd Wright's Price Tower*, New York, Rizzoli International Publications, Inc., 2005, 22–41.
10. Ibid.
11. Watts, James D., "Frank Lloyd Wright-designed Skyscraper in Running for UNESCO World Heritage Site," *Architectural Record*, online journal. April 10, 2011. Accessed on April 16, 2011. http://archrecord.construction.com/yb/ar/article.aspx?story_id=157864924
12. For more information about the building refer to:
 - *Architectural Record* (1956) vol. 119, a periodical issue dedicated to the Price Tower, cover and pages 153–160.
 - *Prairie Architecture: Frank Lloyd Wright's Price Tower*, published in conjunction with an exhibition by the same name organized by Price Tower Arts Center in cooperation with the Frank Lloyd Wright Foundation in Scottsdale, AZ, which contains a comprehensive history of the building and Wright's tower theories and designs.
13. Richardson, H. Wayne, ed., "Handbook of Copper Compounds and Applications", *Treatment in Copper-Laden Waste Streams*, Peters, Robert W., New York, Marcel Dekker, 1997, 205–209.
14. It was determined in speaking with the site's landscapers that copper-containing fertilizers are not used on the lawn, therefore any copper found in the soil is either naturally occurring or a result of building runoff.
15. The 0–6" depth was a universal standard among multiple sources testing for copper, so this was an important measurement to adhere to. There is however no universally accepted protocol for collecting soil samples. This experiment was interested in finding point-specific values of copper and not average values, so two sources of guidance were used to develop a procedure that fit the purpose of the study.
 - The University of Minnesota's Soil Testing Laboratory, How to Sample, <http://soiltest.cfans.umn.edu/howtosam.htm>. Accessed December 17, 2010.
 - Allison Turner, "Urban Agriculture and Soil Contamination: An Introduction to Urban Gardening," *Practice Guide #25*, Environmental Finance Center, EPA Region 4. University of Louisville, Center for Environmental Policy and Management, Winter 2009.
16. Soil Testing Laboratory, University of Minnesota, Rm 135 Crops

Research Building, 1902 Dudley Ave., St. Paul, MN, 55108; Tel: 612-625-3101; Fax: 612-624-3420; email: soiltest@umn.edu; <http://soiltest.cfans.umn.edu>.

17. The metals are extracted and subsequently separated, thereby producing results that are within a small margin of error from the actual content in the soil.
18. Richardson (2007).
19. Toxicology is concerned with the study of chemicals and other hazardous substances, their actions, their detection, and the treatment of adverse effects produced by them in living systems, whether they be human, animal, plant, or microbe. It is an interdisciplinary branch of sciences that integrates the principles and methods of many fields, including chemistry, biology, pharmacology, molecular biology, physiology, and medicine. The sub-discipline of ecotoxicology is the study of contaminants from the biosphere and their effect on other elements of the biosphere. An extensive study of the toxicology of copper can be found in the master's thesis: Amy Swift, *The Toxicology of Copper and Its Implications For Preservation*, Columbia University, 2011.
20. Determination of the Suppressor Additive in Acid Copper Plating Bath (2002) Application Note 145, Dionex Corporation.
21. The difference between adsorption and absorption will be critical to note here. Adsorption is the process by which a copper ion is incorporated, or added, into a chemical compound, thus altering the composition. Absorption refers to copper's ability, regardless of the mineral form it is in, to be incorporated into liquid or gaseous water.

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Former American Embassy in Baghdad, Iraq Designed by Josep Lluís Sert (1957-1959): **A Ruin That Nobody Wants**

By Pedro Azara¹

THE future of Josep Lluís Sert's masterpiece, the former American Embassy in Baghdad built in 1957, is in jeopardy. Not too many people consider that it has to be kept and restored. The state of the premises of the building, situated by the River Tigris and inside the so-called Green Zone (part of the city closed off to the general public), is threatened by a danger that also menaces other instances of Modern architecture in Baghdad, such as the Saddam Hussein stadium, which was built in the 1980s on the basis of a project by Le Corbusier dating from the late 1950s.

AFTER the Second World War, the U.S. government decided to commission the design of new embassies to renowned Modern architects (such as Gropius, for instance)², especially in Near Eastern countries that were beginning to become independent states. This policy was intended to underpin a series of political and cultural values that marked a difference from those of the society that took part in the war. The image of modern architecture chosen for the embassies was a clear sign that under North American protection all the benefits from Modern times would come. Until then, neo-classical style was most in favour: it was a style used in most public buildings that carried notions of respectability, security and stability. It was a style associated with the ancient Greek democracy, but also with Roman republican and imperial values: severe, imposing. "Modern Style", on the other side, indicated a shift from a past that was hard to accept. The lack of naturalistic decoration, and the use of white flat walls, indicated that new times

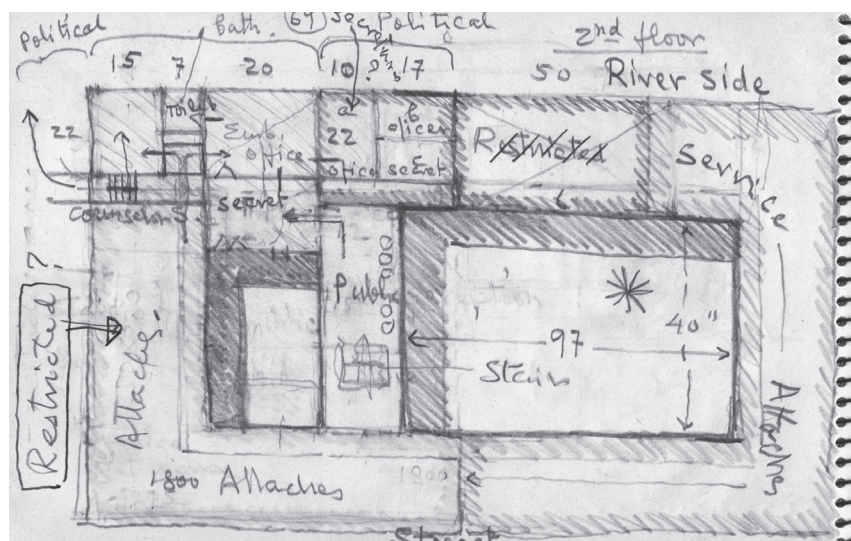
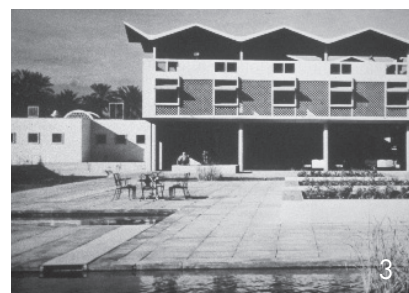
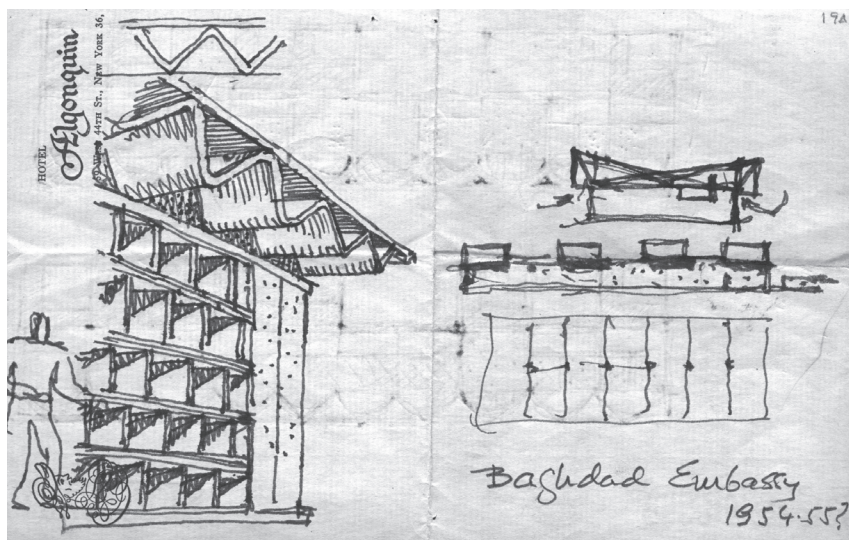




Figure 1. Chancery building sketch by **Josep Lluís Sert**.

Figure 2. Notebook sketch by **Josep Lluís Sert**.

Figure 3. Ambassadors Residence. Sert Archive at Harvard University, Cambridge.

Figure 4. Chancery building. Sert Archive at Harvard University, Cambridge.

Figure 5. Sert in Baghdad. Anonymous picture sent by Mouafaq Jawad Ahmed Al-Tai, Baghdad.

Figure 6. Amabassador's house. Photo by Ghada Siliq, 2011.

Figures 7, 8, 9, 10. Chancery building. Photo by Ghada Siliq, 2011.

were coming. It was the style of a house: a place where it was easy to enter, a space opened to everybody. And this freedom of movement was guaranteed by the North American government that was choosing a style which was not related to the past, any past. The freedom from the burden of classical conventions, shown in the new embassies built in the 50s, was a symbol of the freedom brought by the United States (meanwhile, the neo-classical style was heavily used by the Soviet Union). It was then that Josep Lluís Sert, a Spanish architect in exile and dean of Harvard University (an institution which, like the Ford Foundation, was close to the

republican government), was chosen to build the U.S. embassy in the capital of the new kingdom of Iraq, which emerged after the fall of the Ottoman Empire at the end of World War I and following the withdrawal of the United Kingdom, which then ruled what had been the cradle of Mesopotamian culture in ancient times (Iraq had been an English colony, under the control of the Secretary of State for India, even using Indian currency from 1918 until 1921—the city Basrah became an English colony even before, in 1914. It became a controlled monarchy, with a king, Faysal I, chosen by the Great Britain, until 1948 when Iraq became a totally independent country).

The new U.S. embassy was located on the right bank of the River Tigris in a sparsely populated, open area, as compared to the dense old city built of mud and wood in Ottoman times on the opposite bank. The right bank was much in favour of a new class that wanted to be free of the traditional values of the old and traditional city. On an elongated site, perpendicular to the river, with a small jetty, Sert built several independent blocks with different functions: the chancery, administrative offices, staff accommodation and the ambassador's house with adjacent lodgings for guests, distributed around a garden intersected by a narrow canal that

flowed into a pond from the river. Side canals, arranged like the veins of leaf, carried water to other parts of the premises, also dotted with areas of water, including a swimming pool for guests near the ambassador's house.

The design of the buildings, as the one of most of these embassies, was influenced by the climate which in summer is dry and extremely hot. Layers of latticework screening—which became the style of all American embassies in warm foreign countries in the fifties—were used and air spaces under the roof-top terraces were incorporated for ventilation. But the screens were used not only for climatic reasons but also because they were giving a “modern” look to the buildings. The division between walls and windows, opaque and transparent plans, closed and opened panels, disappeared. The screens were at the same time a closure and an entrance, and a structural and decorative element. However, the lax distribution of the buildings, scattered around the site, made it impossible for these to shade each other and create wind tunnels, which is essential in central Iraq (the layout of the central part of Middle Eastern cities is deliberately dense in order to create shaded pockets of cooler air, as it happens in the Shiite neighbourhood of Khadimiya in Baghdad, with a lace of lanes). The postulates of the Modern Movement, which conceived buildings as splendid isolated objects under the sun, located in green areas, suited (north and central) Europe well (and north-America too), but not cities like Baghdad with its harsh and excessively dry climate. The plan was not suitable for the functions of an embassy, as it was not for a so warm country as Iraq.

The U.S. government only occupied the complex designed by Sert for a few years. The unenclosed site and the scattered arrangement of buildings made surveillance of the whole complex difficult. Finally, in 1967, after the Six Day War between Israel and the Arab countries, the U.S. embassy was moved across the river to a new site. During the eighties and nineties, relations between the United States and Iraq broke down. Finally, after the end of the Second Gulf War and until the recent completion of a huge—but low—new embassy—a walled and almost invisible city within a city—the United States occupied a kitsch Babylonian palace, previously used by the former Iraqi President Saddam Hussein.

What happened to the complex following its abandonment by the United States delegation is still unclear. The destruction of records, the fact that the embassy is in the so-called Green Zone (a high security area, created by Saddam Hussein, in which government institutions, the homes of senior officials and presidential palaces were located, and

off-limits to the people of Baghdad—and this is still the case, which has forced Sert's work into oblivion, unfamiliar even to some high members of the U.S. military), and the dispersal of government staff in the times of Saddam Hussein, makes it impossible as yet to find out what the current situation is. The complex was transferred to the Iraqi government, which used it as the headquarters of the Ministry of Foreign Affairs between 1973 and 1983. Having been abandoned, the U.S. government finally handed over ownership of the property to the new Iraqi government in 2008, which ceded the buildings, but not the land, to Baghdad City Council. Then, the Barcelona City Council, which had begun a process of twinning with Baghdad, offered to restore the complex (those were the days when Barcelona was acting as a rich city managing and financing urban projects in third world cities or cities damaged by war or violence such as Gaza); the idea was to install a Cervantes Institute there, together with a pioneering centre for Baghdad studies, at the request of the mayor of Baghdad. Then, in 2009, there was even talk of moving the small Spanish embassy, located in the relatively safe Red Zone, to the Sert premises (for security reasons, the Spanish ambassador's house and the Spanish embassy in Iraq are located in the same building in order to avoid moves, which are still dangerous, in Baghdad). However, because of doubts about the implications for Spain's image in Iraq if old U.S. government buildings were occupied, the idea was dropped. The economic crisis and uncertainty about the final purpose of the complex (even if restoration was undertaken by the Spanish government, because, it seems, this does not imply a say in the use of the premises), has resulted in the postponement of any of the repair work so badly needed after years of neglect and the severe damage (which must be evaluated to see if it has affected the structure of any of the buildings) caused by a suicide bomb attack. Nowadays, the Iraqi government is using again some of the buildings for some second rate offices, while the garden, in a poor state, is a neglected parking lot, but no restoration has been undertaken. The administration is using the complex mainly as a storage space: for this reason, it does not spend any funds in any improvement, and it does not see the need to do so. The fact that no one knows what to do with the complex and what will happen to it is a good reason for letting it as it is. So the buildings are deteriorating rather quickly. This led some Iraqi authorities and experts to suggest in April of this year that Sert's work—evoking times they would rather forget—should be demolished. Even some well-known and respected north-American scholars, who have been against the war and the inva-

sion, consider surprisingly that the embassy, which for them is the worst building in Baghdad, should have been more heavily bombed, in order to tear it down without any moral problem. So, the future of the Sert masterpiece is in jeopardy. Not too many people consider that it has to be kept and restored.

