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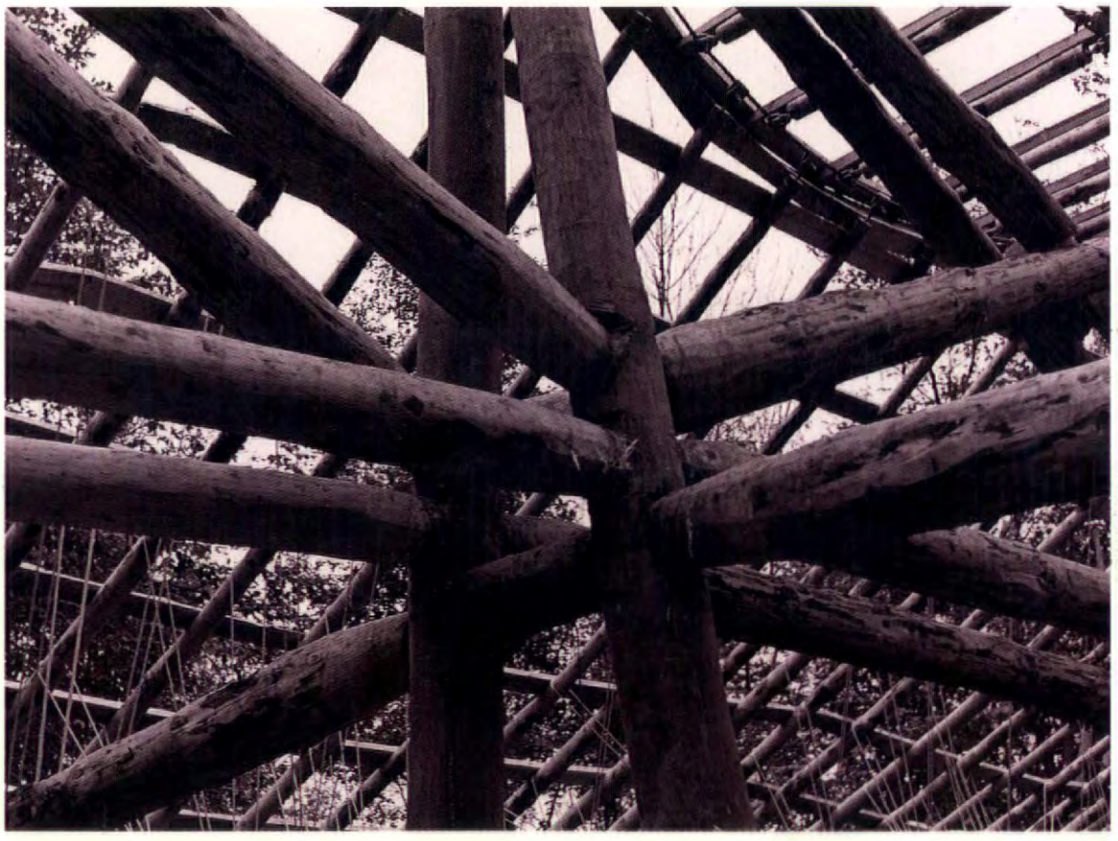

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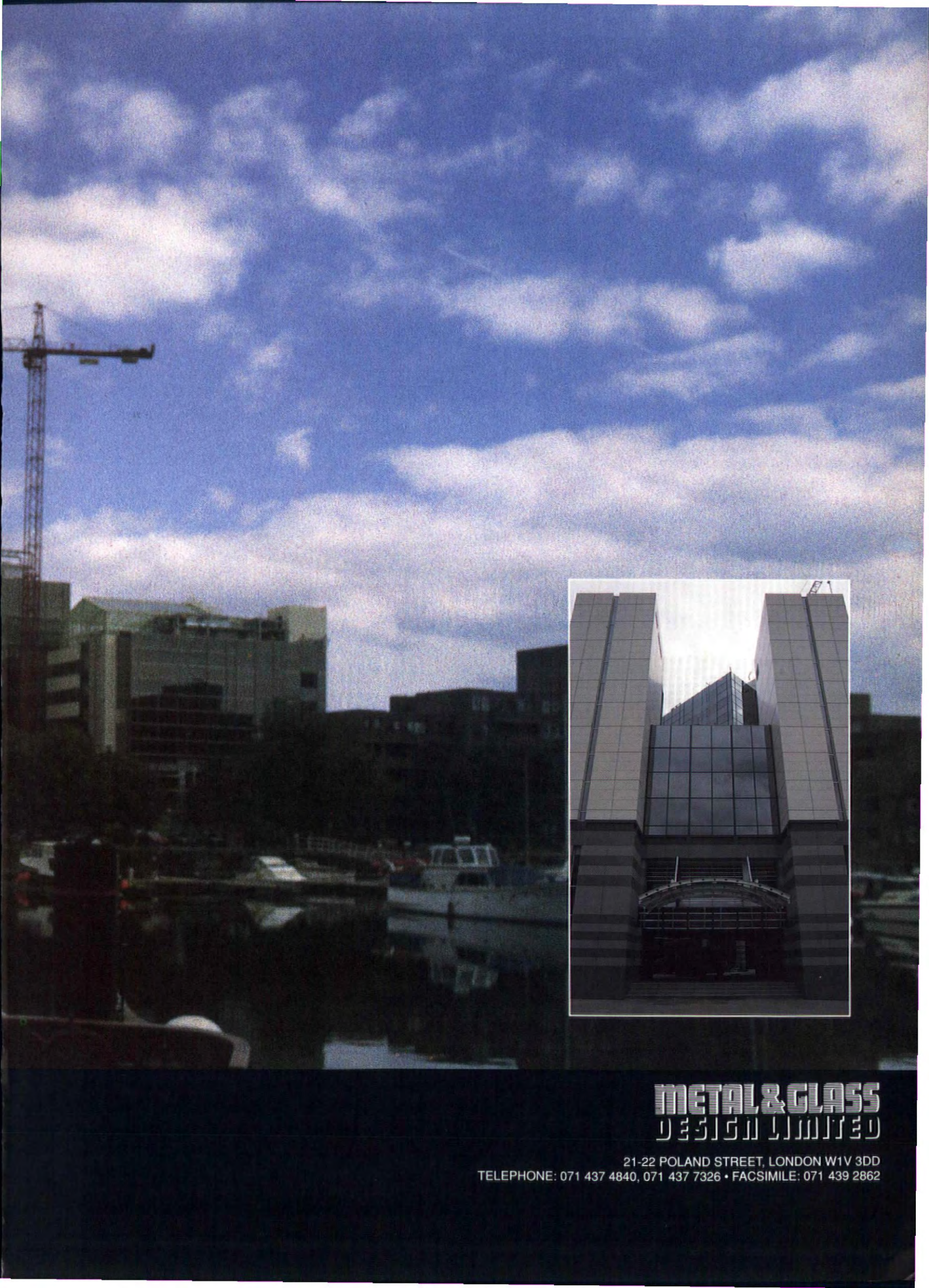

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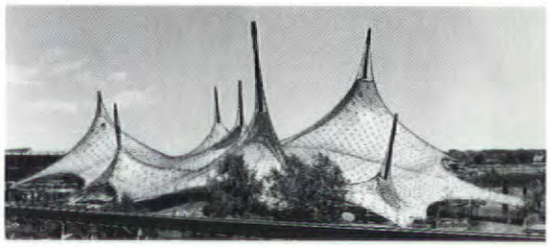

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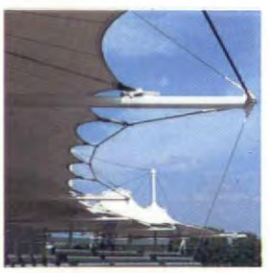

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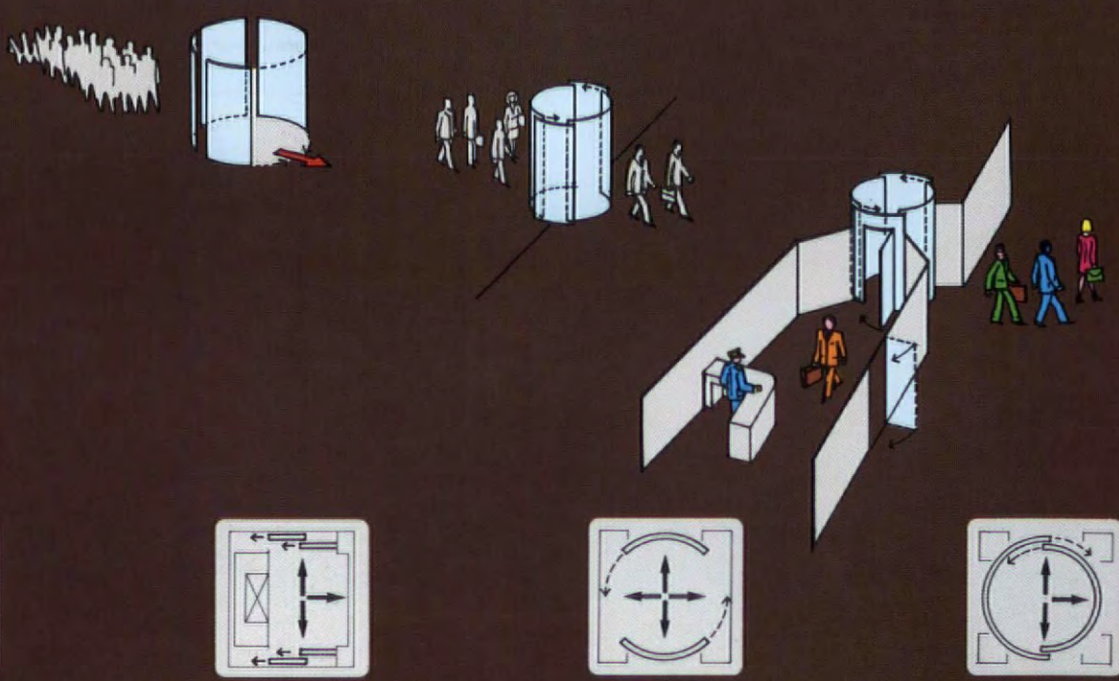

