

# 'Zonnestraal': Restoration of a transitory architecture

## Concept, planning and realisation in the context of its authenticity

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Ever since its completion in 1928, Jan Duiker's Sanatorium 'Zonnestraal' in Hilversum has probably been the most canonical and internationally celebrated example of Modern Movement architecture in The Netherlands. But ever since its changing function around 1960 a consequent series of adaptations and refurbishments caused the disfigurement of Duiker's masterpiece, which has doubtlessly been the most controversial issue in architectural heritage in the country...

After two decades of extensive preparatory research and with the prospect of an eventual UNESCO World Heritage nomination, the restoration of the first building could finally start in Fall 2000. The careful dismantling of the main building proved an unprecedented source of knowledge and hands-on experience with early modern building technology and its preservation. Albeit partly, with the first stage of the restoration completed in 2003 the great value of Duiker's work is now again attainable to the expert community as well as the public at large.

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by Wessel de Jonge

Sanatorium 'Zonnestraal' is arguably one of the most clear cut demonstration of the vanguard philosophy of the Modern Movement in architecture. Its design as what appeared to be a temporary structure challenged Eternity in a reinterpretation of some of the grand ideas of the Enlightenment. Conceived between 1925-27 by Jan Duiker (1890-1935), Bernard Bijvoet (1889-1979) and structural engineer Jan Gerko Wiebenga (1880-1974) it is strongly rooted in the cultural, social and technological developments of the Industrial Revolution.

During that dynamic period in history, the building tradition underwent unprecedented changes. Industrialisation and the consequent process of urbanisation triggered a demand for new and particular building types. The functional programs for buildings became increasingly diverse and specific and, as a result, more short-lived. New materials and construction technologies allowed engineers and architects to fulfil these needs to an ever growing extent.

In the 1910s and '20s, architects acknowledged a direct link between the design, the technical lifespan of a building and user requirements over time. As the time span for use changed as well, time and transitoriness ultimately became important issues in architectural theory. Consequently, this leads either to a transitory architecture or an adaptable one. The consequent translation of these ideas into practice produced the specific architecture of the Modern Movement, of which 'Zonnestraal' is a stunning example.

### Transitoriness

Jan Duiker was a main spokesman of the Modern Movement in the Netherlands. 'Why is it', he complained in 'De 8 en Opbouw' in 1933, 'that one refuses to view upon the form

as the materialisation of the functions, demanded from the organism. (...) This form (..), that is nothing more than an answer that comes up to the requirements most directly: the most economic solution.<sup>1</sup> Duiker clearly considered architecture as a matter of reason rather than style, attributing great value to the connection between form, function, material, economy and time.

According to some of his writings, he promoted the idea that whenever a building's purpose had to change, the form would lose its right to exist and the building must be either adapted or demolished altogether. Clearly, he regarded buildings as utilities with a limited lifespan by definition and occasionally even as 'throw-aways'.

With 'Zonnestraal' he produced a first and arguably most direct response to a short-lived functional program in his professional life. Based on a solid belief in Science and Progress, the sanatorium was established in the conviction that tuberculosis would be exterminated within thirty to fifty years.<sup>2</sup> Here, the architect managed to subtly balance user requirements and technical lifespan with the limited budget of the client, creating a structure of breathtaking beauty and great fragility at the same time.

Hence, we are faced with the conservation of a structure that was intended to be transitory. It is clear that the restoration of his buildings poses great challenges in both conceptual and material terms as, in such cases, the idea of transitoriness must be understood as part of the original design intention.

### **Spiritual economy**

It is quite striking to see how the engineers were ahead of the architects as far as the employment of modern building technology was concerned. Some of them designed structures which anticipated Le Corbusier's theoretical writings years before these were widely published. Wiebenga designed a remarkably modern Technical School in Groningen as early as 1922, with a full concrete structural frame, light infills, and steel framed window casements arranged in horizontal bands.<sup>3</sup> It was still five years before Le Corbusier canonised the free plan with his 'five points for new architecture'<sup>4</sup>, providing a theoretical basis for the architectural avant-garde, and just four years before Duiker invited him to help him work on the sanatorium project.<sup>5</sup>

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<sup>1</sup> J. Duiker, 'De nieuwe Fordfabriek te Amsterdam', *De 8 en Opbouw*, 1933, pp. 113-118.