For this reason, and as it is almost certain that restoration is still possible (it seems that there are no heavy structural problems, and that the destruction affects more walls and decoration that can be repaired), some architects at the University of Baghdad have appealed for help from abroad to generate reports and projects to halt the plans for demolition, which would suppose a serious loss not only for Baghdad, but also for the architectural heritage of the twentieth century, since the former U.S. embassy is possibly Sert's best work.

We would like to thank Dr. Josep M^a Rovira (UPC, Barcelona)—who has worked extensively on Sert, Dr. Khaled Al-Sultany, Dr. Caecilia Pieri, Mouafaq Jawad Ahmed Al-Tai, Octavio Learco Borgatello, the Spanish Embassy in Iraq (and the ex-Spanish ambassador, Excmo. Sr. D. Ignacio Rupérez), El Amana (Baghdad City Council), the Mayoralty of Barcelona (and most especially Manel Vila) and the Sert archive at Harvard University, Cambridge, Mass., for all the graphic and written documentation they have provided, and especially Dr. Ghada Siliq (Department of Architecture, Faculty of Engineering, Baghdad University), who, among other things, has been able to get a permission, so difficult to obtain, in order to visit the embassy.

Notes

1. Ph. D. Architect and Professor at ETSAB.
2. Loeffler, Jane C., *The Architecture of Diplomacy: Building America's Embassies*, New York, Princeton University Press, 1998, 2nd revised edition, 2010.

Returning to Center: Two Views of the Centro Internacional of Bogota (1959–1982)*

By Miguel Y. Mayorga¹ and Maria Pia Fontana²

In the present-day city, both the architecture and the quality of its urban spaces are key issues for defining urban strategies that are aimed at improving the livability in the city, in its new metropolitan state. Given the inevitability of the changes that the city itself demonstrates, implicitly and explicitly, a return to the center, to the places with relationships between men and things and with humanized space, offers a possible solution.

In this light, the Tequendama–Bavaria complex (1950–1982) within the International Center of Bogota is a center that reveals a series of urban values that may be used as reference points in the challenge of building a polycentric city and in the configuration of livable urban spaces. By analyzing different views since the origins of the city, we can appreciate the consolidation of a project based on the values of territorial and urban “mediation”, which are able to assemble rather than disperse, to integrate rather than segregate, invite rather than repel, and open up rather than close in.

Keywords: modern urban space; modern centrality; polycentrism; Centro Internacional, Bogota; Bavaria complex; Tequendama Complex.

1. The consolidation of a new, Modern center A bird’s-eye view: the area

“In Notre–Dame de Paris Victor Hugo inserisce una descrizione tipicamente moderna: Paris à vol d’oiseau. Il suo occhio, dall’alto di una delle torri della cattedrale, abbraccia dapprima l’intera città e la sua storia per scendere poi lentamente e coglierne singolarità, emergenze e dettagli più vicini. Alla fine di questo movimento cinematografico c’è come un sussulto, il timore che essersi tanto addentrato nel dettaglio rischi di “polverizzare” l’immagine d’insieme; se l’espressione non fosse anacronistica si potrebbe dire “la struttura spaziale della città”.

Bernardo Secchi. *Prima Lezione di urbanistica*.

Panoramic views produce a set of iconographic texts, fully autonomous from the written text, which document the morphologies of the sites, the urban structure, and architecture of the city, and also show their symbolic value depending on the date when the scene was viewed. As noted by Cesare de Seta (*Città d’Europa*, 1996), the iconographic source is a complex system of knowledge that depends as much on the source itself as an artifact with its own characteristics, as it does on the city it represents. In this way, we take in a privileged view of the panorama that leads our eyes to perceive them as single units: the city and the geog-

raphy, the layout and the land, the buildings and the open space, the urban space and the collective life, the symbolic values, and so on.

Aparicio Morata’s Bogota Urbanorama, which appeared in 1772, provided the first representation of the city of Bogota³, and it contained all of the elements necessary to understand the city with respect to its area and its symbolic elements [figure 2].

The city follows a linear structure in which all of the built elements correspond to an arrangement of longitudinal strips, tiered and parallel to the mountains, which does not correspond to the reality of the map but rather to how the city is perceived.

Additionally, to reinforce this image of a linear city, almost all of the taller religious buildings, with their steeples and towers, have proportions that have been altered to appear to be arranged along a single line⁴.

In periods such as the colonial one, which was dominated by pedestrian locomotion, religious buildings, gates, squares, roads, and intersections, the city structure was based on the relationship of superimposition and intersection between the geographical base and the urban designing. This promoted major focal points, for which territorial hierarchy has been reaffirmed over time. These points of geographic intensity, which are also centers of urban intensity, consist of what we can define as a linear polycentric system.

The subsequent connection of the city’s consolidated core with the new suburb in 1880 Chapinero by tram confirmed that the city was following a pattern of polycentric growth with linear but discontinuous development, which left a gap between the main center and the new north section of the city.

Finally, the emergence of car use in the 1950s produced a new adaptation of the form of the urban center that ushered in a new era of westernization in urban development while, at the same time, reinforced a strategic road intersection between the Carrera Séptima, the Carrera Décima, and the Avenida 26. This development led to a significant adaptive reuse and recovery of areas with obsolete uses (such as the Military School and the Bavaria brewery) and also generated the space for a new modern city center to be located [figures, 1, 3, 4].

During the 1950s and 1960s, major urban interventions occurred for the city in several areas and focal points that were determined either by their geographical and territorial location, or because they were strategic crosspoints between the road infrastructure and the geographical base of the city⁵. One of these is the Tequendama–Bavaria complex, located in the International Center, which was a new center that was brought about by the convergence of several processes in the city. These processes include: the strategic definition of the San Diego area as a new urban centrality and the subsequent formalization of its site (subdivision); the process of adapting the city to car use, with the consequent increase in the area of new road connections to the center and to the city periphery (urbanization); and finally, the process of substituting buildings by renewal or reconstruction along these transit roads, whereby the same type of high-rise buildings, composed of a horizontal “base” and a vertical “tower/block”, were systematically used; these type of buildings were used for architectural planning and the urban areas (edification)⁶ [figure 5].

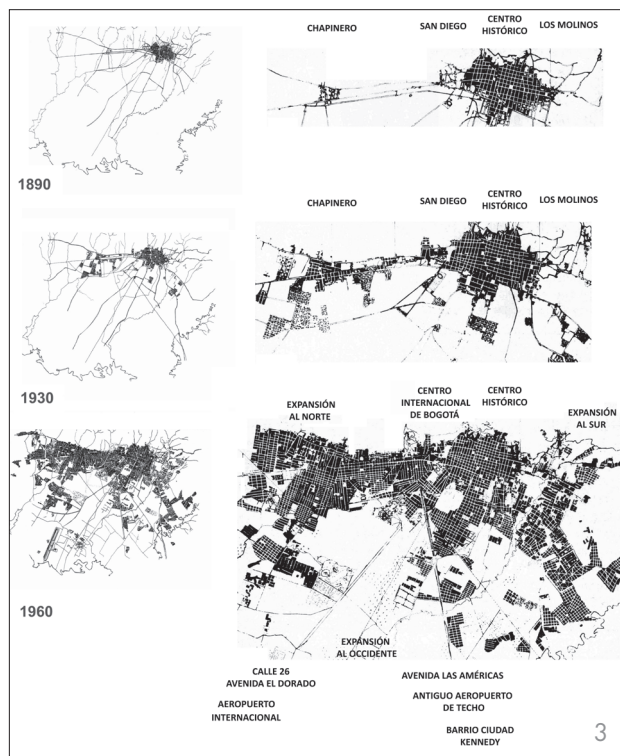
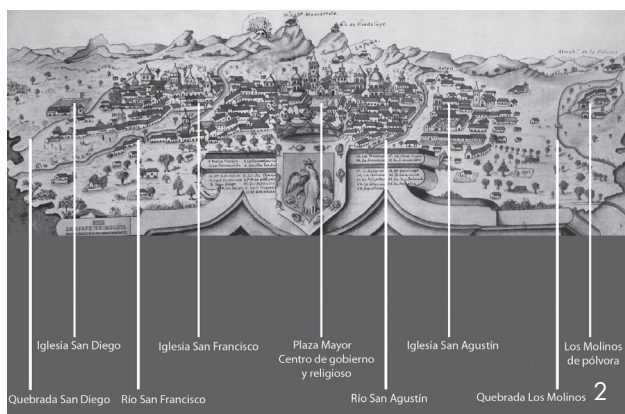
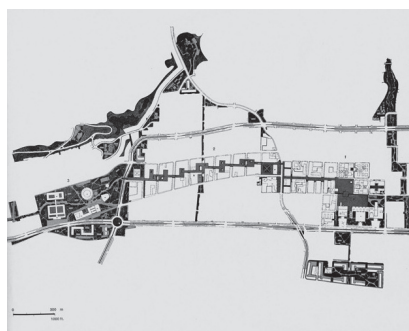
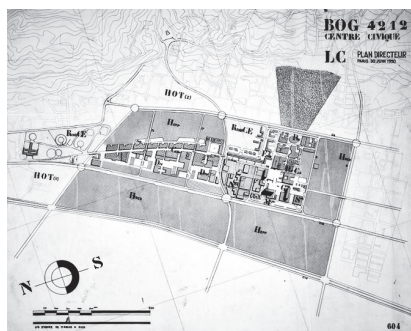
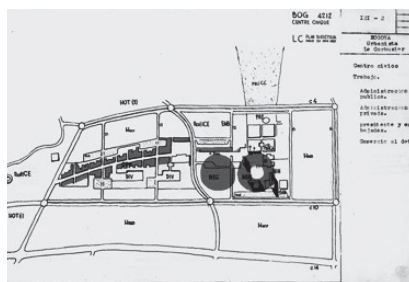
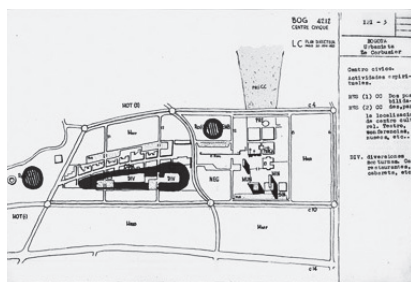


Figure 1. Holabird-Root-Burge, Cuéllar-Serrano-Gómez, Obregón-Valenzuela Tequendama-Bavaria complex in the International Center of Bogotá. 1950-1982: a current aerial view. Composed by the authors based on Google Earth, 2009.

Figure 2. Aparicio Morata, Urbanorama of Santa Fe de Bogotá. 1772: linear and polycentric structure of the colonial city. Composed by the authors based on image of Martínez, C. 1987.

Figure 3. Bogotá, urban growth: development of its polycentric structure until 1960. Composed by the authors based on image of Cartilla del espacio público, 1993.

Figure 4. Le Corbusier, Wiener-Sert, 1947-1951, Plan Piloto for Bogotá. Wiener-Sert and Le Corbusier, 1951-1954, Plan Regulador for Bogotá: linear structure of the centers of the Civic Center of Bogotá. (a,b) Plan of the civic center in: *Le Corbusier en Bogotá*, 2010. (c) Plan of the civic center in *Le Corbusier DVD*, 2010. (d) Plan of the civic center in Bastlund, K. 1967.





A new Modern center was thereby consolidated that strengthened the polycentric linear urban structure of the center, in a location with a high degree of accessibility, through an urban form based on an open order that blended uses and activities.⁸ On the other hand, the high-rise buildings gave the city a new three-dimensionality, and the multiple variations in the type of edification, and the possibilities of the relationships among them, allowed a new configuration of the urban spaces [figure 6].

In a 1966 conference, delivered at the Royal Institute of British Architects in London⁷, the architect Josep Lluís Sert drew attention to the importance of the distant view as a way to refocus a building, and to identify its basic parts and the elements necessary to raise primary relationships with the ground, against the sky and each other. A photo taken from the plane of Saúl Orduz [figure 6] exemplifies one of the distant views that Sert referred to: it allows us to identify the entirety as a unit, in an environment still unbound within an area of new opportunity for the city, while at the same time allows us to recognize each of the buildings, their specific configuration, and some of the relationships established between them [figure 7].