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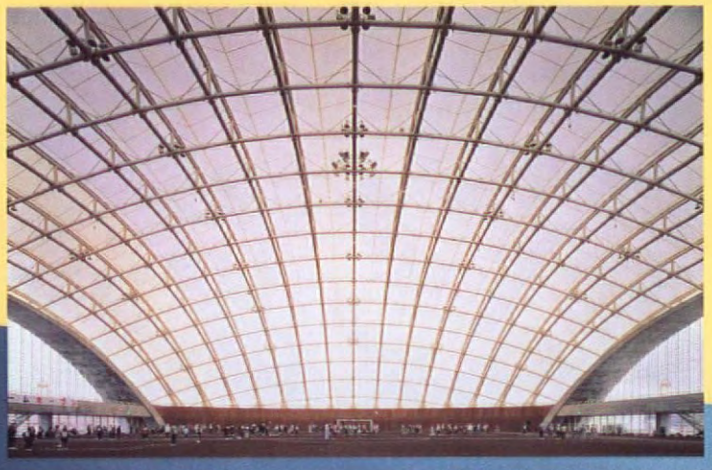

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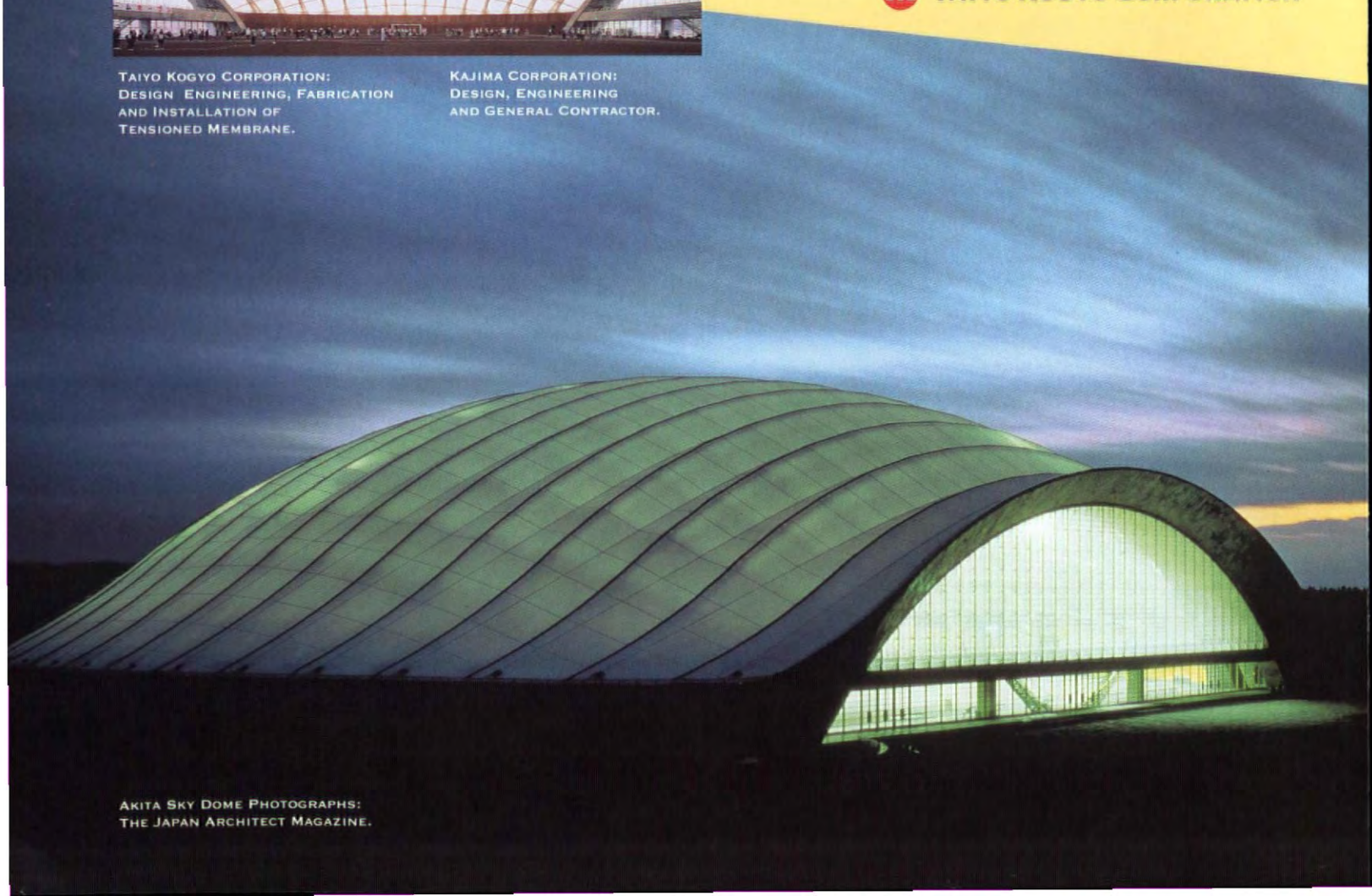

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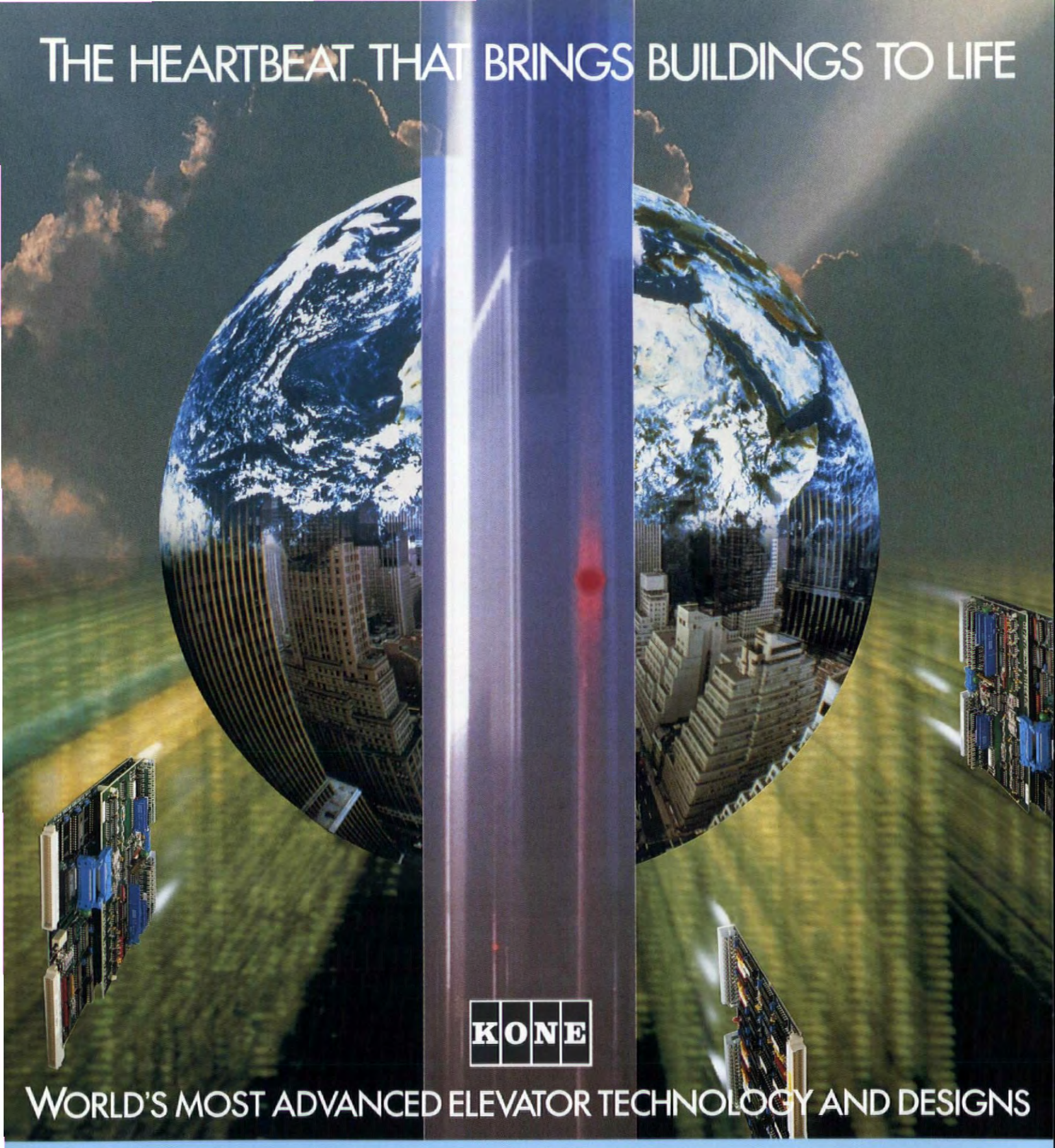

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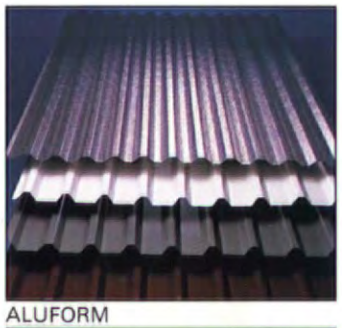

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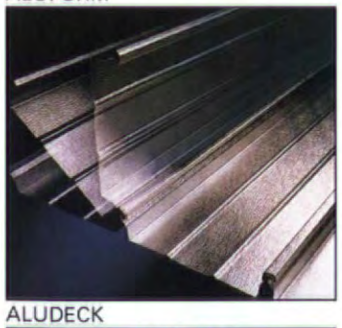

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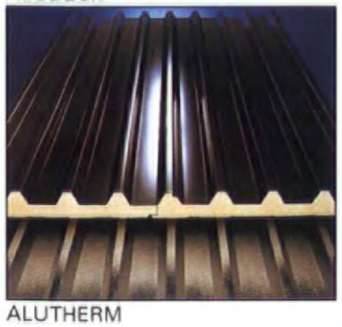

