CONTENT

Foreword 6
Frei Otto 8
Working for a Better “Earth for Mankind”
Winfried Nerdinger

Natural Forms – Architectural Forms 16
Rainer Barthel

The Lightweight Principle 32
Eberhard Möller

Frei Otto and Biology 44
Ulrich Kull

In Harmony with Nature and Technology 56
On Frei Otto’s Architecture and Work Method
Irene Meissner

MODELS AND EXPERIMENTS 64
Where Architecture and Civil Engineering Meet
Rainer Graefe

Institute for Development of Lightweight Construction and Atelier Warmbronn 80
Ewald Bubner

The Institute for Lightweight Structures 90
University Institute and Spinners’ Centre
Berthold Burkhardt

Frei Otto and Ove Arup 102
A Case of Mutual Inspiration
Christian Brensing

Frei Otto and Ted Happold 110
1967–1996 and Beyond
Michael Dickson

Ethics, Aesthetics and Innovation 124
A Speech by Frei Otto

WORKSHOP OF IDEAS 130
DRAWINGS AND SKETCHES

CATALOGUE OF WORKS 168
Buildings and Projects 1951–2004
Irene Meissner, Eberhard Möller

Appendix

Frei Otto and Projects in the Orient 360
A Personal Account
Bodo Rasch

Homage to Frei Otto 362
Biography 368
Bibliography 370
Contributors 383
Glossary 384
Index of Names 386
Index of Locations 388
Thanks 389
Illustration Credits 390

Appendix

Friedens-

Barmen dir

R. von H.
It is the gait of a free man
that leads to the freedom of others

Michel Foucault

Architecture is an existential matter for Frei Otto. He is not interested in creating a piece just for an individual client, or in self-presentation, he wants his buildings to contribute to improving everyone's living conditions. He is not interested in constructing individual works, but in conducting a process that is directed at a vision, at creating architecture for a peaceful society in harmony with nature: “My hope is that light, flexible architecture might bring about a new and open society.” This higher aim makes Frei Otto different from most people who create buildings and, at the same time, it identifies his towering significance as an architect who is aware of his responsibility for working on the “terre des hommes”, an earth for mankind; “An earth for mankind, that sums up man’s earthly habitat.” It is the architect's job to work on “sustaining a habitat” that includes all the realms of man and nature: “I am constantly amazed that even colleagues cannot see the wonderful image of this earth.” Only Bruno Taut, shortly after the First World War, formulated a similar vision of the earth, calling it a “good dwelling” for all mankind."

Shot into adulthood in the war

Social commitment was one of the characteristics of Neues Bauen in the twenties. Frei Otto is one of the few people who took up this approach after the Second World War, and also drew a radical conclusion from twelve years of Nazism, crime and an “architecture of killing”. “We, my generation, who were shot into adulthood in the war, wanted to help with rebuilding, wanted to get over the war, the megalomania, the cult of the Führer and of personality, wanted to be allowed to live - but to remain modest while doing so.” Even today, Frei Otto’s key ideas and work can be traced back to some influential experiences during the National Socialist period: for him, “liberation from the yoke of the thirties” was possible only if “this period is recognized, and people act accordingly”. He himself unsurprisingly admits that as a young person he succumbed in a very few, comparatively harmless cases to NS propaganda, and so he was able all the more clearly to express his contempt for the many architects, lawyers, teachers or politicians who were supposed to be building up a democracy but kept quiet about what they did in the NS period, or did not even regret it, like the “dreadful lawyer” Fibinger.