2. The consolidation of a modern urban space: complexes, buildings, sections, and relationships.

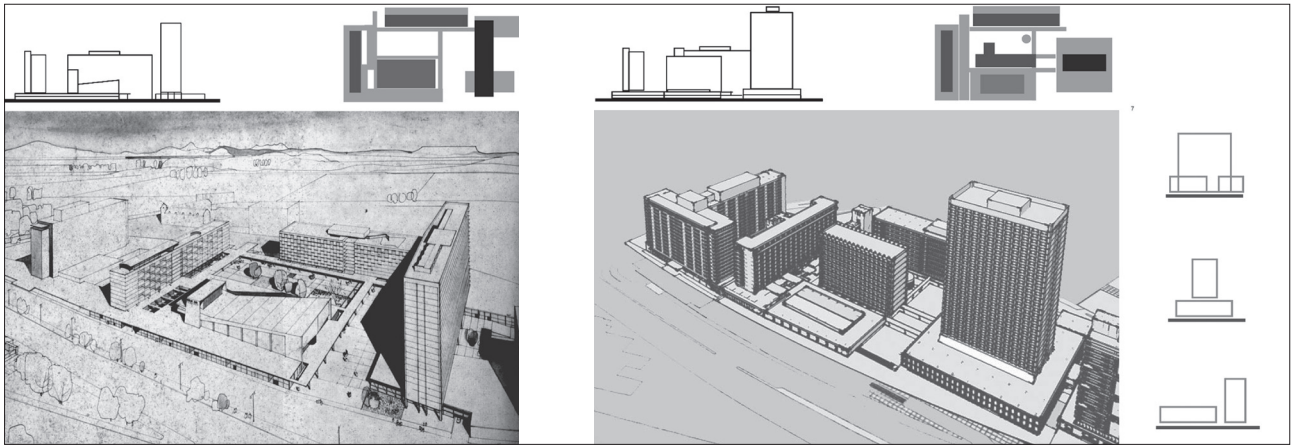
The sidewalk view: the details

The Tequendama-Bavaria complex occupies a block that consists of three plots; however, we will refer to the two major sub-areas, which we term the Tequendama complex,⁹ which occupy two sites, and the Bavaria complex.¹⁰

Figure 5. Holabird-Root-Burge, Cuéllar-Serrano-Gómez, Obregón-Valenzuela, Tequendama-Bavaria Complex, Centro Internacional de Bogotá, 1950-1982: Urban relationship of the complex (composed by the authors based on Google Earth, 2009) Construction of the complex (composed by the authors).

Figure 6. Aerial view. High-rise buildings and the urban transformation of the historic center of Bogotá. Photo by Saúl Orduz, 1960s, Museum of Bogotá.

Figure 7. Aerial view. Tequendama and Bavaria complex. The new modern center. 1970s Museum of Bogotá. Photo by Saúl Orduz, 1960s, Museum of Bogotá.

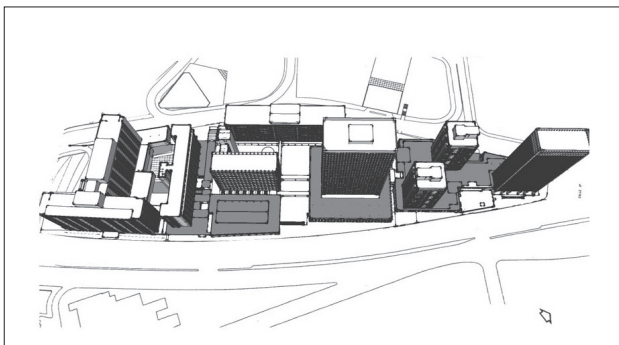


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The Tequendama complex, which comprises 5 buildings, has undergone a long and complex construction process that began in 1950 with the Hotel Tequendama and ended in 1982 with the Bache Residential building (now Tequendama); it arose from an initial draft of the complex from Cuéllar-Serrano-Gómez.¹¹ During the development, the project was modified in both its composition and its form, such as in the orientation of some of the buildings. Nonetheless, the basic approach of the project was maintained, based on some of the following invariants: the layout of the buildings in relation to the public open spaces that link the buildings to each other, various types of urban and architectural elements (e.g., pedestrian streets, plazas, public stairs,

gazebos, and projections); the arrangement of the buildings around the lot perimeter, with the foundations aligned with respect to the lot perimeter and the streets layout; and a consistent use of the same type of high-rise buildings—consisting of a horizontal base and a vertical tower/block—with multiple urban variations and combinations¹² [figure 8].

In contrast, the project for the Bavaria complex was carried out in a single phase. The area consists of three high-rise buildings, two which are residential and one which contains offices, and a horizontal base section that is commercial and contains offices. Different versions of the project were applied: a study was proposed in January, 1962, an initial draft in March of the same year, and then some in-

termediate versions and ground floor studies were developed prior to finalizing the draft in November 1962¹³. Some invariants were maintained throughout the project development: the organization into two principle areas—residential and office space—connected through the horizontal base; occupancy of the entire perimeter with the horizontal base; a connection with the environment by three transversal access spaces; and group of business premises around the entrance lobbies of the three higher towers [figure 9].

In the Tequendama complex, public and collective spaces are related through the horizontal base by the presence of an exterior “plaza”, while in the Bavaria complex, these spaces are located inside of the horizontal base. Both cases clearly illustrate an intervention strategy that is based on a logical compatibility between the different parts—that is, the connection, the union, and the transitions between the buildings—by resolving the relationship between horizontal bases, ground floors, open spaces, and circulation spaces. An approach was taken in which the design of the building limits, or the edges of the complex, was set as a “mediation” of varying thickness; this achieved an interface between exterior and the interior, using urban squares, plazas, public, semi-public, or semi-private spaces, community spaces, open ground floors, galleries, lodges, balconies, terraces, gardens, and so on. These are relational spaces that allow integration, transition, and union between the parts, providing an overall environmental system that is the basic requirement for quality urban livability [figure 10].



Figure 8. **Cuéllar-Serrano-Gómez**, Tequendama complex, *Centro Internacional* of Bogota, 1950–1982: comparison of the initial and final projects for the Tequendama complex. Schematics relationship between the parts of the complex. Preliminary view in *L’Architecture d’Aujourd’hui*, 1958. Current perspective and schemas (composed by the authors; 2009).

Figure 9. **Obregón-Valenzuela**, Tequendama-Bavaria complex, *Centro Internacional* of Bogota, 1950–1982: initial project and the final construction of the project for the Bavaria complex, and the schematics of the relationship between the parts of the complex. Proposed model in: *L’Architecture d’Aujourd’hui*, 1958. Photo by Saúl Orduz, Museum of Bogota; Perspectives and schemas (composed by the authors, 2009).

Figure 10. **Cuéllar-Serrano-Gómez, Obregón-Valenzuela**, Tequendama-Bavaria complex, *Centro Internacional* of Bogota, 1950–1982: urban relationships incorporated into the ground floors of the Tequendama and the Bavaria complexes using diverse solutions. Photos by Germán Téllez, 1970 and Paul Beer, 1965. Museum of Bogota.

Figure 11. Bogota, 2010. Territorial dispersion, urban segregation, and spacial disconnection in the present-day city. Photo by Rudolf.com and Skycrapercity.com.

Figure 12. **Obregón-Valenzuela**, Bavaria Complex, *Centro Internacional* of Bogota, 1963–1965: mediation urban space. Photo by Paul Beer, 1965. Museum of Bogota.

3. Epilog: Returning to the Center

The current image of the city of Bogota, especially in its vast zones of sprawl, reminds us, and many others, of an open city, widespread and disorganized, a city that is vast and diffuse at the territorial level, that has converted itself into a dispersed and fragmented system. Here, the relationship between the center and the periphery is blurred by connections of the transit systems, which are interspersed conurbations between urban and rural, and in which multiple “centers” and peripheries are interspersed. And where the new city centers are in fact monofunctional, specialized polarities, which are moving away from the idea of an “urban center” that is understood as a symbolic reference space for meeting and socializing, characterized by its mixed uses and with the ability to attract and sustain group urban dynamics.

On the other hand, at the urban level, once there is a greater independence of the “architectural object,” with more specialized functions, an autistic

and segregated infrastructure, and an isolation of open spaces, a city will be built in which the buildings are largely disconnected with respect to their environment but rather linked almost exclusively to the flow of traffic and communication, resulting in communal and private waste space. This results in an accumulation of systems, urban elements, and material for which the "mediation space" between the buildings, including parts of the city and the geographic basis, are almost entirely eliminated [figure 11].

Faced with these processes of deconfiguration that are characteristic of the present-day city, it is highly useful to refer back to urban centralities and groups of buildings, such as the Tequendama-Bavaria complexes in Bogotá. For those for which the projects have been rescued, weight has been given to such fundamental issues as the configuration of centers and livable urban spaces, constructed from the values of territorial and urban "mediation", incorporating spaces that are capable to assemble rather than disperse, integrate rather than segregate, invite rather than repel, and open up rather than close in (Gehl, 1971) [figure 12].

* This article refers in part to the following doctoral theses which is currently being finalized: *El espacio urbano Moderno*, M.P. Fontana, ETSAB-UPC; and *Espacios de Centralidad urbana y redes de infraestructura*, M. Y. Mayorga, ITT-UPC.

Notes

1. Miguel Y. Mayorga is Professor of Urbanism at UPC.
2. Maria Pia Fontana is Professor of Projects at UdG.
3. Marcela Cuéllar, Germán Mejía, *Atlas histórico de Bogotá*, Bogotá, Editorial Planeta Colombiana, 2007.
4. "Its purpose was actually to demonstrate to the king that the viceroy's capital of New Granada was a city that was ordered, Catholic, dignified, and richly constructed. If this was the author's purpose, some license might easily have been taken." Marcela Cuéllar and Germán Mejía, introduction to *Historical Atlas of Bogotá*, Bogotá, Editorial Planeta Colombiana, 2007.
5. The pilot plan of Le Corbusier (with Wiener and Sert as consultants) was being developed for Bogotá in these same years (1947-1951). This was part of a global assessment of the city which proposed a system of parks and green corridors that would structure and reconnect with their environment and their geographical setting. Additionally, the plan incorporated a "new", extended civic center for the central area, to be organized and structured along the Carrera Séptima in several centers located at major intersections formed by the rivers and the main roads parallel to the mountains. In their later proposal for the Regulatory Plan for Bogotá (1951-1953), Wiener and Sert (with Le Corbusier as a consultant this time) proposed some overall important changes with respect to the proposal of Le Corbusier (Hernandez, 2004). However, in the central area of the city, which is our specific area of interest, both projects had a similar premise at the level of urban structure, namely, using main central areas, with correspondence to the Plaza

de Bolívar, the Santander park, and the San Diego area, linked to green areas and structured by a road system parallel to the longitudinal ridges. The civic center of Bogotá was presented at Hoddesdon in the CIAM VIII in 1951, dedicated to The Core of the City as "the element that makes a community a community and not merely a casual aggregation of individuals", in the words of S. Giedion.

6. In this case, the urbanization process of "subdivision + urbanization + development" is carried out in an almost unified manner, following the manner of building up the city by urban complexes. From Solà-Morales, Manuel, *Las formas del crecimiento urbano*, Edicions UPC, Barcelona, 1997
7. Hotel Tequendama (hotel and commercial); 2. Bochica building (commercial and offices); 3. residential building Tequendama (hotel and commercial); 4. Bavaria complex (commercial, residential, and offices); 5. Bachué building (commercial, entertainment, and offices) 6. Bachué residential building (presently the Tequendama; commercial, hotel).
8. Sert, Josep Lluís, "Opiniones cambiantes sobre el entorno urbano," *Cuadernos de Arquitectura y urbanismo*, n. 93. Nov. - Dec. 1972, 45.
9. The Tequendama complex is composed of the following buildings: 1. Hotel Tequendama. 1950-53, Holabird-Root-Burgee and Cuéllar-Serrano-Gómez, ETAPA 1 and extension, finalized in 1960, Cuéllar-Serrano-Gómez ETAPA 2 (hotel and commercial); 2. Bochica building. 1952-1956, Cuéllar-Serrano-Gómez (commercial and offices); 3. Tequendama residential building. 1957-62, Cuéllar-Serrano-Gómez (hotel and commercial); 4. Bachué building. 1964-66, Cuéllar-Serrano-Gómez (commercial, entertainment, and offices); 5. Bachué residential building (presently the Tequendama). 1978-82, Cuéllar-Serrano-Gómez (commercial and hotel). The entire block, which also includes the Bavaria complex, is presently called the *Centro Internacional* Tequendama. However we thought it important to identify and separate the two areas of the complex, to explain each of the specific forms of organization.
10. Bavaria complex, 1962-1965, Obregón-Valenzuela; Pizano-Pradilla-Caro (commercial, residential, and offices). This is a project composed of two residential towers and one office tower, related to each other through a commercial horizontal base.
11. The proposal was published in the journal *L'architecture d'aujourd'hui*, number 80, 1958.
12. These variations are found in the different buildings that form the complex: the horizontal base composed of sections fit into the block, in the Hotel Tequendama; three variations of a block superimposed on the base found in the Bochica building, Edificio Residencias Tequendama residential building, and the Bachué residential building (currently the Tequendama); and finally, a block offset with respect to the base in the Bachué building.
13. Archive Obregón-Valenzuela. Archivo Distrital, Bogotá.

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Architecture in Sudan: The Post-Independence Era (1956–1970)

Focus on the Work of Abdel Moneim Mustafa

By Omer S. Osman¹, Amira O. S. Osman² and Ibrahim Z. Bahreldin³

THIS article is part of a study on the Sudanese social and political context during the formation of the Modern Movement and the manifestations in built form and spatial expression during the period 1900–1970. The study has been on-going for several years and includes a literature search, local surveys (of unpublished and undocumented information) as well as photographs taken by the authors, sourced from architects or published material. It is argued that the Sudanese response to the International Style was in fact early experimentation in critical regionalism.

The most notable architectural heritage in the Sudan are the archaeological remains at Kerma and Napata as well as the remains of ancient Meroe about 180 km north of Khartoum. These cultures demonstrated sophistication in building materials and construction techniques. Due to climate changes, political changes and religious changes over a large stretch of time (642AD with the signing of the Bagt Treaty–1898 at the demise of the Mahdist era) the qualities of the built environment became more transient and rudimentary in character with a greater focus on manifesting tradition through body images, clothing and rituals that were not necessarily tied to a particular physical location rather than through monuments. With foreign interest in the strategic location of the Sudan, and as a part of the scramble for Africa, came specific stylistic and technical manifestations.