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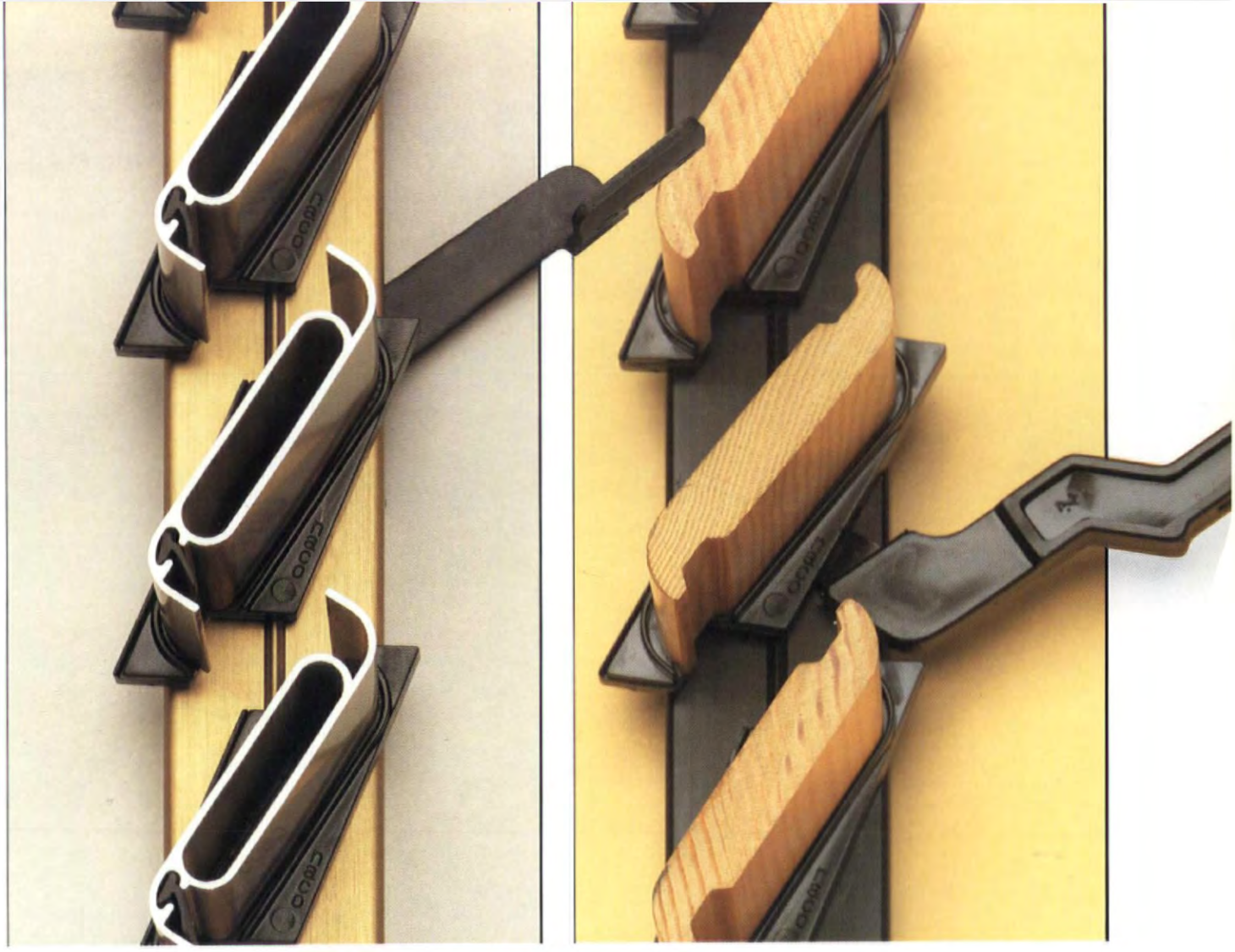

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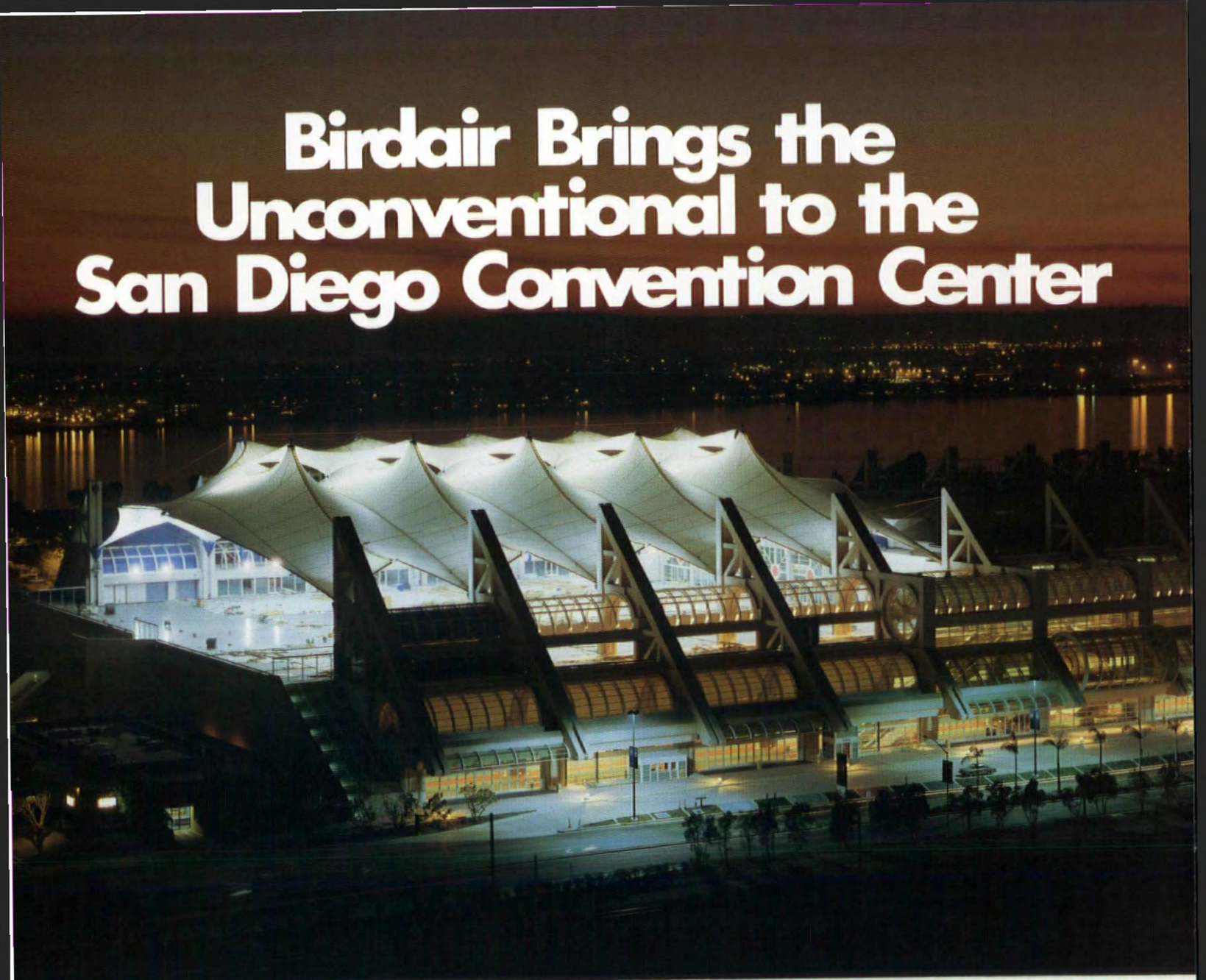

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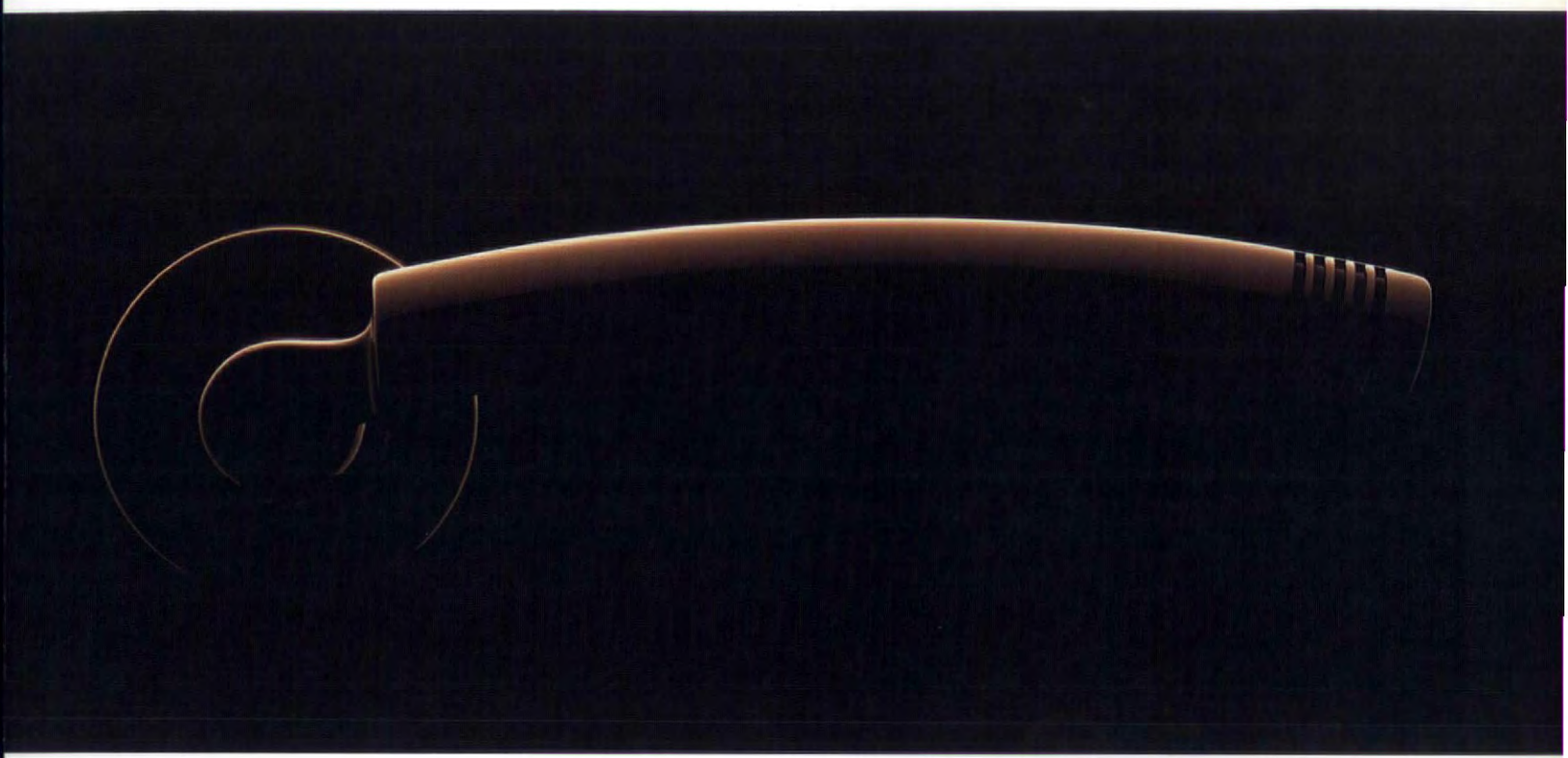