<sup>2</sup> The sanatorium was built for the Amsterdam Diamond Workers Union, and funds were in extremely short supply. From the minutes of the January 26, 1924 meeting of the building committee of the 'Zonnestraal' Association (Studiecommissie exploitatie landgoed 'Zonnestraal'), it appears that the depreciation period was set at fifty years. The minutes were in the 'Zonnestraal' historical archives (uncatalogued) which has since been donated to the International Institute for Social History (IISG) in Amsterdam, current file number unknown.

<sup>3</sup> These features were adopted by Wiebenga to respond to the limited construction time that was allowed, while the program for the schools was still unclear, thus creating maximum adaptability. See literature 6.

<sup>4</sup> Le Corbusier and Pierre Jeanneret, untitled, in 'L'architecture vivante, Autumn/Winter 1927, pp. 13-27.

<sup>5</sup> Wiebenga left to work in the United States soon after the schools were finished in 1923. After his return in 1926 he published series of articles that reflect his fascination with a variety of professional issues ranging from rational planning and construction, to functional building and material properties. His involvement in the planning of 'Zonnestraal' and several other key modern buildings in The Netherlands reached far beyond the average professional involvement of a structural engineer. He advised Duiker on many issues, among others about the finishes to be applied in 'Zonnestraal', and revised the specifications, which is unusual in the Netherlands' building tradition. See literature 4.

With 'Zonnestraal', they followed out a rigorous distinction between load bearing structures and infills, in order to allow for maximum flexibility, and used light and transparent materials in the facade to ensure the unhampered access of daylight and fresh air into the building. Related to the idea of varied lifespans was the introduction of prefabrication for building components, since it allowed the easy replacement of deteriorated or malfunctioning parts, as well as later adaptation to respond to functional change. Directly linked to the principle of the open plan are series of technological inventions such as the radiation ceiling panels for Duiker's Open Air School in Amsterdam (1927-28), and his patented hot-air system for Gooiland Hotel in Hilversum (1934).

Duiker designed his buildings as light as possible, with minimum amounts of material used. This is demonstrated among others by the extremely slender concrete frame of 'Zonnestraal', with the beams haunched at their bearings and tapering cantilevers to follow the moment diagram as closely as possible. The necessarily complicated carpentry for formwork was not uneconomic in a period with cheap labour and relatively expensive materials.

His aim for optimal construction is referred to as 'spiritual economy' that, as Duiker wrote in 1932, 'leads to the ultimate construction, depending on the applied material, and develops towards the immaterial, the spiritual.' He introduced this notion so as to distinguish this conceptual principle from financial economy.<sup>6</sup>

Still, in many of his projects optimisation was a bare necessity, due to shortage of funds with his clients. He again needed all his 'engineers-art' to make actual construction of 'Zonnestraal' possible, albeit in two stages as the financial position of the client allowed for a second pavilion for patients only to be completed in 1931, three years after the main building and the first pavilion had been opened.

## **Zonnestraal**

The sanatorium was part of a larger aftercare colony for tubercular patients, which was founded in 1919 by the Diamond Workers Union of Amsterdam after British examples. Duiker's masterplan involved a main building with two patient pavilions, to be extended later with two more pavilions, arranged along a North-South axis. The pavilion wings are set at 45° to each other, allowing unhampered views out and plenty of daylight in. Since money was extremely short a cheap construction method was required. Observing also hygienic requirements, eventually a reinforced concrete frame was chosen. The buildings are entirely structured on a 3 m module, based on the Dutch 1918 Concrete Regulations which allowed the formwork of floors with a span of 3 m to be removed in a weeks' time rather than the four week curing period that had to be respected for larger spans. This was a crucial condition in view of the strict six months construction schedule for 'Zonnestraal'.<sup>7</sup>

The pavilions clearly illustrate how Duiker and his associates assimilated the concrete frame with the architectural lay out, that is tailored around the required functions. The wings feature parallel girders set off at 3 m, creating a zone for individual 3x3x3 m patient rooms. The 1.50 m cantilevers of the floor slabs provide terraces at the sunward side and a corridor to the North, that connects the rooms and links the stairs at both ends. Thus, the building is almost like a functional program enclosed by a steel, glass and plaster envelope.