Stylistic and Technical Manifestations: the Influence of the Foreign Invaders

Periods in history perceived to have influenced the development of a Sudanese modernism range from the Turkish era, through the Mahdist era and the British Egyptian rule in the Sudan till independence. There was significant focus on construction during the Turkish/Egyptian era of 1820–1882 which gave the central region its spatial and physical identity. Khartoum is representative of that era in layout and by virtue of certain iconic buildings. The Mahdiya state established in 1885 led to the development of Omdurman in a unique manifestation of a typical pattern of Sudanese Urbanization. Settlement patterns revealed a dynamic relationship between the Mahdist government policy, traditional practices and social interaction. Condominium forces, led by General Kitchener, defeated the Mahdist army in 1898 and found the

country in ruins due to fighting off foreign invaders, lack of sustained economic activity and political instability. Local construction expertise and building practice had suffered. However, industry was flourishing in Europe, from which the dominant invading forces originated, where the architectural arena was bustling with new ideas and a new Middle Class was campaigning for better housing and more humane working conditions. Thus 2 cultures and vastly different conditions met due to the invasion of Khartoum.

Several architectural movements in England in the late 19th century were oriented towards the abandonment of classical approaches. Ebenezer Howard published his book *Tomorrow: A Peaceful Path to Real Reform* in the same year of the invasion of Khartoum 1898. Howard advocated the creation of garden cities of limited size, combining the merits of the urban and rural life—some features of his “ideal” plans are a rectangular grid and

diagonal arteries which had immense influence on his contemporaries. Kitchener’s plan for Khartoum (consolidated by McLean in 1912) was influenced by the trends in England at that time—working on layers of the city established by the Turkish administration before him.

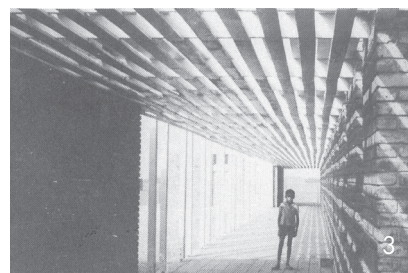
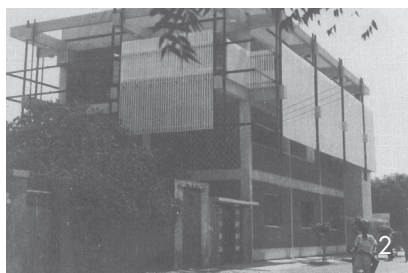
Kitchener appointed Gorringer who went on to design a variety of large public buildings fronting on to the Blue Nile. Calling himself ‘Eureka’, Gorringer described his work in *Building News*, 1902, under the heading ‘A New Style’. Inexperienced as he was, Gorringer, with his ‘New Style’ approach, set the ground for the subsequent introduction of the Modern Movement to the Sudan. His buildings showed Islamic features of Byzantine legacy such as sandstone courses sandwiched between load-bearing brick and pilasters integrated into the external walls with small balconies in between and plaster mouldings made of a mix of sand and slurry of Gum Arabic. Building techniques were commonly used in the buildings in Khartoum and other provincial capitals during condominium rule were reinforced concrete slabs, supported on mild steel I-sections on the roofs, and good quality bricks and roof tiles that were produced at Soba. Other features were symmetrical plans—similar to British colleges and public buildings at the time and eclectic inclinations borrowing from Gothic or Romanesque vocabularies. The plans of Gorringer’s houses have had substantial effects on later domestic Sudanese Architecture.

All Saints Cathedral (1909–1912) designed by Robert Weir Schultz Weir also went on to influence the future of architectural practice in the country—Weir’s buildings were characterised by simplicity of form and detailing and use of local materials. With these and budgetary constraints, Weir was able to develop distinctive and highly appreciated building forms.

A new form of architecture developed during the recession years around 1929 which included composite structural frames of mild steel and reinforced concrete slabs. The first reinforced concrete frame building in the country, and the first building with a basement – was designed by Stefanidis, a Greek contractor who came to Sudan in 1948. The horizontal concrete shading elements that he introduced were a novelty at the time.

Post-independence Construction Industry in the Sudan

The year 1950 marked an important turning point in the economy of the country due to unprecedented high yields of the Gezira cotton harvest for the season. The construction industry also benefited from Atbara Cement Factory (400km north of Khartoum) which started its production of



Portland cement of a high quality in 1948. This affluence came as saviour for the colonial regime. The government had come under strong pressure during the recession due to demands for education and health care—perhaps a cover for the real agenda— independence and self-rule as people saw education as a priority in the attainment of sustainable independence. So to address the need for numerous new buildings and construction projects, the British supplied engineers in most cases, but builders were mostly recruited from Egypt. Thus transformation of the construction industry was achieved.

The political turbulence that followed the 1956 independence delayed progress in almost every aspect of life. Rebellion had already irrupted in southern Sudan in 1955 – becoming one of the longest running civil wars in history. Consequently most developmental plans were brought to a total standstill. Under such conditions, the new regime saw as its main role the integrity and unity of the country – many times at the expense of development. The first Sudanese Prime Minister declared a telling motto that defined the priority of his government: “to liberate and not to construct”.

Under such conditions, the construction industry in the public sector was one of the areas that suffered most during the first four years of independence. However, the private sector continued to build small-scale projects such as family homes, two-storey commercial buildings and minor light industry projects—many having minimal architectural significance. Nevertheless, several government units had inherited unfinished jobs that could not be terminated abruptly. British engineers were given the choice of keeping their jobs with new contracts or cashing their after-service benefits and quitting the country—most opted for the latter option. The Sudanese Public Works Department included a construction division responsible for designing or reproducing architectural drawings, proposing construction specifications suitable for the country and initiating building by-laws and regulations. The early staff of the Public Works Department were British, Egyptian or Syrian. However, the great depression that hit the country in the 20s forced the government to send most of those experts back home.

The Emergence of the Architectural Profession in the Sudan

As need for local replacement was accentuated, extra efforts were made for training for Sudanese to take over from the foreign officials. The pioneers who shaped the newborn engineering profession were Mirghani Hamza (1895–1973) and Hassan Atabani (1916–1997). Atabani became the first Sudanese architect at the Department. He later became the Chief Architect in 1950 and also held the office of an Honorary Corresponding Member of the RIBA in the Sudan.

Gordon Memorial College developed to encompass several professional colleges, one of the first being the College of Science and Engineering which recruited its first batch in 1940. In 1947 the Gordon College was upgraded to a University College in a special relationship with the University of London, awarding University of London external degrees. After independence in 1956, the University of Khartoum appointed Alick Potter, who then recruited four second-year engineering students to join the new Department of Architecture in 1957. Abd ElMoneim Mustafa joined the staff of the architecture department at the University of Khartoum in the mid-sixties and was the first Sudanese national in such a post.

By 1961, the Khartoum School of Architecture graduated its first batch. The first architectural practice in Khartoum, that of Peter Muller, attracted the top two graduates: Omar El Agraa and El Amin Mudathir.

Seeds of Modernism: Influential Architects, Planners and Practices in Sudan

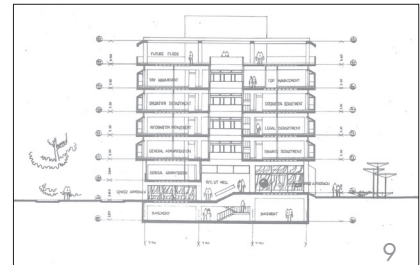
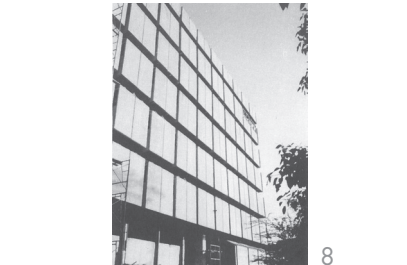
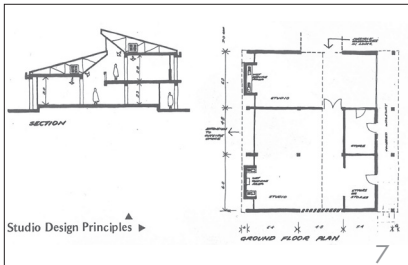
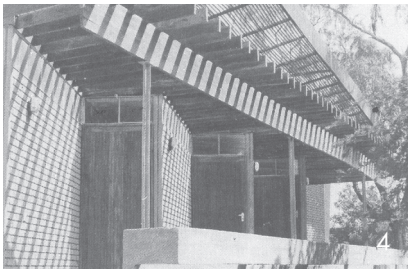
Peter Muller, an Austrian architect, designed and executed some of the most outstanding architectural projects of the early post-independence era. Despite the severity of 6 years of military rule (1958–1964), the construction industry as well as architectural practice did well during that period. The military regime managed to attract funding from the American Aid Programme which focussed mainly on the field of technical education. Muller designed the Senior Trade School (1962–1964)

which expressed architectural authenticity through reinforced concrete frame structures, free plans, free façades and wide windows. Unique roof shading not only added dynamic visual impact but was also able to create a good response to the prevalent climate. Many of Muller's buildings were built by local builders using mostly local building materials. His plans, while innovative, had much in common with Gorrings's plans. The focus on transparency and lightness, maximisation of natural daylight rendered his contributions prominent examples of the architecture of the 60s which had immense impact on the Sudanese architectural scene. Pure, functional, dynamic, transparent and embellishment-free forms were a source of inspiration and admiration for generations of young architects and architecture students, many of whom had the opportunity to get training in Muller's office or on his building sites. The heritage remaining from that practice is still evident.

During the early years of independence, the national government became aware that, the capital needed a Master Plan to replace Kitchener's plan of the city. By 1958, Doxiadis, the renowned Greek town planner was requested to propose a comprehensive town plan for Greater Khartoum.

Following the directives of Doxiadis' Plan, the first qualified Sudanese town-planner, Salah Mazari, prepared the detailed plan for the new housing extension of Khartoum city comprised of about fifteen hundred house plots. The municipality of Khartoum issued new building by-laws and regulations which specified the percentage of the plot area to be built, the materials used and most important, the plans must be prepared by a qualified architect or engineer-architect, referring to the civil engineers who were trained in the construction division of the PWD.

A major aspect of the new plan was the new residential townships proposed as extensions for all three cities of which the capital Khartoum is composed. Khartoum New Extension came as a blessing for the new-born profession. It provided a testing arena for new architectural ideas and construction methods. The great construction boom thus initiated, created a great demand for the service of architects. Four architects who were educated at Lester were



lucky to come back at the apex of that demand. They all had opportunities to explore the relevancy of the knowledge they acquired in Britain to their home land. Two of them; namely, Abdel Moneim Mustafa and Hamid ElKhawad, were able to distinguish themselves through authentic design approaches. Most of the residential designs that each of them started with immediately after they returned, still stand as models of adaptation of the ideas of the Modern Movement to a tropical environment.

H.E. Kramel described the dominant architectural character of Khartoum extension in the following passage: "...the search for a new residential architecture at this phase has never had as its objective a traditional revival or local continuity. The current impact of the international style and its tropical adaptation by European architects in Africa, Asia and Latin America has been so pervasive that for all intents and purposes it has set both the vocabulary and the structure of residential architecture of Khartoum for this phase. The most obvious manifestations of the international style in the residential architecture of Khartoum can be summarized in five points:

- Disappearance of the veranda and the porch as distinctive and characteristic semi- enclosure in the house space composition
- The emergence of the enclosed central living hall as the main family living area. In most designs it was flanked by other spaces (bedrooms, guest reception salon, bathrooms and kitchen).
- The central hall, of an open type is, in fact of Mediterranean origin initially used in Khartoum by Greek and Italian residents;
- The tendency towards a more compact building form with abrupt juxtaposition of the outside space and the inside space i.e. unroofed space and roofed space.
- The inclusion of the kitchen and the bathroom as

integral elements in the building block to achieve a compact form and an integrated composition. The excessive use of concrete, glass, and hence, air cooling and air conditioning."

(Kramel, 1995, p40-41)

While some characteristics of the new architecture represent progress, in the later years, some adopted design and building forms were not so desirable as deviation from climatic considerations became more and more apparent. These are unfortunately the characteristics of many buildings in the Sudanese capital today and have affected even the buildings in smaller towns and cities throughout the country, making them thermally uncomfortable, spatially inappropriate to meet the socio-cultural demands of the society and environmentally inadequate due to the reliance on mechanical cooling.

Abdel Moneim Mustafa's role in establishing a Sudanese Modern Architectural Language

While both Moneim and ElKhawad had their own distinct styles, there are certain common features in their designs. The most obvious of these are purity of form and honesty of expression. They both used reinforced concrete frame structures and red-brick infill walls. Moneim tended to clad the external walls in coloured cement/sand

Figures 1, 2. The interplay of voids and solids in two private houses. Scans from office pamphlets.

Figure 3. Rural primary school, Elturabi village. Scans from office pamphlets.

Figures 4, 5. Lecture theatre, Khartoum University. Scans from office pamphlets.

Figure 6. Omdurman University campus. Scans from office pamphlets.

Figure 7. College of Fine and Applied Art. Scans from office pamphlets.

Figures 8, 9. Arab Bank for Economic Development.

Figures 10, 11. Nifidi and Malik mixed use developments in Khartoum.

bricks and to extrapolate the regular and smooth forms of the bricks to produce decorative relieves. Furthermore, he used to introduce additional features through interplay of voids and solids and by inserting delicate projections in the cladding surfaces [figures 1, 2].

He also attempted to integrate the buildings and their plot by reducing the visual dominance of the boundary wall. Following in the tradition established by Weir, he focussed on the use of indigenous materials and forms of construction attainable by Sudanese contractors and also reflected structural systems in his built forms. By optimum orientation

he was able to achieve maximum shading and good natural ventilation. By designing and building more than 40 private houses in the three towns of Khartoum, Bahri and Omdurman (Greater Khartoum) the practice left a clear imprint in people's minds with regards to residential styles and this influence continues till today.