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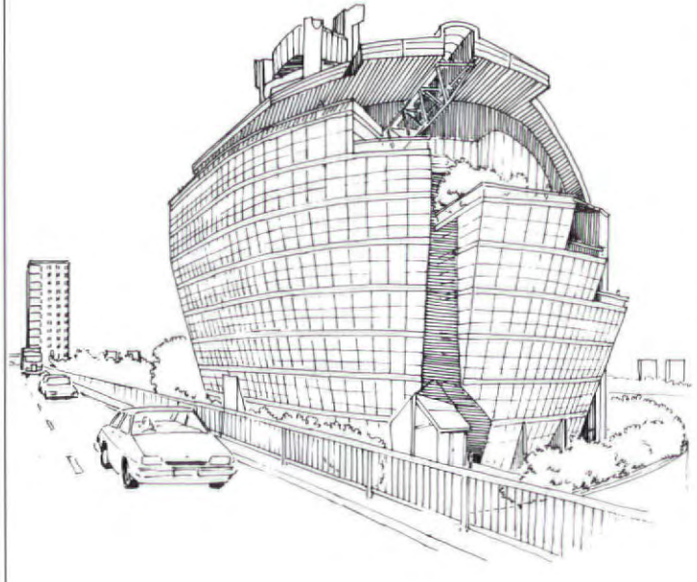

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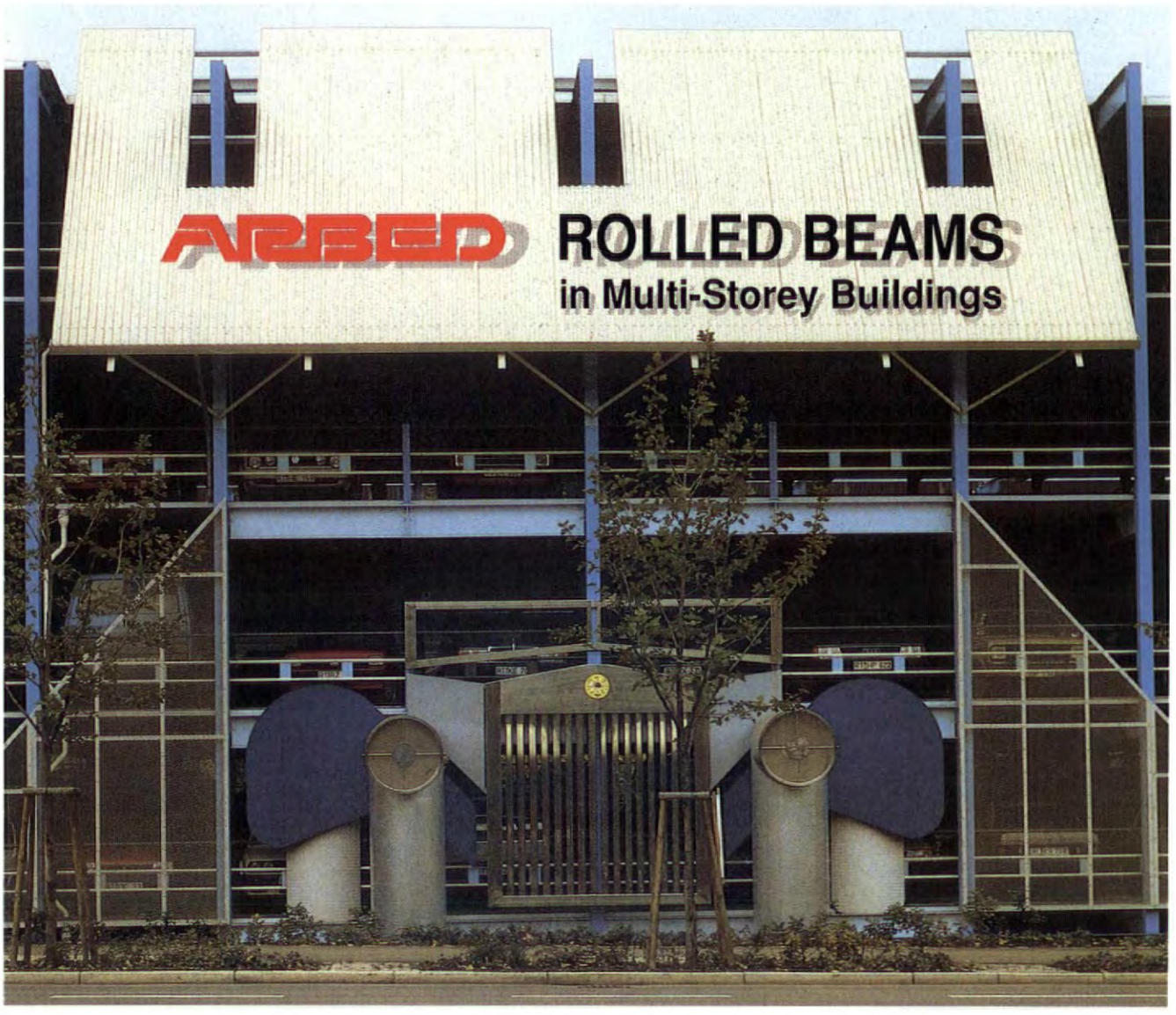

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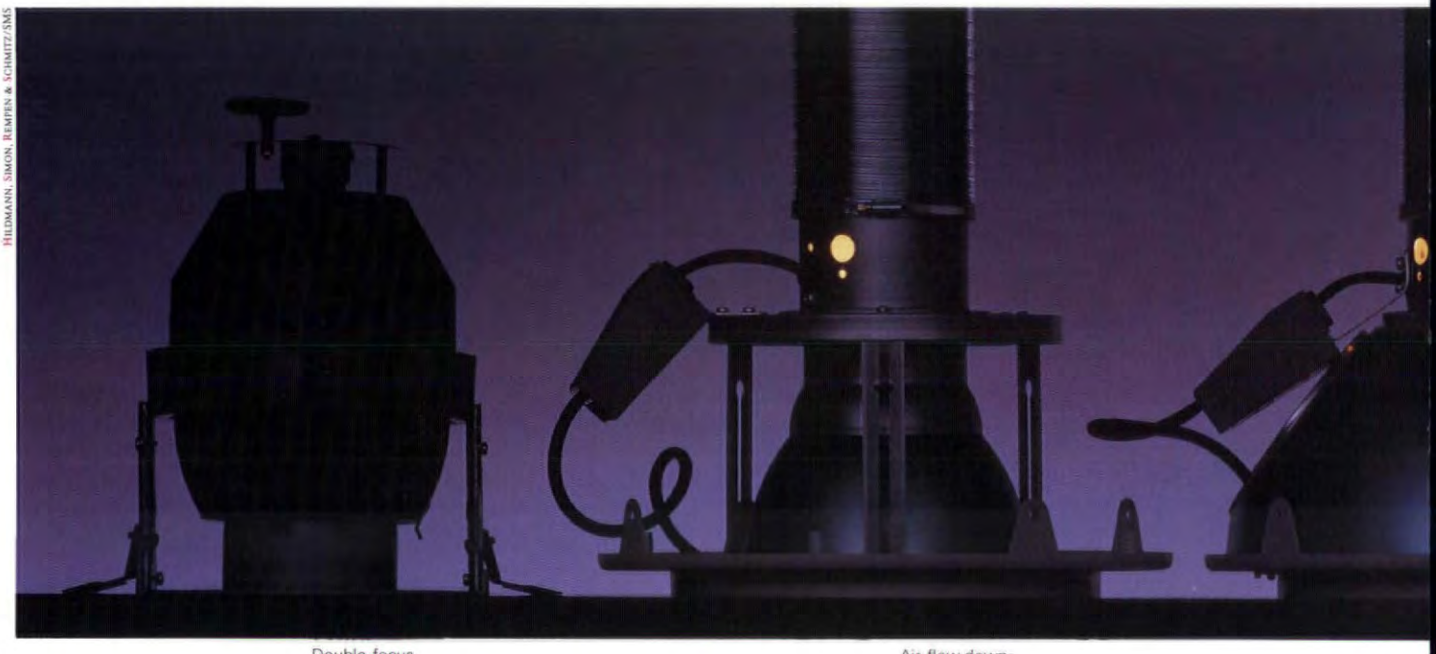

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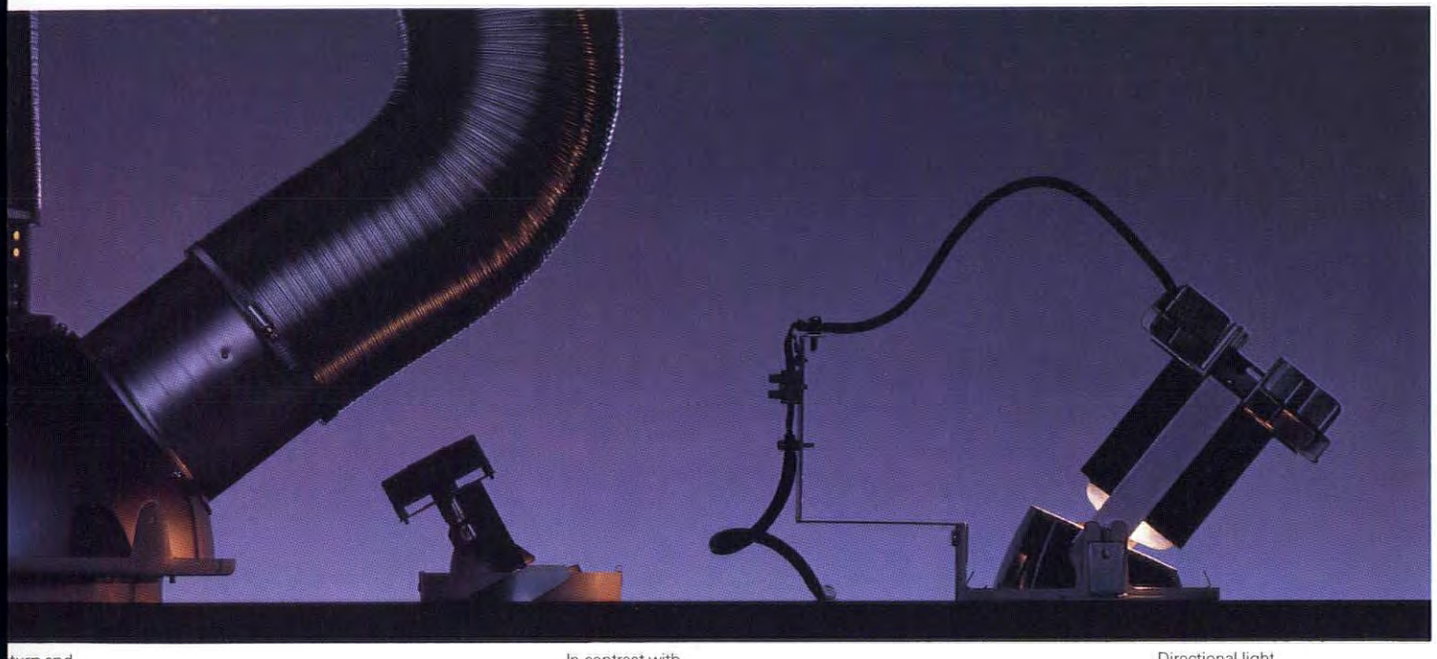

