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

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 craftmanship 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.

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

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

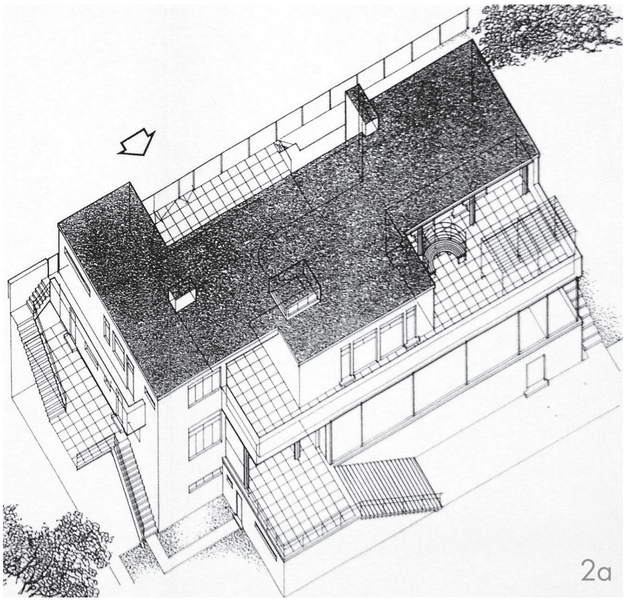
Figure 1. Tugendhat House, Brno, 1928–30 by **Ludwig Mies van der Rohe** and **Lilly Reich**. View from the south with the garden. The lower portion of the house is covered with vegetation. Photo by Fritz Tugendhat, circa 1935. (Repro: Dieter Reifahrt 2008).

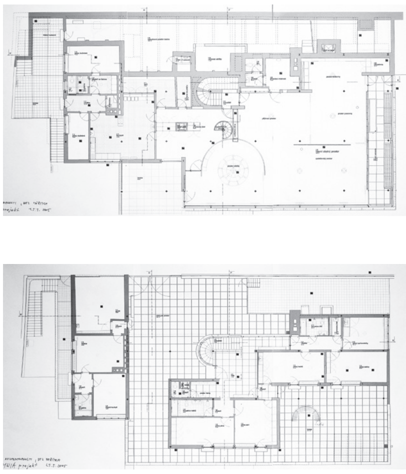
Figure 2a. Tugendhat House, Brno, 1928–30 by **Ludwig Mies van der Rohe** and **Lilly Reich**. Axonometric projection from 1982 (ex: architectural history study Karel Ksandr and team, 2001, digitalized 2003).

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.





2b

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 traditional 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

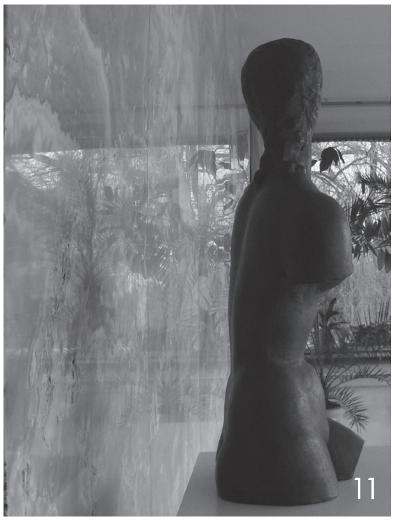


Figure 8. Tugendhat House. Main living space, showing the detail of the polished chrome cladding of the cross-shaped steel columns. In the mirror, the subtle unevenness of the surface of the metal caused by the craft fabrication process is clearly visible. Photo by Dieter Reifahrt, 2008.

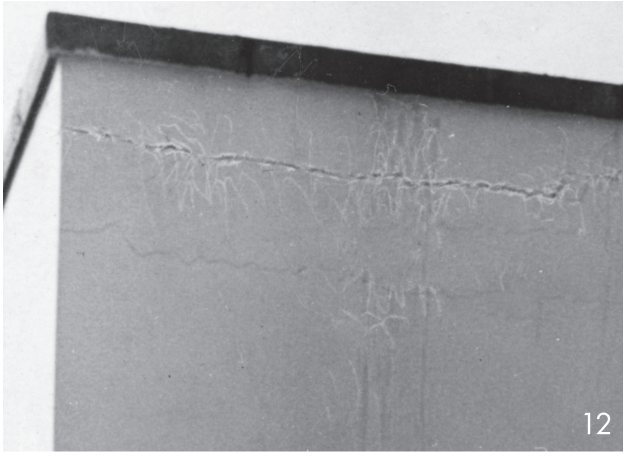
Figure 9. Detail of the dining room buffet from the Tugendhat House, now in private ownership in Vienna. The shadow of a straight line in the reflection of the surface shows a slight ripple caused by the properties of the material and also by the manufacturing process. Photo Ivo Hammer, 2010.

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.



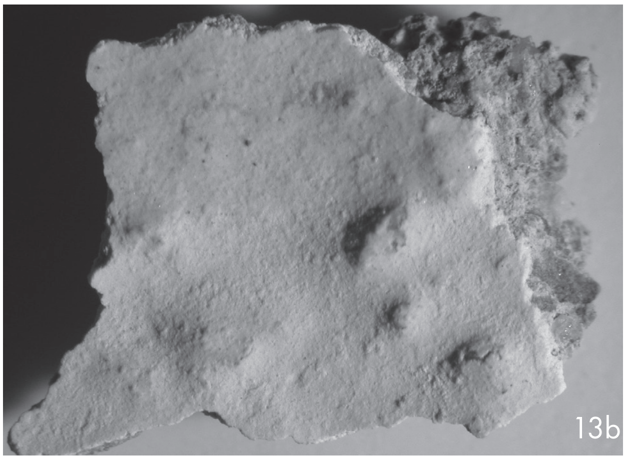


Figure 12. Tugendhat House. Detail of the east façade of the bedroom of Grete Tugendhat. Shortly after the building was completed, crackingof the plaster took place at the intersection of the concrete ceiling and the brick wall caused by different thermal movements of the materials, a built-in draw back 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 facture, 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 façade 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 façade 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 façade 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 buildings is only appropriate to the reality when the environmental impact is assessed through the entire process of use of resources, construction, maintenance and adaption 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 façades, 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, Brünn 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 príspevku 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 mesta 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 Volkwang 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 fo 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*, Brünn 17.-29.4.2006, Museum der Stadt Brünn (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 aestetic 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 R*eclams 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, Kundmanngasse 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 wiederentdeckten Gelehrten* and 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 Bratcice, 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.hornemanninstitut.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", *Restauro. 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 (edrs.), *Nachhaltigkeit und Denkmalpflege. Beitraäge 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 Altlast. 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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