Although less obvious due to the complexity of the program, the lay out of the main building is based on the same principles. The building seems to evoke a striking demonstration of Behne's original definition of 'functionalism' of 1923, as opposed to

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<sup>6</sup> J. Duiker, 'Dr. Berlage en de "Nieuwe Zakelijkheid"', *de 8 en Opbouw*, 5 (1932), pp. 43-51.

<sup>7</sup> See literature 4, p. 36, 37.

'rationalism'.<sup>8</sup> According to Behne, functional planning departs from the brief and involves the careful design of individual spaces for each particular function, with specific dimensions and performance characteristics, organically producing a tailor-made suit. One may conclude that, consequently, the building may not be easily adaptable to functional change and is likely to have a short functional life expectancy, as opposed to such striking examples of 'rationalism' as the Van Nelle Factories in Rotterdam, where the a-specific, neutral space could be relatively easily adapted to a new use as a centre for design studios.<sup>9</sup>

In 'Zonnestraal's main building each room has particular dimensions, and even the height of the parapet varies according to the use of the space concerned. Moreover, the building features several programmatic clusters such as the medical/administrative department, the kitchens and the boiler/bath house, which are accommodated in separate wings on the ground floor. By detaching these wings from each other by passages for cars the functional status quo was fixed. Such obstruction of future adaptation may be best understood in its relation to the building's limited lifespan. On the other hand, the particular lay out of the building suggested an interesting interaction between an East-West axis through the passages, which connected the sanatorium complex with the outside world, and a North-South axis that organized the day-to-day use of the premises by the patients during the harsh years they spent to cure from their life-threatening disease, and that ran from the main staircase through the large hall on the first floor to the open field and the pavilions. One of the beauties that lie within Duiker's architecture is this symbolic expression of the main building as a crossing at different levels of these inner and outer worlds.

## **Industrial technologies**

The extensive preparatory research projects performed since 1983, showed that 'Zonnestraal' has been a test ground for new and experimental building technologies.<sup>10</sup> Though aimed at industrial mass production and the dry assemblage of prefabricated building parts, most solutions actually adopted in the main building still involve hand-made prototypes, with all the related problems and failures. Remarkably, Duiker had the opportunity to improve some of the technologies applied in the main building and first pavilion of 1928, when completing the second pavilion three years later.

Fascinatingly, also in the materialisation of the sanatorium buildings Duiker demonstrated a profound understanding of how to balance the technical lifespan with the requirements and the scarce resources of the client. By using cheaper non-galvanised steel windows he limited the technical lifespan of the buildings, though they would surely last for the expected functional lifespan of thirty years. Moreover, as part of their labour therapy, patients were planned to paint the steelwork regularly, avoiding access maintenance cost.

The main building of 1928 involved a prototypical curtain wall, consisting of individual window units made of 25 mm steel profiles. These casings were produced in a workshop and mounted on site against vertical steel posts IPE 8 that ran between the floors. To

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<sup>8</sup> Adolf Behne's 'Der Moderne Zweckbau' (Munich 1926) had already been written in 1923 but could only be published three years later, when publications by Gropius, Mendelsohn and others had already sparked a wide debate. See literature 2.

<sup>9</sup> See W. de Jonge, 'The Technology of Change. The Van Nelle Factories in Transition', in literature 5, p. 46.

<sup>10</sup> The research by H.A.J. Henket and W. de Jonge resulted in a report, that has later been summarized and extended with an English summary, as literature 4 in 1990. Since then, the building history of the individual buildings has been reported in greater detail by our office in various unpublished volumes.

save material, the second and further window units came with just one jamb and were fixed against the previous casing to create a stable unity, actually producing one large window frame over the full 33 m of the building's length. The lack of any tolerance in the joint between the casings of course gave rise to problems in controlling the measures. Also, the 25 mm deep window profiles were so shallow, that the 1.50 m wide top hung casements were too unstable to avoid early glass breakage. Even during construction, additional mullions had to be placed in the casements so as to cut the glazing surface into smaller sections to become more flexible.

When the other pavilion was finalised in 1931 these shortcomings were countered by choosing a stronger 32/37 mm profile series, introducing side hung casements of much smaller size, and by designing independent steel framed window casings that were placed between the IPE 8 posts with sufficient tolerance, largely according to contemporary curtain wall systems.