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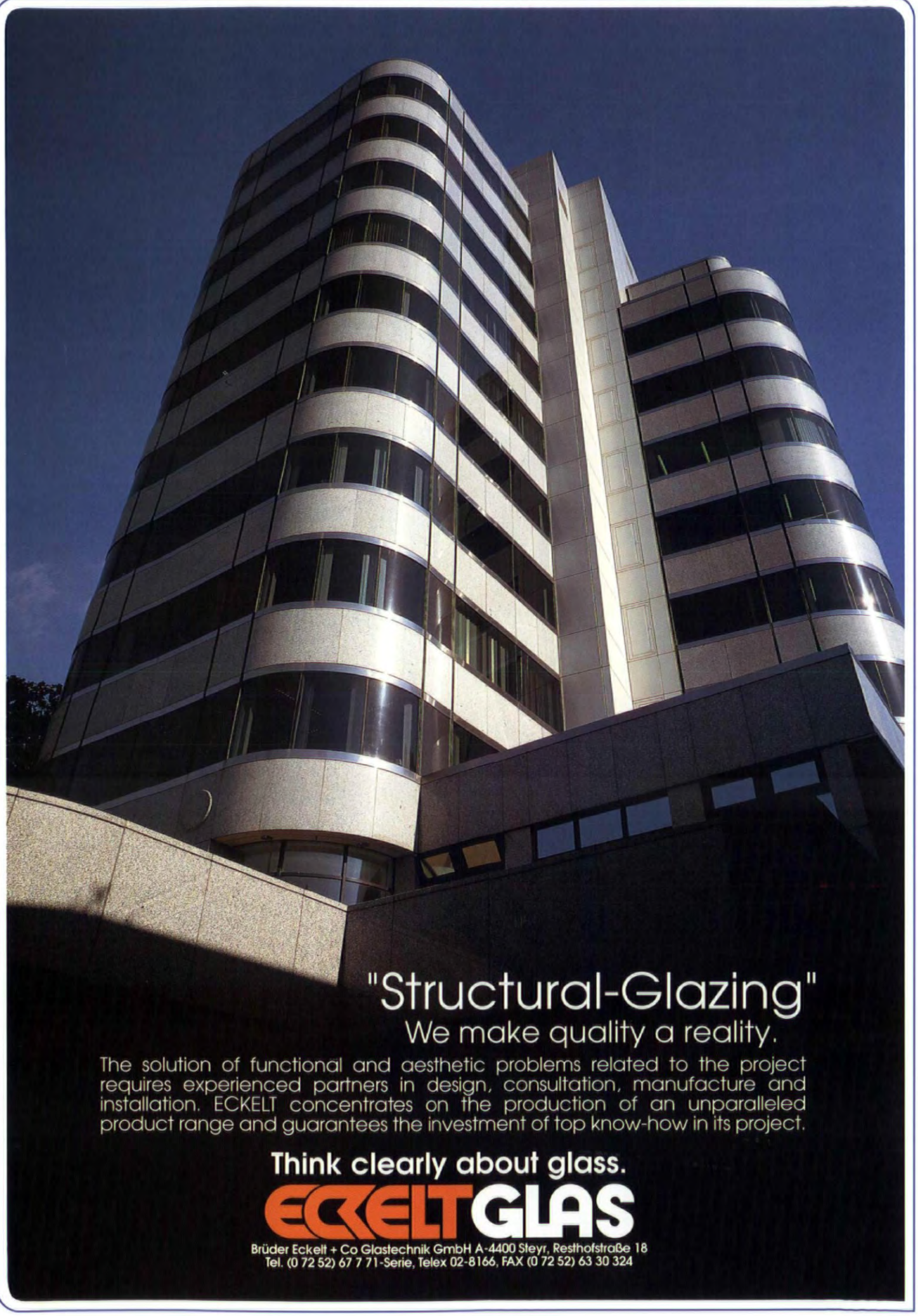


Arch.: Fitzroy-Robinson-Partnership London - Curtain walling: Koller UK

WORLD ARCHITECTURE

Frei Otto: structure in nature

Frank Lloyd Wright: nature in structure

Nature is a profound inspirational source. It has inspired generations of architects, artists and designers. But for many, nature has always been a difficult task-master. With the added impetus of the ever-expanding demands of the international green movement, more and more designers are now seeking affirmation of their design decisions from nature.

A new, fundamental kind of questioning is going on among designers. Is it going to work well at an ecological level? Does the project respect the need for conservation? Is it right for the context? Is it responsive to energy saving and space enhancing demands? These questions are constantly before the architect who feels a responsibility to answer them positively. It has led to an attitude of respect and concern which, however, has rather disappointingly often led to dull design responses.

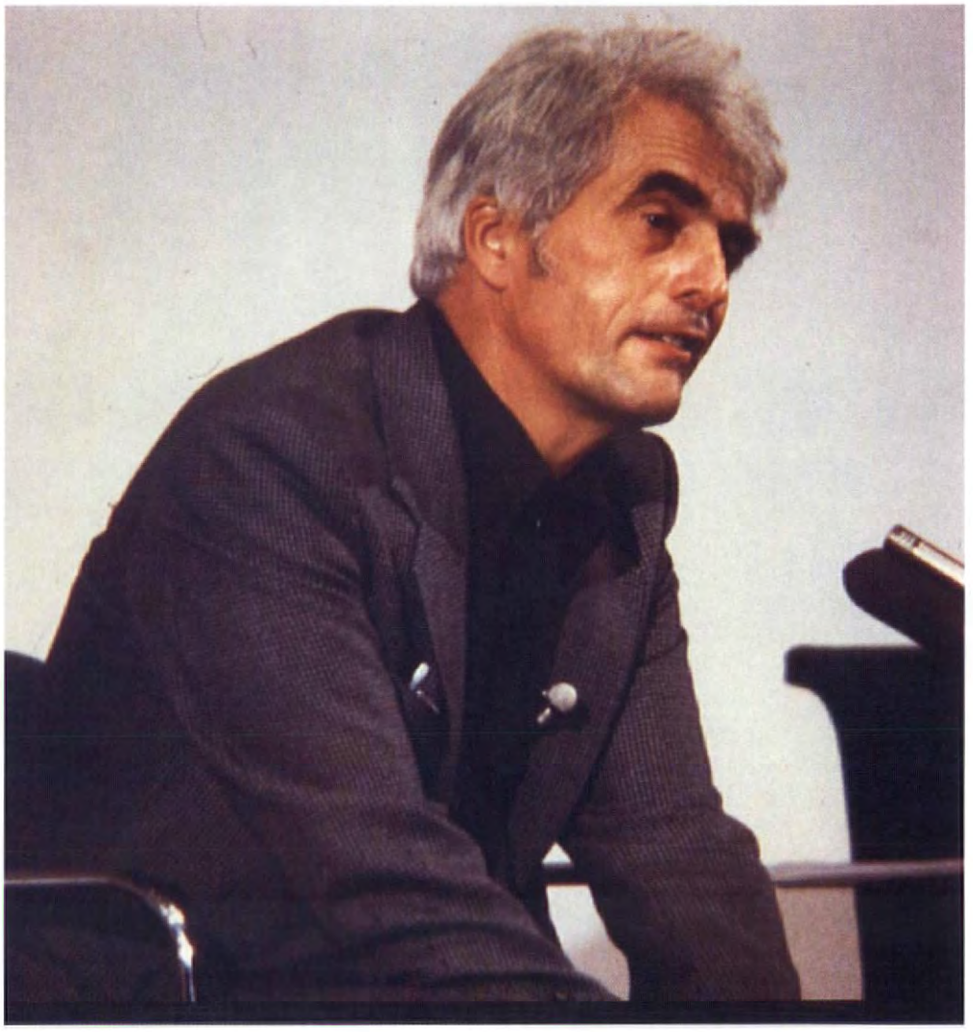
Perhaps this is because of the immense difficulties that are to be encountered when trying to respond creatively to nature and natural principles? One can feel confident about the vast repertoire of forms, materials, and even the analogies available in nature. But as a source of inspiration there are real problems of interpretation. There is clearly a love-hate relationship here. Even those designers who have aligned themselves with the organic architecture movement have never been fully able to overcome these difficulties.

Frei Otto has argued the case that mankind has constantly been at war with nature. In this issue he claims: "Architects have been building against nature for 5,000 years". But he – unique among contemporary architects and engineers – has made enormous inroads into the problem. The theme of this special Frei Otto issue of *World Architecture* is concerned with the nature of structure and the structure of nature. In Otto's own contribution he takes up its challenge and focuses on what he calls "the new plurality". He indicates an openness to new approaches in formulating commitment to "obligations and rights on behalf of all human beings who build or have something built".

In his ten-point manifesto Otto emphasizes the need for a new understanding of the terms "humanity and nature" as an inseparable whole. He looks for "a striving for natural security for every human being in a society . . . " and, among other things, the avoidance of building unnecessary buildings in the environment.

Professor Otto also makes a plea for the use of adaptable building methods through the design of adjustable structures and for the integration of all the contemporary arts in this plural process. His own work serves as a testimony to many of these proposals. □

Dennis Sharp



The exploration of architecture, engineering and nature in Frei Otto's work has a sustained structural originality which transcends the passing fads of architectural movements. In the first article of a three-part profile, Otto's long-standing friend and colleague Edmund Happold of Buro Happold looks at the German architect's contribution to the creation of a more natural and humanistic mode of building.

FREI OTTO
THE FORCE OF NATURE

Throughout his career, Frei Otto has drawn on the shapes and structures of nature – such as the spider's web – to inform his work.

Frei Otto has been around a long time and in architecture, with its strong element of fashion, it is easy to slowly slide into irrelevance. People think they know all about you and they slot you into a pigeonhole in history. But Otto's work is consistently original. What makes him unusual is that he never stops learning and thinking, and the results of that transcend fashion.

He might have been an engineer since his childhood hobby was flying. From making model airplanes he took up gliding and, at 18, became a pilot in the German air force. In 1945 he became a prisoner of war and became fascinated by constructional problems in the camp which had to be solved in primitive conditions using the minimum of materials.

On release he went to read architecture at the Technical University of Berlin. He made a study tour to the United States in 1950 where, among others, he visited Severud, Elstadt and Krueger, the New York-based engineers for the Raleigh Arena, the first large modern suspended roof.