“Burning cities are a hard introductory course for young architects”, Frei Otto pronounced in retrospect. It was from this appraisal of his experiences and influential events in the NS period that he drew the moral force to keep involving himself in building events in West Germany and to point out mistaken developments more clearly than scarcely anyone else; such developments were often symptoms of a past with which the country had not yet come to terms. But his angry appeals against “unnatural” building, his call to tear down the “sinful mountain” with which “the surface of the earth” had been “encrusted (...) in the last 30 years”, or his cry that “our modern housing make me sick” rang out just as ineffectively as his protests and open letters railing against the “destruction of the European culture landscape with state-driven, barracks-like dwellings,” against “chicken batteries for human beings” or the “re-nazification” of Stuttgart’s Weissenhofsiedlung in the post-war period.
Federal Garden Exhibition Kassel 1955, music pavilion

Federal Garden Exhibition Cologne 1957, dance pavilion
Build light and keep mobile

Frei Otto's determined rejection of any form of heavy, solid, earthbound building, which was associated, not just for him, with German sentimentality about the homeland and the Nazi-style cult of blood and soil, was also based on his experiences in the National Socialist period. When the German architectural élite met in Darmstadt in 1951 for a discussion on "man and space", Egon Eiermann declared that the old homeland with folk-songs did not exist any more, the new homeland was the whole world, and so it was his job to design "homelessness".13 And Hans Schwippert added: "is it not remarkable that (...) good master-builders are building tents all over the world, light, open things."14 This plea for light, mobile architecture is not just reminiscent of the many connotations of the "international" modern architecture of the twenties with aeroplanes, ships and nomads' tents, but also of manifestos immediately after the First World War, when some architects, faced with destruction from the material battles, demanded dematerialisation of architecture, and thus its spiritualization. Just as the glass and tent fantasies from the group of friends around Bruno Taut ("The Crystal Chain") were a pacifist response to peoples "drinking blood"17 in the war, the appeal for lightweight building after the Second World War had a strong ideological tinge at first.18

But it was only Frei Otto who developed a comprehensive, society-related idea of architecture according to the motto "with lightness against brutality"19 from these beginnings. Even his first tent structures, which brought him recognition and caused a stir, like the awnings for the Federal Garden Exhibitions in Kassel in 1955 (+13, 15) and Cologne in 1957 (+18-22) and the tent roofs at Interbau in Berlin in 1957 (+26-30) were signs of a hitherto unknown approach in German architecture: light, filigree structures, almost floating, and yet firmly braced, with no other function than to protect the people underneath them, and simply taken down again when the people go away. The tents seemed simple and modest, and yet they were signs of technical perfection. The open spaces with fluent transitions to the surrounding area drew visitors in and did not keep them captive. "A gentle roof like a cloudscape" was Frei Otto's poetic image for the vision of a peacefully cheerful harmony between protective roof, landscape and people, and at the same time invoked the mobility and transience of the tent structures. The German Pavilion in Montreal (+76) was his first opportunity to realise this vision on a larger scale; he aptly referred to it as a "light-hearted improvisation". It started a new era20 of lightweight building using cable net constructions, after Vladimir Suchov's tent in Nijni Novgorod and Matthew Nowicki's Raleigh Arena. The transparent German Pavilion at the Brussels World Fair by Egon Eiermann and Sep Ruf was intended to show the world a changed Germany, and Frei Otto's tent in Montreal brought international recognition for the transformation into a new, peaceful democracy.

Lightweight construction programme

Dematerialisation and lightweight construction had been under discussion, ever since industrialisation and the increased use of steel and glass in building, as indicators of modernisation and of construction that is calculated in terms of building statics and planned economically. Sigfried Giedion and other architectural historians have constructed a history of the development of modern architecture from the increasing dematerialisation that could be linked with the disappearance of historical forms. The dematerialisation of objects or equipment as a "liberation" of human beings was celebrated at the Bauhaus as well, and seen as parallel with the development of mobile, international human beings.21 Then after the war dematerialisation, understood as using a great deal of glass, and transparency, served as a usually vague statement resisting the heavy, massive architecture of the NS period. But other than Frei Otto, very few people developed a "philosophy" of lightweight construction with social connections. One who did was Buckminster Fuller, who defined the weight of buildings as a measure of the standard of development not just of industrialisation, but also of mankind.22
Lightweight building and "liberation" are linked for Frei Otto as well. But unlike many other advocates of programmatic Modernism he did not believe that transparent material or lightweight constructions alone can improve the world we live in, as "constructions are not bound to scale. They can be enlarged and reduced several times by the power of ten, they still work, (and so) we should be aware that constructions do not actually have anything to do with people." So the crucial feature for him is the link with people and the quality of the structures for people. He does however strictly reject the woolly term "humane building", which is mostly applied to use, as he is not concerned with the well-being of individuals: "Buildings are 'humane' only when they promote peaceful human co-existence." This ambitious claim is one of the reasons why Frei Otto is never content with a solution that has been found once, and why a certain form of lightweight construction never became a universal architectural solution for him: "I have never been satisfied with a piece of work I have been actively involved in, and would never want to be." 