In addition to the numerous private villas that Moneim designed in the early years of his career, he also worked on other building types. The rural primary school he built in Elturabi village 75 km south of Khartoum completed in 1967 is a unique as both the plans and the superstructure of the school are striking in their simplicity and functionalism, yet still manage to achieve a strong and memorable visual language and presence through shading strategies and strong emphasis of the circulation routes [figure 3]. Innovative technical developments in the school included the use of a type of Vierendeel beam in the foundations to overcome unstable soil conditions.

Moneim also collaborated with other architects, one of them being Rimner of the University of Khartoum in the design of a lecture theatre on campus completed in 1970 [figures 4, 5]. The contrasting lightness of the steel structures and the roof are used with visually heavier brick panels, a juxtaposition of elements that distinguishes this architect's work. The layered language of the façades and deep overhangs are very important for protection from the heat and excessive glare that can be experienced in this particular climate. These elements are also used to scale down the large building.

Moneim also collaborated with Ayoub and Omer Salim Architects in the design of the Omdurman University campus [phase 1 – built, figure 6] and the College of Fine and Applied Art [unbuilt, figure 7]. The logic and order of the planning as well as the spatial qualities aimed to have influenced architects and architecture even though the developments have remained conceptual to a large extent. The completed buildings for the University of Khartoum's Faculties of Agriculture and Engineering respectively again rely on layered façades and horizontal panels for shading.

The most distinctive Moneim landmarks are perhaps the headquarters of the Arab Bank for Economic Development [figures 8, 9] and the Nifidi and Malik mixed use developments in Khartoum [figures 10, 11], both by virtue of their respective locations but also because of the strong imagery and scale. The bank, completed in 1980, is a box, albeit an interesting one due to its proportioning and spatial qualities of its section. In addition to its simplicity, the bank was also unique at the time for its panel cladding and a resistance to emboss traditional building idioms onto the building.

The staggered façades of the Malik building still maintain a distinctive presence in the centre of the city. The formal response to the urban scale and orientation has created a visual language that is highly relevant and outstanding. Brick panel and beams of the Nifidi building as well as the horizontal timber panels on the balconies became fixed features in many Khartoum buildings for many years. These types of apartment blocks, with rentable shop space at the bottom, came into appearance in the 60s and 70s and are still common in Khartoum.

Concluding remarks

By the end of the 19th century, and after the Mahdya regime, Sudan was very detached from the architectural developments in the rest of the world. Moreover, it was equally detached from scientific and artistic knowledge beyond its closed borders. Due to various other factors—such as religious changes, foreign occupation, climate changes, the lack of wealth and natural resources, and political changes—there was a lack of continuity of the rich architectural heritage that was prevalent in the earlier historical eras of the country.

The arena was thus set for accepting the ideas that the invading forces of the condominium regime intended to introduce. There was little opposition to the built forms of the colonizers or their construction methods. At the time, the Modern Movement was well under way in England as well as in most European countries, therefore influencing colonial architects who had free reign to experiment and shape the practice as they wished.

Coupled with all the above mentioned factors were the limited funds available, the limitation of choice in building materials and the rarity of skilled labour. The architects had to prove themselves within the constraints of all those factors. Thus, whimsical features were abandoned in favour of a more pragmatic approach, in the process satisfying some requisites of the Modern Movement. This situation demanded simplicity of plan forms and adaptation to prevailing weather conditions. The shallow plan extending along the east/west was an intelligent device to offset the extreme heat and to provide day light. While the architecture was clearly influenced by the Modern Movement, it also then developed with an appreciation for regional factors that make it unique to the Sudan and other contexts with climatic, political and historical similarities in Africa.

Abdel Moneim Mustafa and his practice played a key role in the development of this trend by building on existent heritage up until that time. They therefore had much influence on architecture for many years. These gradual developments of a Sudanese

regional architectural language may have been completely severed the complete political and cultural isolation of the Sudan starting in the mid 80s and the consequent opening up of the country following the new-found oil wealth in the 90s—which brought with it foreign interests in the country, foreign materials and an alternative language and scale of buildings. That, however, is a topic for another discussion.

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Notes

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Most images are scans of office pamphlets sourced from Monim's practice.

Visionary Prefab in the Modern Age: Deconstructing Keaton's Films

By Cristian Suau¹

THIS essay analyses Buster Keaton's masterpieces: *One Week* (1920); *The Haunted House* (1921) and *The Electric House* (1922). His filmic work reveals the montage of mass housing prefabrication in the Modern Age in the United States: repetition and mechanisation of the building production; generic layouts; and modular like-catalogue constructions. Rather than following a sequential building process, these cases are executed as mere accidents or flaws. Buster Keaton's films however show ironically a non-standardized architecture.

This study analyses and compares Keaton's film production with *Catalog Modern House*,² a prefab dwelling manufactured and shipped by Sears, Roebuck and Co³ in the 20th century.

Keaton's Houses: Living Systems in Motion

"Nearly every American house I've lived in has long ago been demolished to make room for some other building. There is a delicious (though painful) paradox here: Americans long for stability, but all they get is stationary impermanence. No wonder then many of us long to become permanent nomads, snails with houses on our backs, Touareg tribesmen, and Gypsies". Poet Andrei Codrescu.⁴

The limits of architecture flow between what is stationary and what is in motion. What happens to architecture when foundations are removed? To investigate this question, it is useful to look at the origins of prefabricated houses. Beside what the architectural scene has written about the failure of prefab systems, the fact is that these constructions

have succeeded. Luckily architecture is not yet commodity but art.

Nowadays proceeding on the assumption that social change and a change of residence are closely correlated, post-modern sociologists aim to gain an understanding of societal trends such as *pluralisation* and *flexibility*, and thus to draw recommendations about future housing requirements. Living in motion indicates that modes of housing are becoming visibly pluralised, moving away from canonical models towards a new type of *content-design* mobility. As classic models of nuclear families erodes, new housing forms are emerging that offer new flexible ways of living.

Keaton was a visionary *architect*. As an organiser

he was obsessed with the idea of capturing the Modernity of domestic life mainly by the house as a kinetic lab. In order to illustrate this let us consider some key examples. *One Week*, is a short-comedy film written, directed and performed by Keaton. Many special effects are employed were filmed as they occurred and were not the result of model work.

The story involves a couple, Keaton and Seely, who receive a build-it-yourself house as a wedding gift. The house can supposedly be built in one week. A jealous party secretly re-numbers the packing boxes containing the house parts. The movie recounts Keaton's struggle to assemble the house according to this new random arrangement. As if this weren't enough, Keaton finds he has built

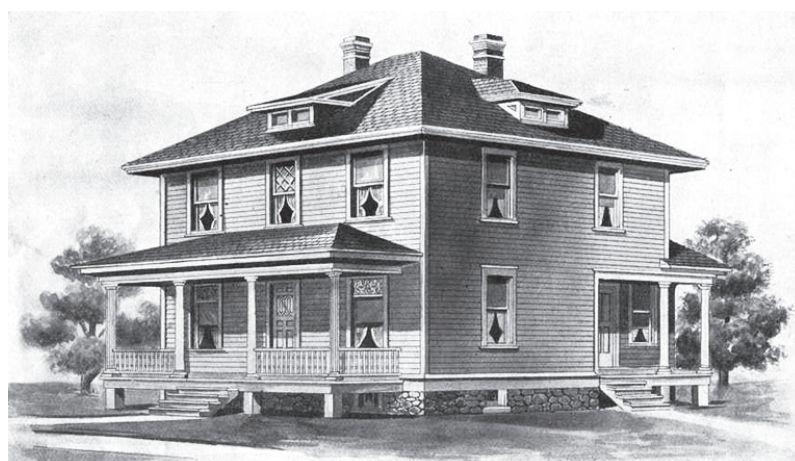


Figure 1. Keaton versus Sears Modern Home: while Sears factory was manufacturing and shipping catalogue houses like Modern Home 102; Keaton was building his 'customized version' of a similar mail-order Modern Home in the film *One Week*. Sources: <http://www.archive.org/details/OneWeek> and Sears Archives, <http://www.searsarchives.com/homes>

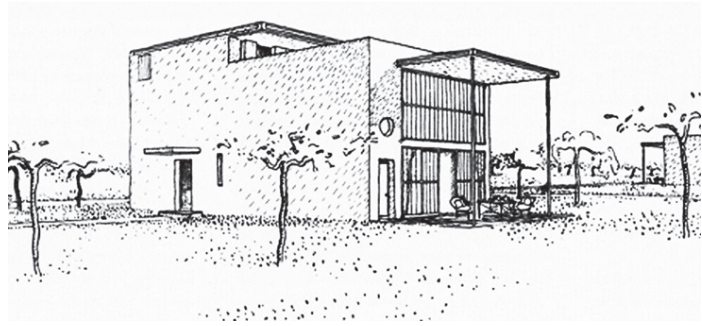
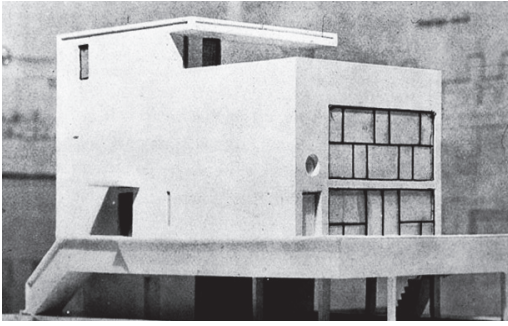


Figure 2. Maison Citrohan by **Le Corbusier**. Plaster model, 1920–1922. Le Corbusier's initial vision of adopting mass-production techniques never developed to what he had hoped for. Unfortunately off-site housing fabrication is still associated with the idea of automated shoe boxes, allocated in trailer parks or the like. Source: <http://www.usc.edu/dept/architecture>

his house on the wrong site and has to move it. Wheels replace the original foundations and the house is moved like a caravan by car. This short film achieves its peak when the house, now a mobile device, becomes stuck on railway tracks on which a train is coming. The house remains static and the train hits it producing a shower of wreckage. Keaton stares at the scene, places a 'For Sale' sign with the heap and walks off with Seely.

At the same time Le Corbusier was carrying out preliminary sketches for the Maison Citrohan; a mass-produced house type.⁵ The shape is basically a non-ornamental whitened cube. The paradox is that the reinforced concrete structural frame was constructed on-site and bearing walls were filled with local materials. We can deduce that this standardized prototype was a result of the romantic idea of industrial fabrication. This purist object was not an off-site invention but the artisan reproduction of unachievable machinery.

Nonetheless, how can we define the house we are confronted with in Bustin Keaton's *One Week*? By investigating several of Keaton's silent films and comparing them with the housing production in the US around the same period, we are able to obtain some remarkable outcomes.

The house in *One Week* is similar in shape and sizing to the Sears Modern Home, prototype 102, which was published in the 1920's Catalogue called *Honor Bilt, Modern Home*. The film's script is structured according to the *Catalog Modern House's* framework: mailing, shipping, delivering and rapid-building. The film critic Malcolm H. Oettinger, in his essay called *Low Comedy as a High Art* (1923)⁶ described the *One Week* house, saying that "(...) Buster has ordered a *Sears-Roebuck* bungalow for his bride-to-be. *The wicked rival mixes the numerals on the various parts, and the comedy ensues when Buster attempts to assemble the jazzed sections*".

The *One Week* housing model as collapsible

design is classified according to their uses or capabilities: *Transportability; adaptation; combination; assembling and disassembling process; and folding/unfolding*. Therefore, the *One Week* house is a complete organism. Its initial generic housing pattern is modified, by altering the sequence of packing boxes containing the house parts. The *One Week* house is a sort of customised variation of the so-called *Catalog Modern House*, a prefab dwelling manufactured and shipped by Sears, Roebuck and Co.

Modern Conveniences and Appliances: Towards Customised Prefab

If *One Week* was an investigation of the Sears Modern Home as a collapsible and mobile hardware, *The Haunted House* (1921) and *The Electric House*⁸ (1922) were focused on mechanical appliances, simply innovative domestic devices, providing a great deal of comic business for Keaton.

The Electric House represents a visionary conceptualisation of the house as a plug-in system, which performs as a sort of software. The idea of electrical innovation was naturally in the forefront of people's minds in the early years of the 20th century. The goal of the film was to keep the existing house framework but to electrify everything in the professor's house, both furniture and devices. For example, a mechanical type stairway—which could be reversed—was a pioneering idea that later became practical in department stores in the form of the escalator. Here Keaton brings this device into domestic life.

In addition, the pool table, which racks its own balls, has become available to us. Conveyor belts are in evidence along with electric trains for bringing food and dishes to the dining table. Buster Keaton, of course, adds the enthusiasm to the Swedish *smörgåsbord* or banquet of comedy delights.

Such as Keaton shows in *The Electric House*,

Sears introduced the latest technology available to modern US dwellers in the early part of the twentieth century. Central heating,⁹ indoor plumbing, and electricity were all new developments in home design that Modern Homes incorporated. Indoor plumbing and homes wired for electricity were the first steps to modern kitchens and bathrooms. Sears Modern Homes program stayed abreast of any technology that could ease the lives of its homebuyers and gave them the option to design their homes with modern convenience in mind.

Ironically in *The Electrical House*, all new appliances fail. This failure is in turn used to generate comedy; the accident is the generator of inventions and each thoroughly envisions new needs in the Modern domestic life.

Sears Mail-order Homes: Standardization and the D.I.Y. (Do-It-Yourself)

Purchasing a house from a mail-order catalogue seems like a fantastic story made for comedy value but in fact it was a pioneered practice in the US in the 20's. The entire process consisted of the following sequence: *catalog* or pattern book design; mail order; pre-cut timber fabrication (balloon frame); and shipping and delivery by rail, typically in two boxcars each.