He came back to write his doctoral thesis under Professor Bickenbach, on the virtually unknown field of suspended roofs. He wrote to Peter Stromeyer, who headed the tenting division of his family's textile firm and who shared a vision of new tent forms. With Frei designing and Peter Stromeyer's staff carrying out the engineering and manufacture, they produced a whole new generation of tents.

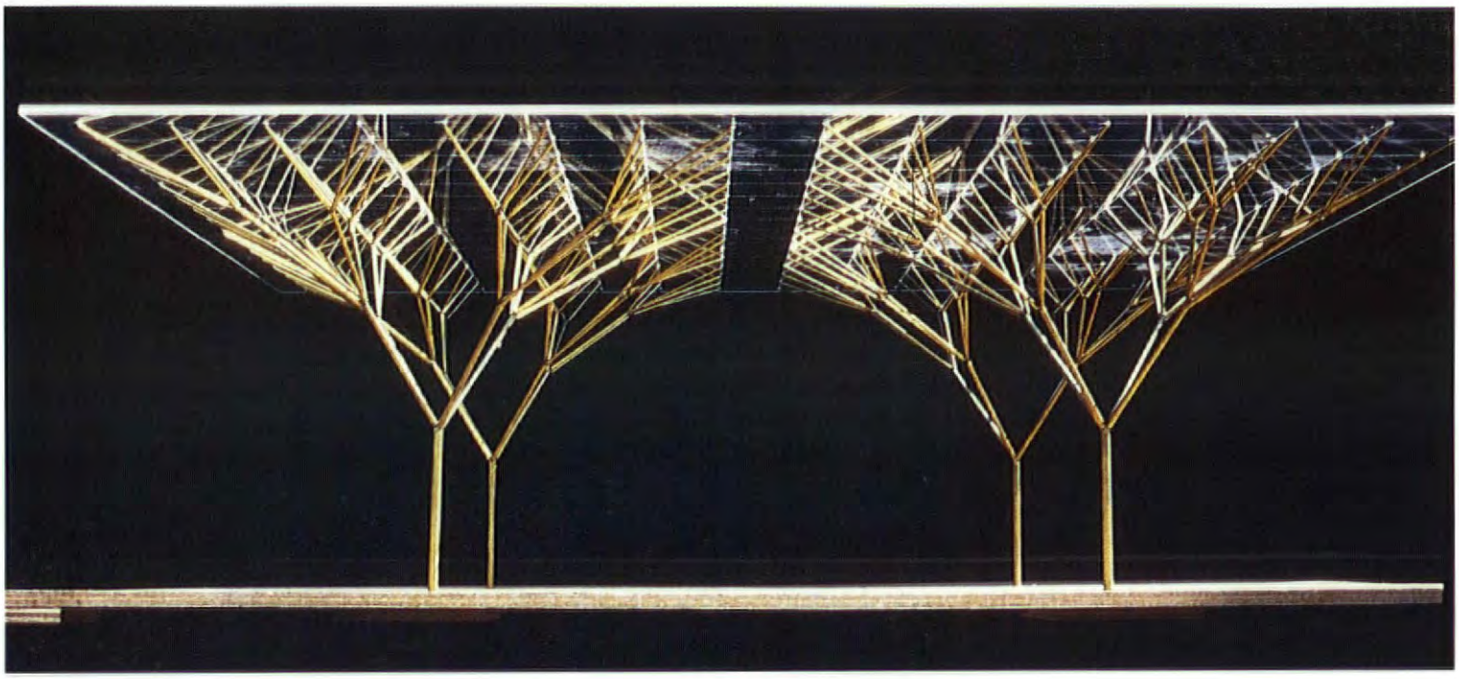
The relationship was not a traditional one. The Germans have led the world in seeing architecture and engineering as having a joint culture, which they call Technik: a synthesis of science, art and craft, which produces competitive products through effective production processes. The field was so new that Otto had really only been able to study tensile structures in nature: in his partnership with Stromeyer, he could not only experiment but actually construct these new possibilities.

Above: German Pavilion for the 1967 Montreal Expo, designed by Frei Otto with Rolf Gutbrod. Its use of a freeform cable net supported by casts introduced a whole new type and scale of building.

New scale of building

Yet Frei Otto stayed in university life, first at Berlin and then in 1965 he was appointed Professor at the University of Stuttgart. In 1967, together with Professor Rolf Gutbrod, he won the competition for the design of the German pavilion for Expo '67 at Montreal and, in its execution, developed a whole new type and scale of building in architecture.
It used a free form cable net supported by masts, the concentration of forces at mast tops

Below: Frei Otto's exercises in tree structures influenced an entire generation of architects. In particular this form can be seen expressed in new airport terminals for Stuttgart and Stansted.



Munich Aviary, 1982: innovative development designed by Otto with architect Jorg Gribl and engineers Buro Happold.

being accommodated by the use of main cables with stress relieving loops. Weatherproofing was achieved by pulling up a membrane of translucent pre-coated terylene. It was using flexible materials to build an indeformable structure and for that he had to interact the shape and the forces that produce that shape.

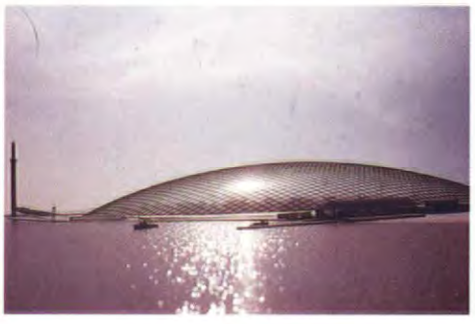
Methods did not exist for this and Otto had to create physical modelling techniques which took him all the way from the initial concept of the design to the final structure. This integrated use of models, both as an inventive design tool to achieve a design and finally as an analysis tool to quantify forces, was very unusual and may be unique. The whole process was geared at each stage to a positive tackling of the next problem which ranged from geometry to force to wind to rain to snow. It was an amazing achievement, partly made possible that year by a seemingly inexhaustible supply of cheap student labour.

This project had another effect. A trial structure was erected at Stuttgart University and became the Institute of Lightweight Structures within which much of the modelbuilding and testing took place. Postgraduate students worked, seminars were held, and a major publishing effort grew up producing the IL books so beloved and so influential in schools of architecture worldwide.

At the same time as Gutbrod and Otto won the Montreal competition, they also won a competition to build a Conference Centre for Mecca where a much more tailored system of cable structures were developed with either highly insulated lightweight cladding covering the air-conditioned spaces or shade protecting structures covering the opens spaces. The engineering design was extremely conscientiously carried out by a group I headed at Arups, including several of my partners in our current practice.

Montreal and Mecca are very different in

Below: Frei Otto's own home in Germany was completed in 1970.



Above: landmarks from Frei Otto's career. The Swiss National Exhibition of 1964 at Lausanne (top) used tented structures created for Peter Stromeyer. The 1972 Munich Olympic Stadium (centre) by Behnisch and Partners used a new form of architecture whose execution Otto assisted and supported. Arctic City (below) was a conceptual scheme for an airhouse, developed for Hoechst in 1971.

character and visually extremely original. I think Montreal was accepted because it was an exhibition building, Mecca because it was seen as continuing the tradition of the Arabic tent and the shade kaffers. Both buildings received considerable recognition. Gutbrod and Otto received the Perret Award of the UIA for both buildings and the Aga Khan Award for "the most technically innovative building of a decade in the Muslim world" for Mecca. However, the demolition of the Montreal Pavilion after the exposition and the inability of non-Moslems to visit Mecca reduced the influence of each respectively.

Behnisch and Partners produced a very elegant development of the Montreal design for the Munich Olympic Stadium in 1972. It achieved worldwide television coverage. Frei Otto took a leading part in that realisation. In 1976 Gutbrod and Otto again acted as architects for a 2.5 acre stadium of this type for the University of Jeddah. His competition wins and innovative designs have continued.

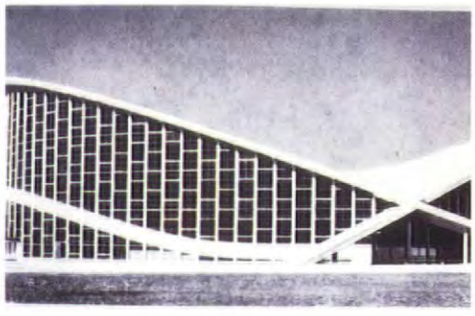
In the corner of the Montreal Pavilion was a small cinema spanned by a lattice of timber laths. In 1975 the same idea was proposed for a pavilion at the exit end of the national garden exhibition at Mannheim. This project, spanning at a maximum 80 metres, really had its moments. The simple idea that one could pin a lattice together, bend it to a shell form, fix its edges and it would stand up, would not work. It had to be stiffened with diagonal cables and erected using scaffold towers. Considerable disbelief in the idea was finally overcome by load testing using the town's dustbins. One of the most innovative - and extremely cheap - structures in the world is now a "protected" building and well worth a visit.

In 1971 Otto worked on a solution for the Hoechst Company for a one mile diameter airhouse called Arctic City. This was a forerunner to the 36-acre 58 North Project of 1982 to cover a town centre in north Alberta, which Otto also worked on. His ideas for movable roofs are very important. They were developed by Tallibert for his design for the Montreal Olympic Stadium. His humped tent for Dyce in Scotland was a major advance in fast, economic covering of a large space. I am sure Ron Herron would admit his Imagination headquarters building in London owes a debt to it. The Munich Aviary is intensely innovative, and so on.