**Do not build prestigiously, but ephemerally**

For Frei Otto, lightweight construction does not just mean minimising mass, materials and energy, but always building adaptably, changeably and thus "ephemerally". This attitude is also based on experiences with the "Nazis' whispers of eternity". Official National Socialist architecture was intended to give an impression of eternity and permanence through its monumentality and mass, and to represent the state as a symbol of power. So throughout his life Frei Otto has rejected not just heavy architecture, but also any form of symbolic or prestigious architecture. The "thousand-year Reich's" claim to eternity, intended to be made visible and manifest in marble or granite buildings, has always been profoundly repugnant to him. Lightweight buildings, deliberately conceived to be changeable and removed, and that convey no claim to being prestigious or imposing, are his response to the leaden NS architecture, expressing contempt for people. He therefore reacted correspondingly violently to the return of the monumental after the Second World War. The Berlin Kongresshalle was allegedly an architectural sign of "free discussion", financed by the USA and built by Hugh Stubbins in 1956. Frei Otto was the only person to turn against the new form of symbolic, prestigious architecture when he declared: "'Free discussion' cannot be built, but it can be made possible through building." In a discussion with the architect and the engineer Fred N. Severud he criticised the luxurious materials, the pompous platform, the theatrical monumentality and the heavy pressure beam in the roof. As a counter-model, Frei Otto sketched Matthew Nowicki's suspended cable net construction between two paraboloid reinforced concrete arches for the Arena in Raleigh, whose light, unpretentious structure with its bright, completely column-free space had profoundly impressed him even at the design stage on the visit to the USA in 1950, and given important impetus to his own experiments with tents and cable nets. Frei Otto's view was confirmed, late but sadly, when the peripheral beams of the Kongresshalle, excessively large for reasons of prestige, and which he had particularly criticised, collapsed in 1980.

Frei Otto subsequently always criticised buildings with a claim to being imposing or symbolic, even if they had been designed by the most famous architects, like Le Corbusier's concrete tent and the Atomium, which for him symbolised only the nuclear threat, at the 1958 Brussels World Fair, Eero Saarinen's bird-shaped TWA terminal in New York or the sails on Jorn Utzon's Sydney Opera House. But he was particularly outraged when James Stirling's design for the Neue Staatsgalerie was chosen for realisation in "his" city of Stuttgart. He did note positively the fact that Stirling had outdone the Stuttgart architecture cliques, who he felt "shaped the face of the city in a petit-bourgeois fashion with the device of competitions, which look so democratic," as is the practice everywhere, but he saw the new building as nothing but "stone stage-set walls with gigantic cornices that do not support a roof. Fortress architecture with claims to eternity. A demonstration of power as a back-

---

ground for art.” But he did find the “model” for Stirling’s design, Alexander von Branca’s Neue Pinakothek in Munich, even more repugnant: “Here we have the perfect façades of the Speer epoch again, hanging in noble, alienated stone.” The powerful experience of the NS period is the background for all this criticism of a development that Frei Otto fought at first and then just followed with resigned abhorrence: “Modern architecture is dead. The monument is back.”