The Sears prefab house has been chosen as a drive for discussion not only because it is a current topic of critique but also because it challenges the reductive notion of what architecture should be. According to Sears' archives, "*from 1908–1940, Sears, Roebuck and Co. sold about 70,000 – 75,000 homes through their mail-order Modern Homes program. Over that time Sears designed 447 different housing styles*".¹⁰

To buy a house in kit form saved about 40% on labour costs; quality custom design and favourable

financing; and provided accuracy and efficiency of the machine-cutting timber. Apart from this, customers could choose a house to suit their individual tastes and budgets. Modern Home's customers had the choice to build their own dwellings. All these features are exaggerated but still remain in *One Week*, creating a random pattern based on the mixed-up sequence of parts.

Sears was not an innovative home designer. According to Colin Davies, "*Sears Roebuck never claimed to make any contribution to the progress of Modern Architecture*."¹¹ The company was instead a follower

of non-architect home designs, generic rather than monumental; but with the ingenious advantage of modifying and adaptable houses, both hardware and software, according to buyer's way of living.¹²

Patching Balloon-Frames

Rather than a frame-maker Sears was a patch-maker. Instead of introducing a new physical framework or becoming an innovator in home design or construction techniques, he was producing a conceptual system where the 'patches'¹³ can be

fabricated in any order and assembled together in any number of permutations. In the manufacturing sector, the components are the patches. However, Sears's designs did offer distinct advantages over other construction methods.

The ability to mass-produce the materials used in Sears's homes narrowed manufacturing costs, which lowered purchase costs for customers. Not only did pre-cut and fitted materials shrink construction time up to 40% but Sears's use of balloon framing, plasterboard, and shingles greatly eased fabrication for home-buyers:



Figure 3. Serial of *One Week* (1920) by B. Keaton. Source: <http://www.archive.org/details/OneWeek>.

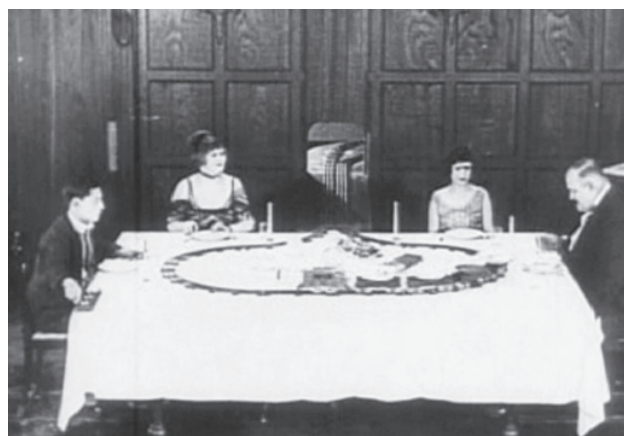
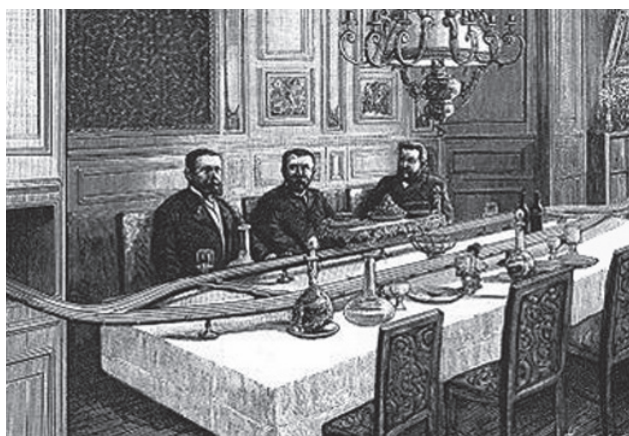


Figure 4. Learning from a railway loop. Left, the electric table (*Le Chemin de Fer de Table*) by Gaston Menier, 1887. Right, Dining table as railway track in *The Electrical House* by Keaton (1922).

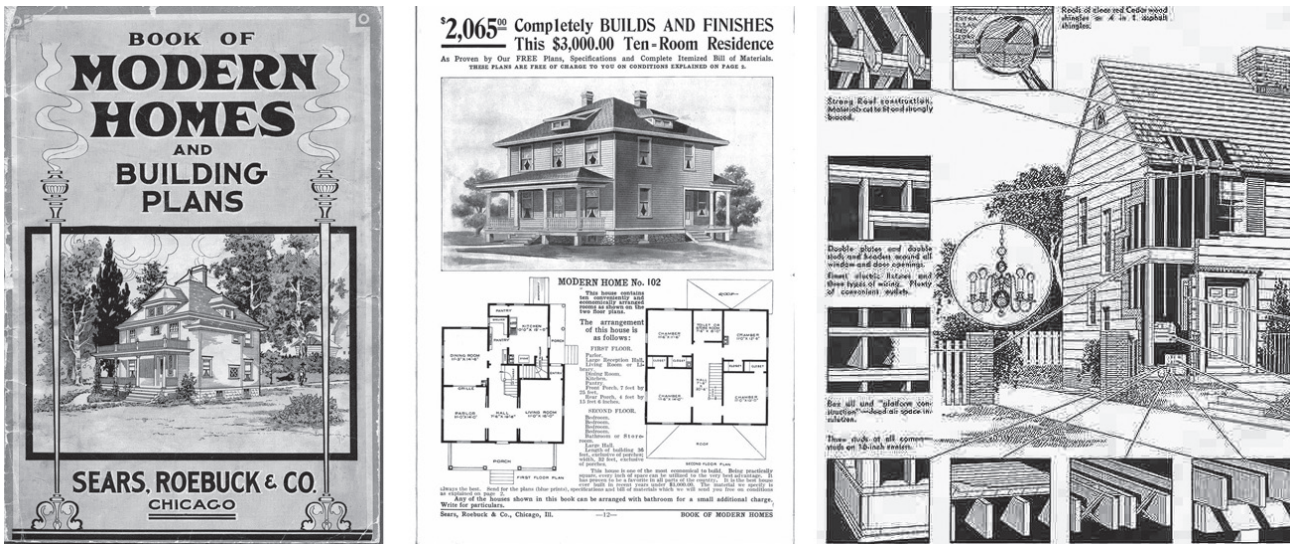


Figure 5. The Sears Modern Home: catalogue type and framing. Sears Archives, <http://www.searsarchives.com/homes>

A. Chassis. Essentially balloon-frame¹⁴ is a wall and flooring timber modular system. Foundations and roofs vary in sizes. This system uses precut standard timber for framing. The walls are formed by vertical studs (50mm times 100mm) in cross section, spaced at 400mm in apart and nailed to horizontal plates top and bottom. In a two-storey house, the studs extend over the entire height, with a ribbon let into them on the inside, to bear the

joists or beams of the upper floor. When the framing is completed, it is covered with siding, traditionally of overlapping timber clapboards nailed to the studs. The Balloon Frame systems did not require skilled carpenters, as previous constructive methods. Sears' balloon frames were built faster and generally only required one carpenter. Precut timber, fitted pieces, including the nails, and shipped by railroad directly to the customer made popular this frame-kit.

B. Plasterboards. Before drywall (US term for plasterboard), the most common wall-building techniques were plaster and lathe. Sears housing fabrication took advantage of the new material called drywall by shipping large quantities of this inexpensively manufactured product with the rest of the housing components. Drywall offered advantages of low price, ease of installation, and was added fire-safety protection.

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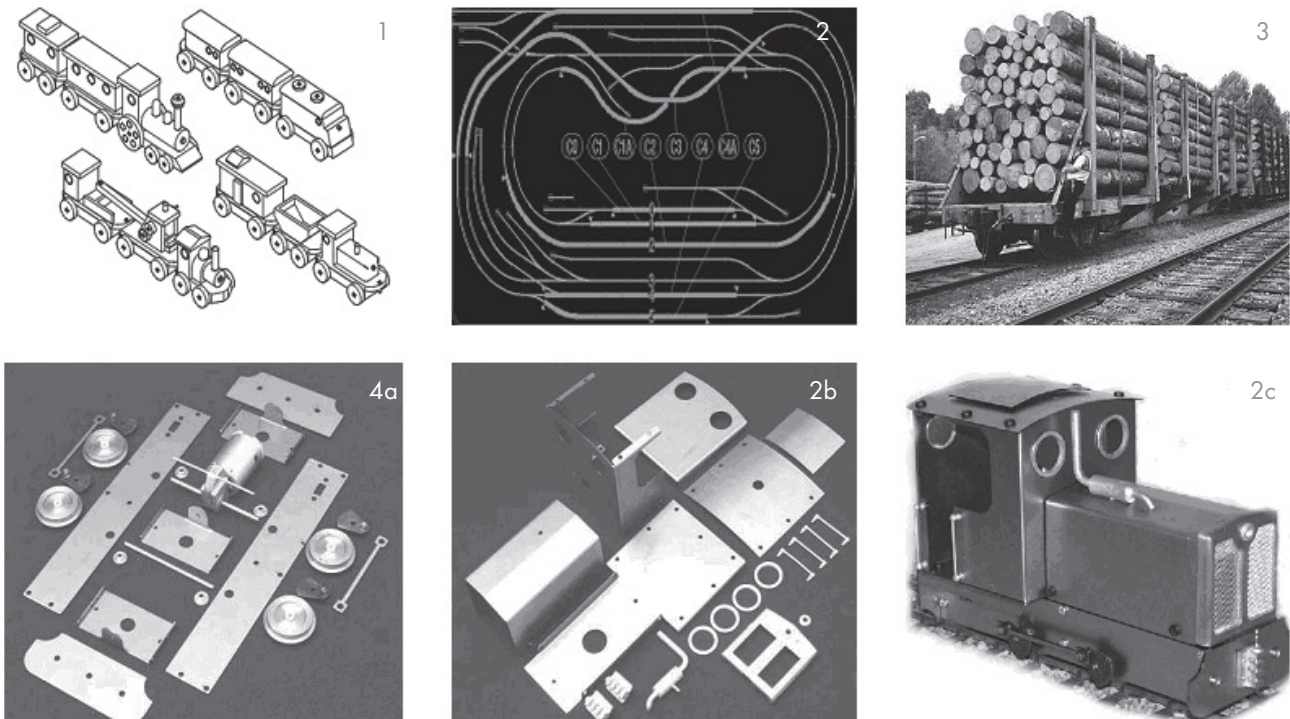


Figure 6. Fabrication of the Keaton's House: 1. House as a game; 2. House as organism; 3. House as movable system; and 4. House a easy-to-make kit. Source: Cristian Suau's private collection.

C. Shingles. According to the Sears archives: “It was during the Modern Homes program that large quantities of asphalt shingles became available. The alternative roofing materials available included, among others, tin and wood. Tin was noisy during storms, looked unattractive, and required a skilled roofer, while wood was highly flammable. Asphalt shingles, however, were cheap to manufacture and ship, as well as easy and inexpensive to install”. Asphalt is also a fireproof material.

Finale: Fabrication out of control

Process sets the stage for the outcome.¹⁵

Beyond this synopsis, what are the Keaton houses? They are simple mistakes, ungovernable places. Nevertheless, Keaton's housing design introduces three features: *flexible plan, advances in construction technology and the role of the individual in the design process.*

His houses capture the random daily activities in domestic scales and mostly ruled by fortuitous circumstances. Morphologically they are extreme dwellings, treated in a radical way. Through Keaton, modular fabrication is no longer a result of mass production, repetition, and uniformity. Keaton's housing design consists of: *transformable and polyvalent plans; customised fabrication; and engagement of users within the assemblage process.*

Keaton's films envision the idea of mass customization as a hybrid system. They conceived new building processes using manufacturing/automated production but with the ability to differentiate and personalised spaces and appliances for those that are generically fabricated.

In opposition to traditional aesthetic of the Modern Avant-garde, Keaton's houses are always *machines for failure*. In a classical sense, only the accident generates the invention.

Notes

1. Dr. Cristian Suau holds a Ph.D. in Architecture and Master in Urban Design (ETSAB). Since mid 2007 he is a lecturer in Architecture at the Welsh School of Architecture (WSA), UK and also lead an NGO called RECICLARQ in Barcelona: www.reciclarq.org.
2. Sears Catalog Homes: People had learned to trust Sears for other products bought mail-order, and thus, sight unseen. This laid important groundwork for supplying a home, possibly the largest single purchase a typical family would ever make. In 1908, the company began offering entire houses as kits, marketed as Sear Modern Homes, and by the time the program ended in 1940, over 100,000 had been sold. Source: Source: accessed in 27.09.2009, <http://www.searsarchives.com/homes>.
3. According to Colin Davies in his book *The Prefabricated Home* (2005, p.25), “Sears Roebuck never claimed to make any contribution to the progress of Modern Architecture”. The company was instead a follower of non-architect home designs, generic rather than monumental; but with the ingenious advantage of modifying and adaptable houses. Sears introduced the latest technology available to modern US dwellers in the early part of the twentieth century. Central heating, indoor plumbing, and electricity were all new developments in home design that Modern Homes incorporated. Indoor plumbing and homes wired for electricity were the first steps to modern kitchens and bathrooms. Sears Modern Homes program stayed abreast of any technology that could ease the lives of its homebuyers and gave them the option to design their homes with modern convenience in mind. Source: accessed in 27.09.2009, <http://www.searsarchives.com/homes>.
4. Siegal, J. *Mobile: The Art of Portable Architecture*, Foreword by Andrei Codrescu. 2002, Princeton Architectural Press, New York, p. 10.
5. The French term Maisons en Séries use by Le Corbusier does not imply the Anglo-Saxon notion of factory or off-site production. It is an even definition of industrial fabrication, which can tolerate on-site fabrication and components.
6. Oettinger, M. *Low Comedy as a High Art* (1923) Picture-Play Magazine. Source: access in 02/02/2008 <http://www.geocities.com/~oldbrit/bkppint2.htm>.
7. Sears Catalogue Homes. People had learned to trust Sears for other products bought mail-order, and thus, sight unseen. This laid important groundwork for supplying a home, possibly the largest single purchase a typical family would ever make. In 1908, the company began offering entire houses as kits, marketed as Sears Modern Homes, and by the time the program ended in 1940, over 100,000 had been sold. Source: http://en.wikipedia.org/wiki/Sears,_Roebuck_and_Company#Sears_catalog_homes.
8. *The Electric House* (1922). Director: Buster Keaton. Cast: Buster Keaton; Joe Roberts; Virginia Fox; Joe Keaton; Myra Keaton; and Louise Keaton. Originally this film started shooting in 1921, but an accident on the set forced all the previously shot footage to be abandoned and the film entirely reshot on a newly designed set in 1922. *The Electric House* starts with Buster's graduation ceremony as the first of his comic misfortunes, including a mix-up of diplomas so Buster receives a diploma in electrical engineering. This leads to a job opportunity: electrifying the family house of the girl he's sweet on. A great chance, so Buster studies hard and soon installs a useful and impressive set of electric appliances.