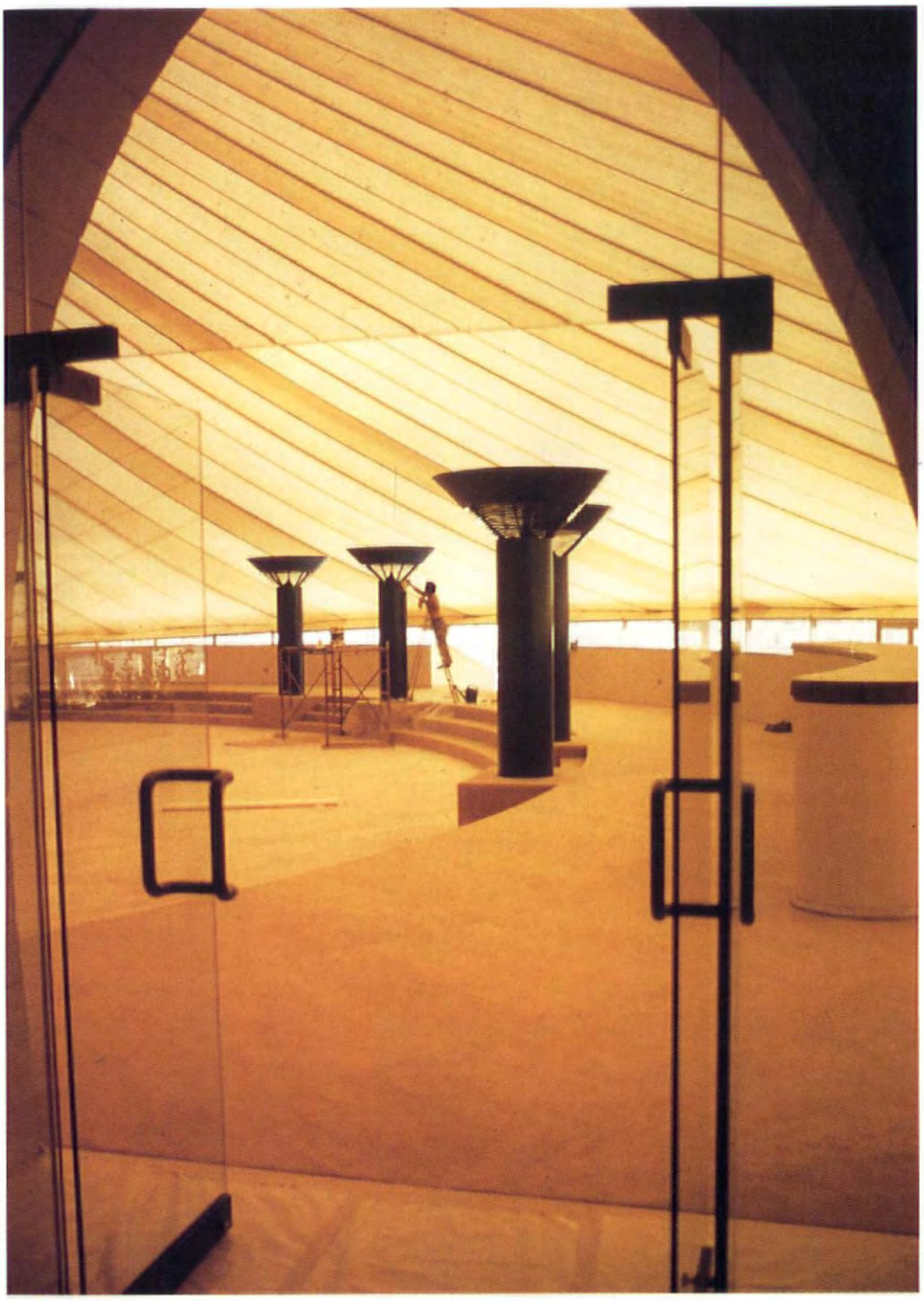
The development of ideas

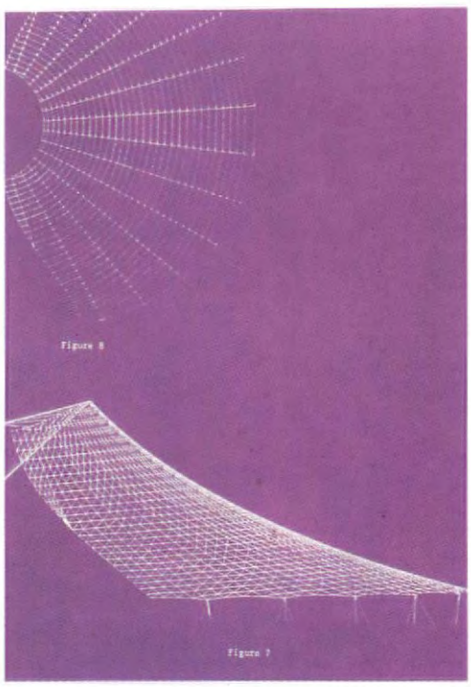
Yet Frei Otto does not see practice as other than for the development of ideas. His atelier will probably only contain two people, his research institution many. Frei's great strength is that he sits down to something and works on it until he understands it. Unlike many architects, he does not think that all you have to do is to want something and therefore you

Raleigh Arena, 1952, USA, engineered by Fred Severud. Its modern suspended roof had a profound effect on Otto.

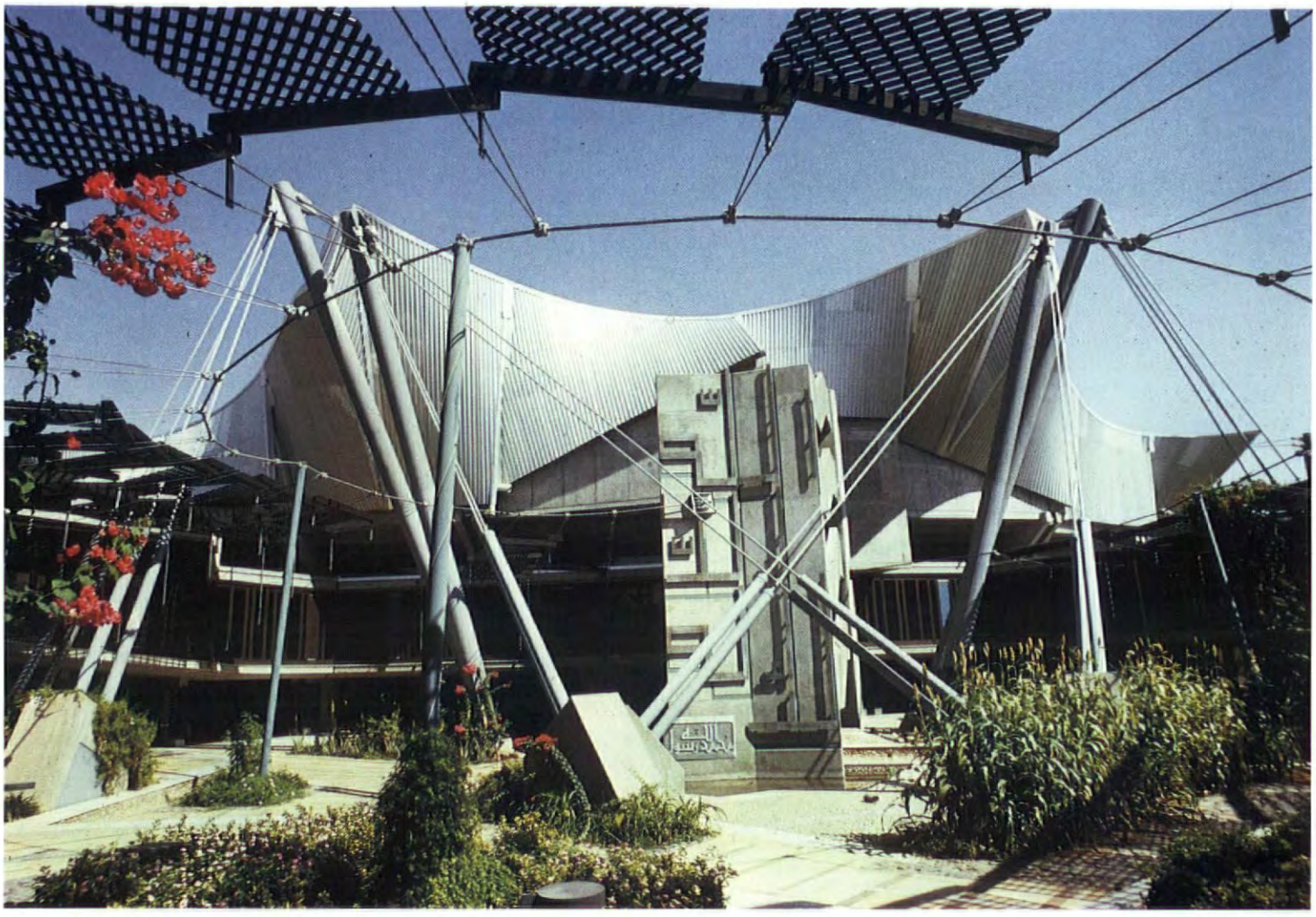


Diplomatic Club, Riyadh, designed by Frei Otto and Nabil Fanous of Omrania with Buro Happold. Completed in 1988, it represents an elegant combination of the radical visions of two architects – and a brilliant fusion of traditional form with modern building methods and materials.

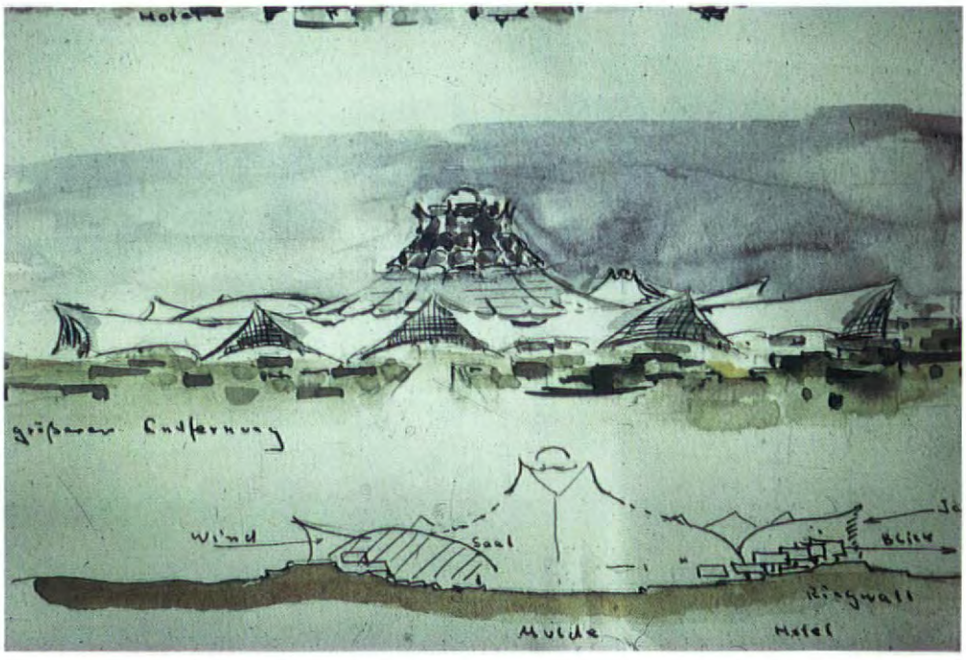




Diplomatic Club, Riyadh: in shape it embraces the garden; in performance, its use of technology resolves the harsh climactic changes between night and day. At the sculptural heart of the scheme is a stainless steel tent with stained glass decorated by Otto's daughter. Its designers believe it to be one of the most individual and integrated building complexes in the world.