Another example of improvement was the construction of the parapet. Steel mesh was fixed between the steel posts under the windows. After the lower half of the mesh was covered by several layers of cement plaster on both sides, the upper half was folded inward to create an inner skin by plastering the interior surface. A similar technique was used for the partitions.<sup>11</sup> As a matter of fact, this had nothing to do with dry assemblage but a lot with the desire to create an abstract, pristine surface.

The parapets of the 1931 Dresselhuys Pavilion on the other hand involve prefabricated spandrel panels made of clay wire mesh and 6 mm steel reinforcement bars, again plastered by several layers on both sides until 50 mm thick. By welding the ends of the rebars against the IPE 8 posts, the panels were fixed vertically. After the joints were filled with tar, the spandrels were finally painted. These spandrel panels are the first prefab 'concrete' building parts known to be used in Holland.

The curtain wall and spandrel construction as well as some other features make the sanatorium complex a unique witness to the rapid developments in building technology in the second half of the 1920s, before the economic crisis and the Second World War halted them until they re-emerged during the building boom of the post-war reconstruction.

## **Obsolete**

The War also caused a brief upswing of tuberculosis in Europe, triggering the discovery of antibiotics shortly after. As predicted by Duiker and his clients in the 1920s most sanatoria became obsolete by the mid 1950s and 'Zonnestraal' was no exception. The sanatorium was transformed into a general hospital in 1957, just before it reached the end of its life expectancy. As a result, numerous extensions were added, and wooden barracks were scattered all over the estate, compromising the serene clarity of the original lay out.

The first pavilion was completely refurbished in 1955-58, enclosing the open balconies and changing the characteristic staircases of the building, and stands unrecognisable today.

The main building was first extended several times towards the North. Around 1976, serving as a general lobby for the hospital, the detached wings of the ground floor plan had to be connected and the Northern passage was closed off. The main entrance was moved to the Eastern tip of the middle wing, where originally the kosher kitchen had been located. Moreover, the rest of the building was completely refurbished. The interior arrangements were radically altered, almost all the partition walls were removed, the

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<sup>11</sup> A construction after American examples advocated by Wiebenga before, shortly after his return to Europe: Wiebenga, J.G., 'Amerikaansche bouwmethoden een economisch succes' in 'Gewapend Beton' 1926, pp. 32-35, see also literature 4 and 19.

slender steel framed window casings were replaced by wide aluminium ones with double glazing and the colour scheme was changed.

The second pavilion was largely left as it was. Since the early 1980s, the pavilion stands obsolete as a victim of the elements and local hooligan gangs. The windows are broken and the concrete is fully being exposed to the climate. The damage caused by corroding rebar is enormous and parts of the roofs have recently collapsed.

After joining another hospital in Hilversum in the early 1990s the premises were largely vacated, waiting for a new use. The big question was, how to find one.

### **Function follows form ...**

In our way of working, the structural analysis of the buildings themselves has grown to be prominent. This requires sufficient time in advance to study the lay out, the structural frame, the building technology and materials, as well as the role attributed by the architects to the building installations, and how all these elements interrelate. The aim of such extensive research is to obtain a comprehensive understanding of the buildings' rationale before actually touching it.

The most complicated issue to assess is how the architects themselves saw the performance of their buildings in terms of building physics in relation to the systems for heating and cooling they devised. As a matter of fact, these installations were of great interest to many of these architects, who preferred to coin themselves building engineers rather than designers, as proper knowledge of heating and cooling systems was decisive in designing light, open plan or even semi-open-air buildings for our climate. Unfortunately, little research has been performed regarding the historic development of such systems and we have to rely largely on period magazines and an occasional handbook.

Given this importance, we have tried to restore the most essential elements of the installations like the tubular heating radiators in the most public areas of the building such as the corridors and the main hall upstairs as much as possible.

Another challenge has been, that these buildings have been designed at a time when the energy performance of buildings was quite differently considered as we are used to since the energy crisis of the 1970s. This is even more the case since 'Zonnestraal' has been designed with a user in mind who advocated to keep all windows open at all times, also in winter. Despite efforts to improve the performance of the buildings in energetic terms it has been obvious right from the start that present requirements can never be met without totally destroying the essence of 'Zonnestraal'.<sup>12</sup>

As a result, the comfort level inside will be hardly fair according to present standards. Rather than trying to change this against all odds, we proposed to look for a new and appropriate use that could comply with these facts. Matching form and function reminds of Duiker's efforts when designing the buildings 75 years ago. But Louis Sullivan's credo 'form follows function' that was adopted by the Modern Movement as a guideline, has now been reversed.