The uniform cannot be overcome with form

Better than most architecture critics, Frei Otto established with his own clarity and precision the reasons why modern architecture was in a state of crisis: even in the twenties there was no real functional building in many cases. Instead function was used as an expressive device, and thus ultimately served the formal ideas of the individual designer. The Neues Bauen architects’ striving for new structural solutions remained trapped in a “style of emphatic functionality,” thus functionality had “become decoration”, as people were still living in the world of Expressionist ideas, and so thought that architecture had to express something. Rebuilding then brought about the “traditionalism of modern architecture”, as now the visions and experiments of the twenties were simply being translated formulaically into mass building. Instead of experimenting further and looking for solutions, people were content to cite formal elements. In Mies van der Rohe’s case still produced crystalline rigidity, but in the hands of mediocre architects it led to the “tedium of gridded façades”, to “mass production in the stylistic garb of the threadbare functionalism” or to the decoration of cubic forms, spreading all over the world as the international style.

The development of an architecture that Bruno Taut had criticised as the “tedious schematics of international trash” as early as 1929 led to the counter-movement of Postmodernism, which saw the return of historical forms, self-presentation by the architect and formal experiments for the sake of form alone. Frei Otto used his continuous interdisciplinary work for understanding the way in which forms and natural constructions emerge to resist this false insight that modern architecture’s new-found uniformity could be overcome by “form”: “The cry for form comes from those who have no idea of the origin and extent of the infinity of forms.”

New building culture needs work on basics

Frei Otto has worked like no other 20th century architect on investigating “Gestaltwerdung” – the emergence of form – in nature, technology and architecture, and on developing a new form of light and natural, adaptable and changeable building from the understanding that flows from research. The research institutions that he founded and directed, the Institute for Development of Lightweight Construction in Berlin and the Institute for Lightweight Structures in Stuttgart, were unique places for basic interdisciplinary research that was open to results, and its impulses and stimuli spread all over the world. This was not about isolated forms and constructions, but about their laws, and understanding them generally, not about individual achievements, but about a joint search for solutions. It is only this kind of basic research, which is seriously neglected in the field of architecture, that can produce new questions and solutions: “New building culture needs the broadest possible work on its basic principles.” Complaints about the lack of a building culture, which have been as effusive as they have been maudlin in recent years, will lead to nothing if this idea of Frei Otto’s is not considered and implemented.

The fact that Frei Otto increasingly directed his research at understanding “natural constructions” from the fifties, and that he wanted to grasp the processes of self-organisation and of the economy principle in nature, also fits in with his rejection of individual self-representation in designing and building. In contrast with the cult of personality pursued by many architects, which he has found suspicious and repugnant since the experiences of his youth, he supports an almost “anonymous” kind of building, intended to emerge from harmony with nature and its laws as a matter of course. And so his working medium is primarily the model, which can be used to
"Nature, what is that? - living, loving, laughing", drawing 1984

Sketches for the "Peace Monument" figure group, drawing May 1988
simulate form-finding and optimisation processes. And understanding the processual character of natural constructions in its turn almost inevitably produces a position that runs completely counter to the individually fixed formal expression of the "artist architect", whose products Frei Otto feels are simply "show-off architecture", even though it dominates the architectural magazines. And so at best, he played the role of an outsider to the architecture scene, was rarely invited to take part in competitions, and never appointed to serve on judging panels.

Frei Otto's visions are aimed at tents with minimal surface areas, at grid shells stabilised by inverting traction lines, at pneumatic envelopes whose form is determined by pressure ratios and that sit on the landscape like a second skin, or at buildings that can be adapted to their particular needs by changing owners and can always be altered. For him, this work on natural constructions is part of a rational form-finding process following natural laws, but it is also part of a larger vision directed at a peaceful and free society in harmony with itself and nature. The ascetic architect falls into astonishing dreams of "sensual architecture" as part of these visions, of a "delicate, heavenly collage (...) on the theme of peace and love", or of building a kind of "love pavilion", as ultimately for Frei Otto work on mankind's earth leads to "peaceful love-architecture" in a "happy cultural landscape". A dream that he does at least dream, unlike most architects, as for him "visionary imagination is never utopian".

42 Frei Otto. "Subjektives und Kritisches zu dem, was andere als mein Werk bezeichnen". Wilhelm. 1985 (note 6), pp. 162-163