9. Central heating not only improved the livability of homes with little insulation but it also improved fire safety, always a worry in an era where open flames threatened houses and whole cities, in the case of the Chicago Fire. Source: accessed in 04.02.2008, <http://www.searsarchives.com/homes>.
10. Nevertheless, no official tally exists of the number of Sears mail-order houses that still survive today. It is reported that more than 100,000 houses were sold between 1908 and 1940 through Sears's Modern Homes program. The keen interest evoked in current homebuyers, architectural historians, and enthusiasts of American culture indicate that thousands of these houses survive in varying degrees of condition and original appearance. Source: accessed in 04.02.2008, <http://www.searsarchives.com/homes>.
11. Davies, C. *The Prefabricated Home*, 2005, London, Reaktion Book Ltd., p53.
12. Individuals could even design their own homes and submit the blueprints to Sears, which would then ship off the appropriate precut and fitted materials, putting the home owner in full creative control. Source: accessed in 04.02.2008, <http://www.searsarchives.com/homes>.
13. Framing is a system where several parts are aggregated into a whole. Patching it is a non-linear system. It consists of elements that are made in different locations and then assembled to form the whole. It is based on less segregation and ore integration.
14. Balloon frame was invented in 1833 in Chigago, US.
15. Kieran, S. & Timberlake, J. *Refabricating Architecture*, 2004, New York, RR Donnelley. P 107.

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- The International Buster Keaton Society: <http://www.busterkeaton.com>
- Sears Archive: <http://www.searsarchives.com/homes>

12th International docomomo Conference

Espoo, Finland, August 2012

docomomo Suomi/Finland will host the 12th docomomo International Conference in Espoo, in 2012. Espoo is part of the greater metropolitan Helsinki area and parts of the conference program are held over the capital region. The Conference is hosted by the City of Espoo and Espoo City Museum and realized in collaboration with public and private organizations, the principal ones being the Alvar Aalto Foundation, the City of Helsinki, Museum of Finnish Architecture, The National Board of Antiquities, the Architectural Department of Aalto University, the Ministry of Culture and Education and the Ministry of Environment. The Conference coincides with the Helsinki region being the World Design Capital 2012, with numerous events and exhibitions dealing with design in all its aspects.

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Schedule

July 25, 2011: Call for papers.
October 15, 2011: Deadline for abstracts.
December 15, 2011: Notification of acceptance.
March 1, 2012: Deadline first version full paper.
April 10, 2012: Deadline final version full paper.
May 31, 2012: Early registration ends.
August 2-7, 2012: Workshop.
August 7-10, 2012: Conference.
August 11-12, 2012: Post-conference tours.

Call for Papers

docomomo invites architects, researchers,
historians and other parties involved in the pro-
cess of preservation, conservation, renovation or
transformation of modern towns and buildings to
investigate on the theme: The Survival of Modern -
From Coffee Cup to Plan. The proposed theme gives
an opportunity to discuss Modern architecture and
town-planning from a holistic point of view. The
concepts of space and scale in Modern architec-
ture are challenged in an age of new ecological and
economical needs for more building density and
energy-saving technical solutions. The theme also
builds on and adds to the themes of previous **do-**
comomo conferences.

The concept of space in architecture and town
planning has changed radically during the last
hundred years. The modernist vision of townscape
opened up the closed urban surroundings of the 19th
century with dramatic consequences. The introduc-
tion of new building materials and pre-fabricated
building techniques influenced the architecture
whereas the uses of zoning in dividing urban land-
scape to separate functions and neighbourhood-
unit concept in organizing suburban areas led to a
new paradigm in urban planning.

All this has had a great impact on us, not only
from architectural point of view, but also through
changes in the relationship between nature and
the built environment, development of urban infra-
structure, and developments in environmental psy-
chology and its uses and misuses in planning. The
four sub-themes examine the concept of space and
design in four different scales and offer views on
how the fundamental urban qualities of modernism
can be preserved and what they have to offer for
contemporary planning.

1. Environment

What is a good living environment? What is the
sense today of preserving modern heritage?
Points of interest: environmental psychology, scale,
urban density, nature and environment, challenges
of sustainable development, landscape architec-
ture, architecture of the infrastructures.

2. Urban Space

How to protect and improve modern urban space?
Points of interest: the ideal of openness and the
contemporary requirements for sustainable devel-
opment, ecologically and economically motivated
requirements for density, challenge of sustainable
urban planning. The form of the modern city in the
scope of a social responsible approach.



3. Open Plan

Where to draw the line between the architect's intention and the preservation of modern building? Points of interest: open floor plan, the ideal of flexible space and the anticipation of the future needs in relation to original arrangement of spaces and original interior program, questions of conservation in situations of shifting purposes/function, everyday environment and its changes, Techniques and constructive issues regarding durability and change.

4. Interior Design

How to preserve modern interior designs and furnishings?

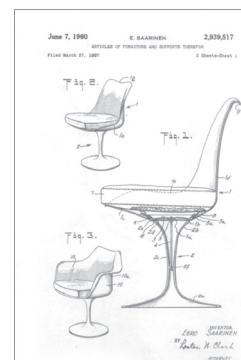
Points of interest: total work of art, innovation in details, the preservation of hardware, built in furniture – loose furniture, balance between the interior and its surroundings, the detail scale and the concept of global design.

Those interested in presenting a paper should submit an abstract with maximum 500 words before 15 October 2011.

Abstracts are to be submitted via an online system operated by Tavicon Ltd. The online form can be found at <http://www.docomomofi.com/conference2012/index.php?k=218279>.

Please note that submitting an abstract to the Conference represents a commitment to participate. Abstracts will be published and made available to conference participants as a Book of Abstracts. Please note that no editorial changes are made, your abstract will be published in the Book only if we have received your registration and payments accordingly.

<http://www.docomomo-fi.com/conference2012/>



9th **docomomo** Brazil Conference. Interdisciplinarity and experiences in documentation and preservation of recent heritage. June 2nd to 11th, 2011 – Brasília, Brazil

The 9th **docomomo** Brazil Conference had as chief subject Interdisciplinarity and experiences in documentation and preservation of recent heritage and was opened with a tribute to Brazilian architect José Galbinski, author of several Brasília's modern masterpieces. As key lecturers, it was honored with the presence of **docomomo** International Chair Ana Tostões (IST, Universidade Técnica, Lisboa), **docomomo** US President Theodore Prudon (Columbia University, New York), Mário Mendonça (Universidade Federal da Bahia, Salvador), Luis Mauro Freire (Escola Da Cidade, São Paulo), Cyro Correa Lyra (National Monuments, Rio de Janeiro), Alfredo Gastal (National Monuments, Brasília), Alfonso Corona Martínez (Universidad de Belgrano, Buenos Aires), Jorge Silvetti (Harvard University, Cambridge, Mass.). The two latter also integrated, along with **docomomo** Chile President Horacio Torrent, the special round table

Brasília and the modern monumentality, chaired by **docomomo** Brazil President Carlos Eduardo Dias Comas.

A foremost aim of the Conference was to congregate contributions from several fields of knowledge committed to the documentation and preservation of cultural properties—such as Geography, History, Restoration, Arts, Economy, Law. This objective was achieved owing to 120 contributions distributed according to three thematic axes: experiences on documentation, experiences on preservation, and reflections on recent heritage. Over 400 participants attended the conference, many of them from other countries, as Argentina, Mexico, Portugal, Spain and England.

Activities also included an international pre-conference—with the theme What to consider as recent heritage? Readings of dwelling space and perspectives of comparative studies; a workshop—produc-

ing, with the kind contribution of Theodore Prudon, a chart of guidelines for the preservation of Cine Brasília, a landmark movie theater designed by Oscar Niemeyer in 1958; momotours—twelve guided tours to buildings ranging from well-known modern monuments by Brazilian architects to outstanding works by foreign authors; a movie premiere, and the release of books and of **docomomo** Journal 43, dedicated to Brasília. During the conference, **docomomo** Brazil Chapter signed a cooperation agreement with the Lucio Costa School for Monument Management, in Brazilian National Monuments.

The conference was organized by the **docomomo** Brasília Chapter and the School of Architecture and Urban Design (Universidade de Brasília), together with the **docomomo** Brazil Chapter and with financial support of the National Council of Science and Technology Development (CNPq). Conducted by local **docomomo** members Danilo Matoso Macedo, Sylvia Ficher, Elcio Gomes da Silva and Andrey Schlee, it was achieved thanks to the dedication and teamwork of over 20 collaborators and 30 undergraduate students.

Danilo Matoso Macedo
docomomo Brazil

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Opening Round Table. From left to right: Professor **Andrey Schlee**, School of Architecture and Urban Design (Universidade de Brasília). **Danilo Matoso Macedo**, **docomomo** Brasília Chapter. **Carlos Eduardo Dias Comas**, **docomomo** Brazil Chapter. **Joe Valle**, District Deputy, **Ana Tostões**, **docomomo** International Chair, **Márcia Rollemberg**, National Monuments, **Elizabeth Mansur**, Centro Universitário Uniceub and **Julio Cesar Peres**, Syndicate of the Industry of Construction in the Federal District.



From left to right: **Horacio Torrent**, **docomomo** Chile, **Carlos Eduardo Dias Comas**, **docomomo** Brazil, **Jorge Silvetti**, Harvard University, **Alfonso Corona Martínez**, Universidad de Belgrano, Buenos Aires.



American Glamour and the Evolution of Modern Architecture

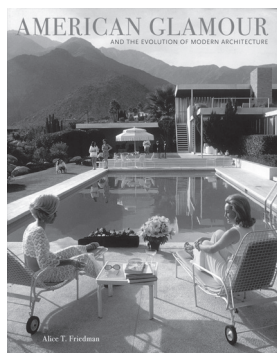
By Alice T. Friedman

Publisher: Yale University Press, New Haven and London

ISBN: 978-0-3001-1654-0

Language: English

Year: 2010



This fascinating book by Alice Friedman provides new insight into the development and acceptance of what we now so often and somewhat erroneously call “mid-century” modernism. She discusses not only different building typologies and some of the “starchitects” of the time but also, more importantly, places them in the social and cultural context of the postwar era. While preservation is not specifically discussed, the “glamour” of the architecture as Friedman presents it may explain why high-style magazines and publications continue to be captivated by the period.

Architecture of the Sun: Los Angeles Modernism 1900–1970

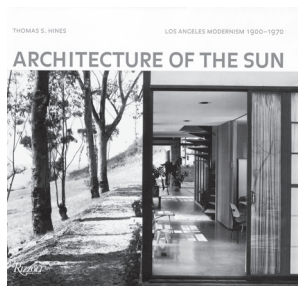
By Thomas S. Hines

Publisher: Rizzoli, New York

ISBN: 978-0-8478-3320-7

Language: English

Year: 2010



With over 745 pages and numerous illustrations in both black & white and color,

Architecture of the Sun is probably the most complete history of modernism in Los Angeles. Not only is the book comprehensive with every major architect included, but also the language is understandable and free of ‘archispeak’, which is unusual in so much of architectural writing today.

Arquitectónica 18–19

Número especial–docomomo

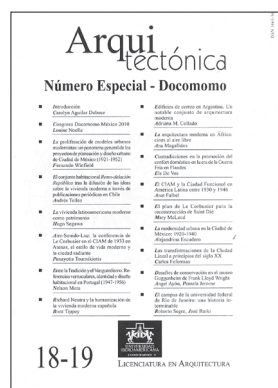
By Louise Noelle, AA.VV and edited by Gigliola Carozzi Arosio

Publisher: Licenciatura en Arquitectura, Mexico DF

ISSN: 166-5-1685-0001-8

Language: Spanish

Year: 2010



This special number of the Arquitectónica magazine is the result of a selection of 15 papers made by an editorial committee involved in the International docomomo Conference which took place in Mexico City in 2011.

The diffusion of architectural culture can not be done in one single way. It is important to join efforts between education, communication, government, and civil society institutions, to reach a collective effort that will benefit the preservation of traditional bastions and the creation of new examples of the creative activity of a society.

That is why it is so important that the Department of Architecture has devoted a special edition of Arquitectónica to the issues presented in the International Congress organized by docomomo Mexico, an extraordinary effort of interinstitutional work where the Universidad Nacional Autónoma de México, the Universidad Iberoamericana, A.C., the Universidad Anáhuac, the Consejo Nacional para la Cultura y las Artes, the Instituto Nacional de Bellas Artes, the Secretaría de Desarrollo Social, the Escuela Nacional de Artes Plásticas and the Sociedad Mexicana de Arquitectos have converged. [...]