### **Project**

Since 1995, a new set up as a health care centre has been developed into a masterplan for restoration and extension of the original ensemble by Hubert-Jan Henket architects and our office, in cooperation with the landscape architect Alle Hosper. The centre will involve a variety of independent, polyclinical health services and additional conference facilities in the main building. Both pavilions will eventually serve as an accommodation for patients. To finance these costly operations, the municipality of Hilversum allowed an apartment complex to be built elsewhere on the forested premises.

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<sup>12</sup> See literature 4, p. 53-54, 81-82, 85-86, 99.

In order to capture 'Zonnestraal's spirit of modernity, the original state of the ensemble as it was completed in 1931 has been taken as a reference regarding the interior lay out, functional clustering and elevations, as well as architectural and technical solutions. The varying condition of the three original buildings may suggest a different restoration approach for each of them in due course.

The oldest pavilion has been put to a new use as a 'health care hotel'<sup>13</sup> after it had been basically renovated earlier on. From September 2000 to December 2002, the original workshops of 1928 have been restored and extended by our office and now serve as an obesity clinic. The main building was actually restored from September 2000 to July 2003 and so far accommodates a sports injuries' rehabilitation clinic and a conference centre in the main hall upstairs. The client's choice not to have one tenant for the building but rather several individually operating users elegantly matches the specificity of the original lay out with the two passages for cars, and allowed the Northern passage to remain open again.

The original interior lay out was precisely known from the preparatory research project and appeared largely compatible with the new functions required, which were then carefully inserted in the tailor-made suit that Duiker had left us. The close interrelation between the exact, 'functionalist' lay out of the various rooms and the facades guided us to select a proper use for each space. Only when a new function could not be accommodated by the old structure it was proposed to deviate from Duiker's plan. Fortunately, the prominent extremities of the various wings originally served mostly as secondary entrances, cloak rooms and sanitary facilities that were also functional in the new set up, so that little had to change. More difficult was to find a new use for the obsolete kitchens in the core of the building, until a physiotherapy hall for the rehabilitation clinic appeared to fit in nicely without being very visible from the surroundings.

Similar decisions were made to fit in an elevator to comply with present regulations regarding wheel chair access. By concentrating the steel members into a U shaped frame in the centre of the shaft a crystalline volume with glass corners resulted, that leaves the contours of the building almost untouched.

The boiler house again serves as a heating plant for – eventually – the entire complex of buildings. As the original radiators were fuelled by steam and their replicas by hot water, additional floor heating was applied for the single glazed main hall. Together with sun-reflective curtains, solar gain is largely compensated by switching the floor heating to cold water in the summer. The reconstructed podium doubles as a ventilation shaft, allowing cold air to the central part of the hall for additional cooling. In doing so, a climatizing system according to present standards could be inserted to ensure a pleasant indoor climate around the year without compromising the fragile transparency of the original building.

## **Material aspects**

When planning the restoration, Duiker's search for new and specific technical solutions and materials for 'Zonnestraal' has given rise to attach great value to the few remains thereof in the main building.

The works largely involved the reconstruction of the original facades, partitions and finishes, and there has been little conservation or restoration of authentic materials except for the concrete structural frame, a few partitions and the salvage parts of one

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<sup>13</sup> Rather than occupying hospital beds, after a brief period at intensive care patients are accommodated in a health care hotel to further recover at much lower cost. Mostly located in nature, patients enjoy their stay much better and tend to cure faster. The advantages for the insurance companies are due to benefit the intervention project at 'Zonnestraal'.

facade. As the essential meaning of this building lies within the conceptual starting points of the original designers, and the project has been aimed at revitalising the perception thereof, to my mind one could successfully argue that it still concerns a real restoration. Yet, we realised that the material aspect was vital to revitalise Duiker's architectural concept successfully and to make the full cultural context of 'Zonnestraal' comprehensible.

Some lost parts have been carefully reconstructed at high cost such as the steel window casements, the sheet glass and finishes like the linoleum and the terrazzo floorings in particular areas. Some components like window hardware may have been industrially produced in the 1920s but have since been taken out of production and had to be hand crafted for the restoration.

In a way, the 'functionalist' principles in which the sanatorium buildings originate have caused us to attach greater value to the truthfulness of the very materials than has been the case in some other recent restoration cases of modern buildings<sup>14</sup>. Also, it has required more artisanship than anticipated.

## **Curtain wall**

The faithful reconstruction of the exterior became within reach due to the discovery of an original section of the facade in the summer of 1997, after an extension to the building was demolished. Apart from a section that could be reconstructed from this salvage material, the facades have been built up from new, steel framed window casements. As the shallow 25 mm profiles of the original casements could not hold double glass and the initial stability problems had to be avoided, the new units have been made of slightly heavier 32/37 mm profiles, similar to the 'improved version' of 40 mm that Duiker used himself in the 1931 pavilion. Due to the greater depth, the sharp putty framing of the original glazing could even be made at the shallow double glazing units that were specially designed for the restoration.

To remake and guarantee a facade without any measure tolerance, as was originally the case, is something not even an experienced restoration team is willing to accept today. We redesigned the facade into a series of individual casements, fixed against the vertical posts with a minimally acceptable tolerance of 3 mm in the joint between them. By filling the joint with a flexible sealant and pushing it back by a finger nail, the joints slightly show and indicate which sections of the facade are actually new.

Thanks to extensive colour research performed by Evert-Jan Nusselder and Mariël Polman of the National Heritage Department RDMZ, the original colour scheme could be fully retraced. 'Zonnestraal' appeared a rare example in Holland of a Modern Movement building that had actually been really white, even with a dash of blue in the mineral paints to add more brilliance to the plastered surfaces. The heavenly blue shade of the casings, with a remarkable touch of violet, makes the steel frames dissolve against the sky.

## **Glass**

Being nothing more than a concrete frame with a transparent membrane enclosing it, this building required serious efforts to find types of glass that would allow to perceive the original building as closely as possible. 'Zonnestraal' predates the invention of float glass<sup>15</sup>, which was developed by Pilkington in the 1950s and became readily available only in the late 1960s. Sheet glass as used for 'Zonnestraal' was slightly warped,

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<sup>14</sup> Particularly the restoration of the Van Nelle factories in Rotterdam. See: 'The Technology of Change. The Van Nelle Factories in Transition' in literature 5, pp. 44-59.

<sup>15</sup> An absolutely smooth contemporary glass, produced by floating molten glass onto liquid metal. See literature 14 and 22.

producing vertical distortions, which was essential to the vision and reflection qualities of the state-of-the-art curtain wall of 1928. Moreover, the colourless glass of the 1920s, made of low-iron sand that has since been used up in Western Europe, could only be found at reasonable cost in the new member states of the EU. For 'Zonnestraal', colourless sheet glass was eventually imported from Lithuania.<sup>16</sup> Single glass has been used again in spaces that did not require careful climatisation, such as corridors and staircases, as well as spacious rooms like the main hall upstairs that would allow people to move away from the glazing sufficiently not to be affected by cold draughts. As the cross shape of the hall easily allows to look through four layers of glazing, the issue of glass colour has been particularly essential here. For the workspaces, single glazing was not acceptable and a sophisticated solution for double glazing was designed to meet the required conditions. As double and single glazing would be applied right next to each other it was particularly important to reduce any differences in appearance. Therefore we wanted the Lithuanian glass for the outside pane. To avoid any colouring of the double glass unit as compared to the single glass next to it we had Starphire float glass imported from the US for the inside pane, which is of even more neutral colour. Very recent developments in UV-proof adhesive technology allowed the warped Lithuanian glass to be joined with the float glass pane in a Belgian factory, using a neutral grey U-PVC spacer that was specially produced in Italy. On close inspection, the expert eye may find the multiple reflection of the double glazing units slightly diverging from those of the single panes, but casually seen and surely from a certain distance the slightly blurred reflections from the sheet glass surface are predominant. The 11 mm thick double glazing units could be accommodated by the new window units. The increased depth of 32 mm of the steel profiles allowed for similar putty framing as found in the original single glazed section of the facade.