This publication is a vehicle not only to commu-

nicate but also to educate about these changes and the vicissitudes which made them possible. In today’s world, where you must go beyond technology and understand the economic, social and symbolic flows of life, spaces must be redesigned in a continuous and not episodic way, understanding the operation rather than just the appearance (John Thakara, In the Bubble, 2006).

Carolyn Dubose Aguilar

Dean of the Department of Architecture at the Universidad Iberoamericana, Mexico City

Climate and Architecture

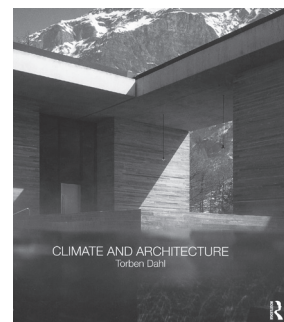
By Torben Dahl

Publisher: Routledge, London

ISBN: 978-0-4155-6308-6

Language: English

Year: 2010



In connection with the exhibition of the same title, the book was written by several researchers in close association with the Institute of Architectural Technology and edited by Torben Dahl. Its most important message is that an analysis of the local climatic conditions and an involvement of the quiet climatic adaptation, being in the traditional architecture of the very same environment, imply a rich and unexploited architectural potential.

In the universe of architecture it is often necessary to go further than to the direct challenges and immediate solutions to find answers, matching the complexity in such important questions like the interrelations between the built environment, its technology, the resources, and the surrounding climate.

Torben Dahl

Head of the Research Institute 2, School of Architecture

Peder Duelund Mortensen

Head of the Research Institute 3, Publishers and Exhibitions Secretariat Royal Danish Academy of Fine Arts

La arquitectura del Movimiento Moderno. Selección de Obras del Registro Nacional

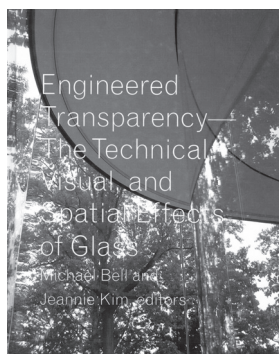
By Eduardo Luis Rodríguez (ed.)
 Publisher: Ediciones UNIÓN,
 Colección Arquitectura y Ciudad
 ISBN: 978-959-209-998-2
 Language: Spanish
 Year: 2010



docomomo Cuba has published a selection of its Register which has been carefully and magnificently edited by Eduardo Luis Rodríguez. Drawings, photos and short explanations of each of these 150 projects built between 1931 and 1978 help understand the value of these selected works.

Engineered Transparency. The Technical, Visual and Spatial Effects of Glass

By Michael Bell and Jeannie Kim
 Publisher: Princeton, New York
 ISBN: 978-1-5689-8798-9
 Language: English
 Year: 2009



Glass was one of the most important architectural materials in early modern architecture and remains so today. While many studies look at either the visual aspects or the technical requirements, this publication, which is the outcome of a two day long conference at Columbia University's Graduate School of Architecture, Planning and Preservation in 2009, does both.

Glass is one of the most ubiquitous and extensively researched building materials. Despite the critical role it has played in Modern architecture in the last century, we have yet to fully comprehend the cultural and technological effects of this complex and sophisticated building material.

Engineered Transparency brings together a multidisciplinary group of international architects, engineers, manufacturers, and critics to collectively reconsider glass within the context of recent engineering and structural achievements. In light of these advancements, glass has re-emerged as a novel architectural material, offering new and previously unimaginable modes of visual pleasure and spatial experience.

The book is a portfolio of various glass projects including SANAA's Glass Pavilion at the Toledo Museum of Art, Yoshio Taniguchi's MoMA extension in New York City, and Steven Holl's Nelson-Atkins Museum in Kansas City, along with contributions from Antoine Picon, Reinhold Martin, Richard Tomasetti and Steven Holl. *Engineered Transparency* redefines glass as a 21st century building material and challenges our assumptions about its aesthetic, structural, and spatial potential.

Equipamientos II. Ocio, Deporte, Comercio, Transporte y Turismo.

By AA.VV. Edited by Susana Landrove
 Publisher: Fundación Caja de Arquitectos, Fundación **docomomo** Ibérico
 ISBN: 978 849378577-2
 Language: Spanish
 Year: 2011



The exhibition of the same name and the book present the research and documentation work done by the Fundación **docomomo** Ibérico on Modern facilities (leisure, sport, commerce, tourism and transport) built in the Iberian peninsula between 1925 and 1926. The book includes all the works related to these subjects, 260 buildings from this territory presented with graphic documents

and a register of each building. The publication counts with a presentation by Celestino García Braña and two essays which address the issue in the context of Spain and Portugal, written by Carlos García Vázquez and Ana Tostões. This book was possible thanks to the support of the Fundación Caja de Arquitectos, an organization that has published the book in collaboration with the Fundación **docomomo** Ibérico, and that also published *Equipamientos I, lugares públicos y nuevos programas, 1925-1965*, the first part of this work.

Ivan Blasi
 Secretary **docomomo** International

Ernesto Nathan Rogers: Continuità e Contemporaneità

by Eugenia López Reus
 Publisher: Marinotti
 ISBN: 9788882731045
 Language: Italian
 Year: 2010



To mark the centenary of his birth, Marinotti has published *Ernesto Nathan Rogers: continuità e contemporaneità* written by the Barcelona based professor and researcher Eugenia Lopez Reus. The title is already a letter of intent: the thought and work of Rogers is in full force in the era of globalization.

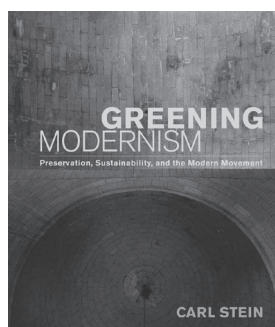
The "rogerian" position, explicit in Cassabella editorials and in his built work with the group BBPR, became a modern long-haul thanks to the setting, already then, of a certain distance from the founding period of the 1920s. Rogers had to professionally deal with Italian and European reconstruction works after World War II. Provided with an non-ideologized pragmatism, he managed to reconcile history and tradition with the demands of modern creativity and managed to highlight the role

of architecture in the urban and community image. The "continuità" that Lopez Reus brings out in her book bridges between past and present, between the isolated building and the whole city and even the country, while putting in value the legacy of the masters of Modernism, such as Gropius, Le Corbusier and Mies, along with other predecessors not sufficiently valued still today such as Henry van de Velde.

Miguel Jaime
Ph. D. Architect

Greening Modernism. Preservation, Sustainability & the Modern Movement

By Carl Stein
Publisher: W.W. Norton & Company, New York
ISBN: 978-0-3937-3283-2
Language: English
Year: 2010



With much of our interest in design and construction focused on sustainability, the preservation of modern architecture has become a subject of much discussion. Buildings created in what author Carl Stein refers to as the 'petroleum' era are coming particularly under much scrutiny and in turn becoming the victim of negative perceptions and opinions. In his new book Stein seeks to address these issues in a broader historical and comprehensive context. Aside from the more general discussion of sustainability and energy, he sees Modernism not solely as a problem but part of the solution. Or, in his own words: "While Modernism does not, in itself, offer new design tools for building reuse and historic preservation, it does provide a very clear framework for the appropriate application of these tools."

Historic Preservation and the Livable City

By Eric Allison and Lauren Peters
Publisher: Wiley, Hoboken
ISBN: 978-0-4703-8192-2
Language: English
Year: 2011



Eric Allison + Lauren Peters

While not specifically addressing modern architecture, the book certainly looks at a modern problem. With planning and city planning being one of the disciplines that emerges fully after World War II when many (European) cities had to be rebuilt, planning as it was experienced in the 1960s and 1970s in the US in the era of urban renewal has come under much attack. The rise of so-called New Urbanism—conventional planning in a traditional dress—has again focused attention on the importance of planning livable cities, which this book does.

Luigi Moretti, le Ville. Disegni e Modelli

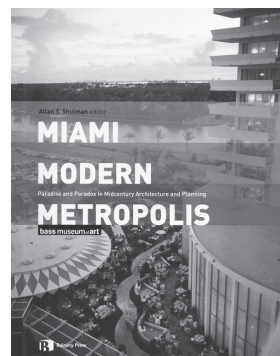
By Carmen L. Guerrero, Salvatore Santucio and Nicolo Sardo
Publisher: Palombi Editori, Milan
ISBN: 978-8-8606-0200-8
Language: Italian and English
Year: 2009



This book, published in Italian alongside an English translation, shows in its 159 pages many small photographs of models and thumbnail floor plans the houses and villas in the oeuvre of the Italian architect Luigi Moretti (1907-1973). In the Americas his name is best known as the architect of the Watergate Complex in Washington DC (completed 1971) and, with Pier Luigi Nervi, the Stock Exchange Tower in Montreal (completed 1965).

Miami Modern Metropolis. Paradise and Paradox in Midcentury Architecture and Planning

By Allan T. Shulman and Diane Camber
Publisher: Balcony Press, Glendale
ISBN: 978-1-8904-4951-3
Language: English
Year: 2009



This extensively illustrated book accompanied the exhibit Promises of Paradise: Staging Mid-century Miami, which was first mounted in the Bass Museum of Art in Miami and subsequently in Samuel P. Harn Museum in Gainesville in 2008. While the exhibit was managed by Ruth Grim of the Bass and co-curated by Allan Shulman and Tome Hine, the book was edited by Shulman, who is a practicing architect in Miami, a faculty member of the University of Miami School of Architecture and an active member of docomomo US/FLA. This lavishly illustrated work, which contains a series of essays about the various aspects of the development of Miami in the postwar period, is in many ways the culmination of a recognition and preservation process of modern architecture in Miami that began as early as the 1970s with its Art Deco hotels. Not surprisingly the majority of the essays, several of which are the work of docomomo members Jean-François Lejeune, Anthony J. Abbate and Alice Friedman, highlights its residential and hotel architecture but also brings attention to

the growth and open-spirited ethos of the region and some of its remarkable examples of its civic, religious, commercial and industrial architecture. Largely illustrated with photographs and images of the book period, as the original exhibit did, it offers an extraordinary insight in the development, growth and architecture of postwar Miami.

Sustainable Preservation: Greening Existing Buildings

By Jean Carroon

Publisher: Wiley, Hoboken

ISBN: 978-0-4701-6911-7

Language: English

Year: 2010



Sustainable Preservation

Greening Existing Buildings

Jean Carroon | Foreword by Richard Meier



Sustainable development, greening architecture and preservation are all words that have become common in our language. However, what it exactly means in real practical terms is by no means always clear. Sustainable Preservation seeks to do that by presenting some of the theoretical constructs and terms in conjunction with some relevant case studies for each category. The book is divided in three parts: Overview, Targeted Resource Conservation and, the last part, titled Of Note, which includes a section on best practices. The preservation of modern architecture and the conversion of 20th century buildings are being addressed in a number of the case studies throughout the book but particular at the end with a small section of the recent past. The book is profusely illustrated in mostly black and white but with a center insert of particular projects in color.

Tomorrow's Houses: New England Modernism

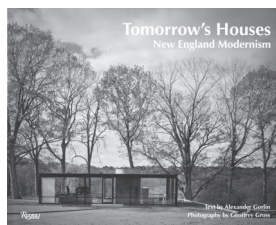
By Alexander Gorlin and Geoffrey Gross

Publisher: Rizzoli, New York

ISBN: 978-0-8478-3399-3

Language: English

Year: 2011



While the cover of the book sports the ubiquitous photo of Philip Johnson's Glass House in New Canaan, the inside of the book covers a wide range of mostly modernist houses in New England. Starting with Purcell & Elmslie's "Bradley Bungalow" in Woods Hole (a 1912 Prairie Style house in New England), the book concludes with Richard Meier's 1967 Smith House in Darien. In-between these two are houses by famous and some lesser known architects. An introduction by Alexander Gorlin provides the historic context for residential architecture in New England, and each case study is accompanied by short descriptions as well as small (but very useful) plans. The major strength of the book is the superb color photography by Geoffrey Gross, who has done similar books about other styles of architecture, such as his Dutch Colonial Homes in America. It is precisely these photographs, in striking color, that debunk the misconception that modern architecture is purely monochromatic.

Riuso del Patrimonio architettonico

**AAM Quaderni Dell'Accademia di
architettura, Mendrisio**

By Bruno Reichlin and Bruno Pedretti

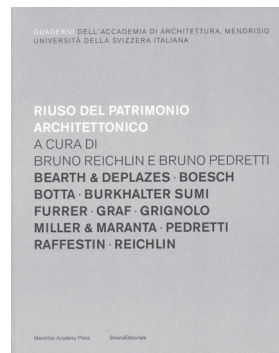
Publisher: SilvanaEditoriale/Mendrisio

Academy Press

ISBN: 978-8-8366-2076-0

Language: Italian with English abstracts

Year: 2011



This book inaugurates the publication of "*Quaderni dell'Accademia di Architettura, Mendrisio/Papers of the Academy of Architecture, Mendrisio*," an annual journal that intends to show the debate that animates the cultural exchanges within the Accademia di Architettura di Mendrisio, in both the theoretical and design matters. This first issue focuses on the reuse of architectural heritage, a theme - that of the recovery of architectural heritage, and particularly that of Modern Movement architecture - that is becoming central to contemporary practice and theory.

The first part presents essays focused on the debate that justify the re-use concept. It is followed by a section which includes some works showing case studies that highlight the different strategies of the relationship between new design and heritage. The last article states information on the research project "Encyclopedia critical to the reuse and restoration of twentieth century" which confirms how the recovery of the built heritage of the 20th century represents nowadays an unavoidable challenge for architecture.

Texts by Bruno Reichlin, Franz Graf, Bernhard Furrer, Claude Raffestin and Bruno Pedretti.

Projects by Bearth & Deplazes, Miller & Maranta, Burkhalter Sumi, E. & M. Boesch and Mario Botta.

Research by Roberta Grignolo.