### **Cement plinths**

The contrast between the interior and the exterior of 'Zonnestraal' in terms of finishes and colour has been a huge surprise. After earlier restorations of modern interiors in The Netherlands, most notably the Sonneveld House of 1932<sup>17</sup>, it has again been striking to see that the originally selected colour schemes and finishes are quite different and much richer than those we tend to consider as 'modern' today. The interior finishes witness the functional character of the building as well. Beneath the whitewashed ceilings and upper parts of the walls, the lower parts were finished with a warm yellow mineral paint covering a section of strong cement plaster. The waterproof 'fortolite' sections in the cloak rooms, toilets, kitchens and behind washbasins were made in a similar shade, though slightly textured and more brilliant. From the draft specifications we learned that Duiker wanted the floors covered with sound absorbing material, for which he initially proposed asphalt roof covering.<sup>18</sup> Eventually he relied on linoleum, which was much more expensive. In order to economise, Duiker decided to use the flooring only in the central field of each space where people would actually walk. The remaining areas along the walls and around

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<sup>16</sup> For the Van Nelle factories, sheet glass in smaller sizes was found in the Czech Republic. Similar glass is artificially reproduced as 'Bauhaus Glass' by Schott, Germany, though at higher cost. More about glass technology and types in literature 14 and 22.

<sup>17</sup> See 'Huis Sonneveld. Modern wonen in 1933', various authors, Rotterdam 2001, ISBN 90 5662 1963.

<sup>18</sup> It was Wiebenga who corrected Duiker's draft regarding this point, claiming that the tar would stain on the white cement plinths. The draft specifications with annotations by Wiebenga are in the archives of the International Institute for Social Studies in Amsterdam.

columns were finished with white cement plaster which was set up against the wall to create a hollow plinth. Again, such handcraft was not uneconomic in a time of inexpensive labour and hence, the disproportionate cost to restore the plinths confronted us with a paradox when restoring the building.

Another way to cut expenses for Duiker was to avoid waste by using either the full 2 m wide or half width linoleum sheets. As the corridors measure 1.50 m centre to centre a hands' width on either side of the linoleum aisle was left for the white cement plinths, exactly as seen on period photographs.

## **Linoleum**

With the architects' original order for Jaspé linoleum we got hold of the product specifications, amounts, colours and the related codes, but no information as to for which rooms each colour was planned. Given Duiker's initial idea to have roof covering on the corridor floors and stairs, we believed the very dark brown to be used there. Similarly, the middle brown colour may have replaced the oak parquet for the main hall that had to be economised on. Finally, the dark green may have been used for the staff rooms. This assumption was calculated in terms of surfaces to find out that the amounts ordered for each colour nicely matched our hypothesis.

Jaspé is a wood patterned design, easily produced by having the upper calender rotating at slightly higher speed in order to stretch the contrasting colour particles, and therefore relatively cheap. Producer Forbo Krommenie still held the 1928 sample books but, much to their regret, was unable to reproduce the pattern themselves by lack of the proper calender. Eventually, rival Armstrong DLW appeared to be still equipped to reproduce Jaspé linoleum. Only because Forbo was still prepared to offer the 1928 sample book as a reference, the process of reproduction could finally start, and we are still extremely grateful to them.

Unfortunately, the green ordered by Duiker was out of production and the alternative colour he selected lacked from the old samples. As we remained unsure of the exact green colour, we decided rather to rely on just the two brown colours that we were sure of, and applied these in all the rooms.

The two brown shades were redesigned on the basis of a digital scan of a salvage piece of Jaspé. After extensive tests and samples, the DLW laboratories managed to remake both colours convincingly.<sup>19</sup>

Together with the yellow walls, the natural linen curtains and the woollen carpets, the light and dark brown linoleums created quite a contrast with the bright blue window frames and the brilliant white facades. Though functional and unadorned, the interiors of 1928 were probably less an expression of progress. Still, the choice for Thonet bent wood furniture can be explained from the fact that these were already mass produced and therefore 'modern', while the steel tubular furniture that we associate with modern interiors was still hand made for the elite.

## **Conclusion**

The restoration of this building has provided us with several new insights, and has helped us to revise and improve some of the conclusions drawn from our researches predating the restoration process.

When speaking about an architecture that pursued industrial building methods and the assembly of machine produced components, one could argue that the very materials are indeed not essential. To the authenticity of Modern Movement architecture the spatial qualities, appearance, form and detail are evidently more significant, though the core of

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<sup>19</sup> An extensive report on the reproduction of Jaspé linoleums for 'Zonnestraal' will be published in an upcoming edition of the DOCOMOMO International Journal.

modernity in architecture remains the idea, the conceptual starting points of the original architect. This may lead us to the conclusion that the absolute value of materials and constructions as applied in modern structures must not be overestimated. In view of the underlying philosophy and the limited functional lifespan of many modern buildings, most building materials applied in modern structures are also shortlived. As the authenticity of materials is therefore often difficult to maintain, for that reason a convenient argument to ignore the material aspects of these modern prototypes seems at hand. The restoration of 'Zonnestraal' thought us that such an alibi can easily be false.

It is self-evident that our earlier conclusion that the assessment of the historic value of Modern Movement buildings must be based on more than just their appearance, was strongly confirmed. Understanding the original design approach appeared critical to the conservation process. Precisely in the case of Duiker's works it made us comprehend that the exposed constructions themselves are vital to the original concept. His technological innovations are directly linked to the free plan and rationalisation of construction. Even if some of them failed, we must be aware that the experiments of modern engineers and architects represent a historic significance of their own. Respecting the material aspects of their architecture helps us to understand what may appear to us as the anachronisms of the era.

The contrast between the interior and the exterior finishes and colours appeared striking, most notably because those originally selected for the interiors do not easily comply with our image of the Modern Movement. To our mind, respecting this difference has contributed greatly to the quality of the present restoration, and to the narrative of Duiker's original architecture in the social and cultural context of its time.

This is vital to make historic continuity understandable as well to the public at large. Apart from its great architectural value, the unique history of 'Zonnestraal' has made it into an unprecedented symbol of our social democracy, attracting almost 2000 visitors on the first day the restored building was open to the public.

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## **Speaker resume**

*As the principle of Wessel de Jonge architects in Rotterdam, The Netherlands, Wessel de Jonge has been involved in such prominent Modern Movement restoration projects as the Van Nelle 'Design Factory' in Rotterdam and Rietveld's Netherlands Pavilion at the Biannual in Venice. In cooperation with Hubert-Jan Henket architects he has been in charge of the restoration of 'Zonnestraal' since 1993.*

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## Summary for Russian translation

Ever since its completion in 1928, Jan Duiker's Sanatorium 'Zonnestraal' in Hilversum has probably been the most canonical and internationally celebrated example of Modern Movement architecture in The Netherlands. But ever since its changing function around 1960 a consequent series of adaptations and refurbishments caused the disfigurement of Duiker's masterpiece, which has doubtlessly been the most controversial issue in architectural heritage in the country...

With 'Zonnestraal' the architect produced a direct response to a short-lived functional program of his client, the Amsterdam Union of Diamond Workers. Based on a solid belief in Science and Progress, the sanatorium was established in the conviction that tuberculosis would be exterminated within thirty to fifty years. Duiker managed to subtly balance user requirements and technical lifespan with the very limited budget of the client, creating a structure of breathtaking beauty and great fragility at the same time. Hence, we were faced with the conservation of a structure that was intended to be transitory.

After two decades of extensive preparatory research and with the prospect of an eventual UNESCO World Heritage nomination, the restoration of the first building could finally start in Fall 2000. The careful dismantling of the main building proved an unprecedented source of knowledge and hands-on experience with early modern building technology and its preservation. When planning the restoration, Duiker's search for new and specific technical solutions and materials for 'Zonnestraal' has given rise to attach great value to the few remains thereof.

The works largely involved the conservation and restoration of the still authentic concrete structural frame, a few partitions and the salvage parts of one facade, as well as the reconstruction of the remaining facades, partitions, finishes and colours. Some lost parts have been carefully reconstructed at high cost such as the steel window frames with colourless sheet glass (that is no longer produced in Western Europe and was imported from Lithuania), and some finishes like the cement plinths and the original patterned linoleum, which was remade in Germany. Albeit partly, with the first stage of the restoration completed in 2003 the great value of Duiker's work is now again attainable to the expert community as well as the public at large.

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