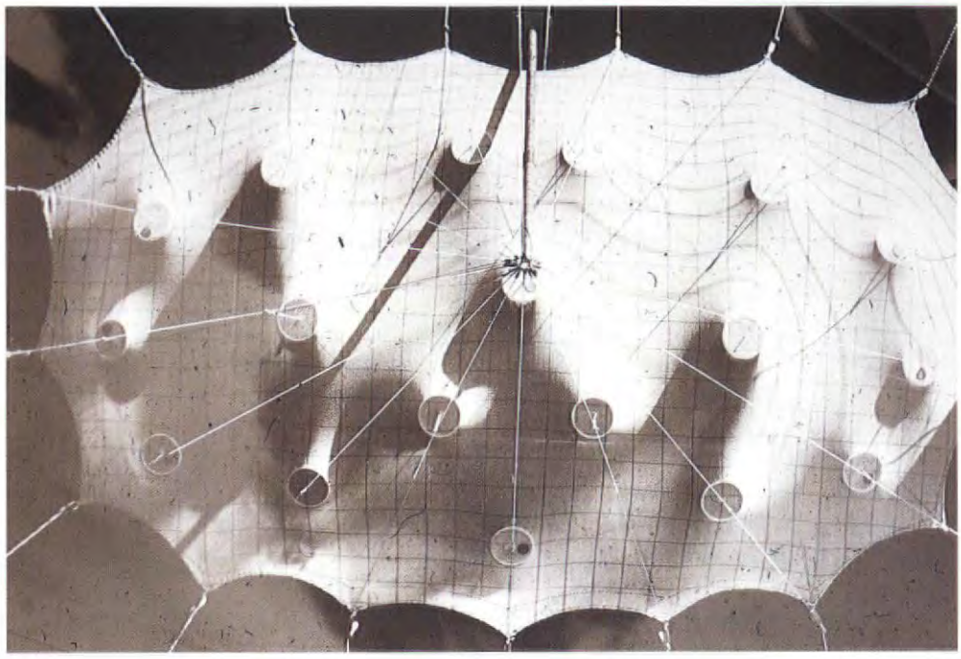
Mecca Conference Centre, 1967: Frei Otto and Rolf Gutbrod won a competition to design this scheme at the same time as the Montreal project began. Together, the two buildings confirmed Otto's reputation – even though the temporary nature of the Montreal pavilion and the inability of non-Moslems to visit Mecca reduced the influence of each. Mecca, however, was commended for its technically innovative continuation of the Arabic tent tradition.



have created it and it will come right.

Another difference is that he does not have a very close relationship with any other architect. No partner. He does everything that is important himself. Most of what he is doing – lecturing, going to international meetings, teaching, promoting his ideas, design work, furniture design – he has to look after himself. Yet he gains from others a sense of space, organisation, discipline, planning. It is one of the reasons that he likes to work with other architects. And the list is long. Gutbrod heads it. Muschler, Tallibert, Tangye, Gribl, Fanous, Burton, HOK and so on. It is successful when they are really willing to work together with him and allow him time to realize his inventiveness and amazing sense of form. He is easy to work with in one sense, but not so easy to communicate with until some time has elapsed.

Of recent work, the Diplomatic Club in Riyadh is a good example of such



Drawing on the mechanisms of nature (top), Frei Otto's moveable roof for a swimming pool in Regentsberg, Germany (above) was developed in the late 1960s. It is still in use today.

collaboration. Nabil Fanous of Omrania and Frei Otto have very different tastes and skills, yet had common objectives. The result is a totally modern expression of the two traditional types of buildings; in form, it embraces the garden; in performance it follows tradition yet, by use of modern materials and building methods, radically improves internal conditions. The whole is elegant and functional. I know no building better integrated.

Of the really recent work, the scheme for the rebuilding within the old shell of the Gilbert Scott-designed cathedral in Hamburg, by Frei Otto alone, is again a totally contemporary version of the traditional masonry cathedral. The design for covering the walls of Barbarossa's ruined castle, using only glass as a structure to rebuild the original roofs, is a reflection of a building industry before cheap metals, when minerals were the materials for long life. The ideas Buro Happold put into that, as in so much of the work we do with Frei, owe much to the writings of my guru, Professor James Gordon, who also contributes an article for this issue of *World Architecture*.

Frei Otto's engineers are important to him, and I and my colleagues have been fortunate to work with him since 1966, first in Ove Arups and, since 1976, in Buro Happold. He is tough in argument but a true partner. He sees the problem as a holistic one, and his willingness to go on discussing a problem until you can agree on a solution is intensely satisfying. This is done with humility as well as enthusiasm. He has forced me to continue educating myself, and those around me, because he has asked me questions nobody else has. Now I even sometimes manage to answer questions before he asks them.

The reason that I think Frei Otto is so unique for me is that his overall objectives and mine are always the same. He is not a rich man, nobody who works with him will be, but the excitement of going forward is an active process that one shares, an adventure of uncertainty; it is living life to the full.

A service to architects

Yet it is this constant mental concentration on the problem of building, expressed in the pictures, writing and publications as well as the actual buildings, which is his great service to architects. He ensures his own continuing education by his research groups on long-span structures and on structures in nature, and by regular seminars and conferences.

Candela once wrote that "Architects should be very grateful to Frei Otto since he restored to them the privilege of designing structures that cover large areas. But, like all privileges, it entails obligations which, in this case, consist in the pre-determined and specific definition of the shape. It must not be imagined that this is an easy task".

That was in 1965. Otto has gone further since then in his essays – actual and theoretical. He has tied his moral sense that man is a part of nature and has an obligation to live harmoniously with nature, and to use resources efficiently, into his work. His share in the design of Hooke Park shows this. While still recognising the importance of symbolism in architecture, his buildings, which are not only "economic" to build but also economic to service, inspire the young.

A man with great energy, his interests are wide. He once organised a worldwide painting competition for schoolchildren on Nature and Architecture. He loves drawing, fell walking and skiing. A private man, he lives in a large glass greenhouse with an opening wall within which a series of small houses provides privacy for him, his wife, and those of their five children and grandchildren who are visiting.

His children's names are Angela, Bettina, Christine, Dietmar and Erdmute – an alphabetical progression which reflects his belief in order in nature. □

Right and below: Otto's Institute of Lightweight Structures, erected in 1966, which became a valuable test centre for new ideas. Bottom: performance pavilion for rock group Pink Floyd, 1977.

TOWARDS BIO-ARCHITECTURE

Professor James Gordon reveals the broader canvas behind the relationship between biology and engineering, nature and structure, in order to lend a fresh perspective to the work of Frei Otto.

In many engineering circles – and especially at international conferences – there is nowadays a strong tendency to discuss the subject of biomechanics and its probable influence upon the future of engineering materials and design. Yet for many years the division in thought between engineers and biologists was almost complete. Although Sir D'Arcy Thompson had published his pioneering book *On Growth and Form* in 1917, which was the first serious analysis of biological structures in engineering terms, any interdisciplinary approach to the subject was regarded for a great many years as intellectually and professionally suspect.

The recent breakthrough has been a good deal assisted by the work of some distinguished orthopaedic surgeons, such as the late Sir John Charnley, whose success with hip-joint replacements is famous. If doctors are prepared to learn from engineers, some engineers at least are now prepared to learn from biologists. The consequences in many fields , especially perhaps in aircraft, are likely to be important. It is natural to ask how far these ideas are likely to affect architectural thinking and traditional building construction.

In engineering, as a matter of fact, the separation from biological archetypes is relatively recent and dates roughly from the Industrial Revolution. Previous to the widespread use of metals and of machinery such as steam engines and railways, many traditional technological structures were based pretty closely on biology. Not only were the materials biological, such as wood, rope and canvas, but so were many of the structural forms.

Similarities are startling

Whether or not the craftsmen who built such things realised it, the similarity between, say, the structural principles of a square-rigged ship and that of a vertebrate animal, such as a man, is startling. Compression loads are concentrated in a backbone or mast, bending loads in ribs or yards, while tension loads are diffused in tendons and muscles, in ropes such as shrouds and stays, halliards and braces.

Fluids and gases are controlled by flexible membranes such as skin or sails. Rigid monocoque or shell structures which are structurally dangerous and not very efficient are usually only found in large animals in skulls which have a good deal in common with ships' hulls. Moreover the basic materials such as wood and textile fibres were evolved by Nature to resist stress systems which were basically very similar to those put on them by shipwrights and millwrights and coachbuilders.

It is perhaps not generally realised just how efficient many natural materials are in resisting the loads imposed upon them in a Darwinian world – whether these loads be tensile or compressive. Biological design is generally very clever in evading that great cause of weight and expense, shearing loads. The "structure loading coefficients" (that is the ratio of the magnitude of the load to the distance over which it has to be carried) are low by the standards of mechanical engineering. Biological structures are designed to be exceedingly efficient at carrying light, diffuse loads; much less so at resisting concentrated ones; which is one reason why one can stick a metal weapon into an animal.

Again, biological materials work very efficiently over a limited range of temperatures (say 0°C to 50°C). Outside this range they are usually less satisfactory. Then natural materials are "bio-degradable", in other words they rot and are recycled – which is nowadays a fashionable concept. But of course, these sort of properties make them unsuitable for things like engines and weapons. It was the triumphs of weaponry and of the Industrial Revolution which gave its prestige to "cold steel".

Often metals are still regarded as almost the only materials to be considered seriously for important structures. But, historically, there was another, less technical, aspect of the introduction of metals, especially mild steel. Organic materials, such as wood, call for a certain degree of skill and, more importantly, a sense of responsibility, in the people who fabricate structures from them. Metals are usually isotropic and ductile and are especially suited to the use of unskilled labour on the production line. It is the sociological or moral aspect of ductile metals, at least as much as the technical ones, which made the world of Adam Smith, of mass production and the *Wealth of Nations* practicable.

Dramatic evidence revealed

We had rather dramatic evidence of this during World War Two when, at a time when aluminium aircraft had become fashionable, it became necessary to revert to wood for the construction of about 30,000 aircraft and gliders. The accident rate in these wooden aircraft was high. The problem was not primarily technical, it was primarily moral. Metals are, broadly, materials for sinners. Most of the accidents to wooden aircraft were due to failure to exercise adequate care in assembly. Sometimes the workers left the glue out of the joints.

Today the problem is repeating itself. In the modern context, both wooden aircraft and wooden yachts are basically highly efficient, often more so than their metal counterparts. The impediment to their production is the high cost of reliable labour.

A related aspect is that of design. Stress calculations using isotropic, ductile metals are relatively foolproof and are well suited to handbooks and pocket calculators. Design with anisotropic materials which may also have complicated work of fracture mechanisms is more difficult and more responsible. Though all this is true, it still remains that, for many modern yachts and aircraft, the advantages of the newer artificial composite materials is proving to be very great and many of these projects are going ahead in spite of the difficulties and of the comparatively high cost of the materials. These composites are, of course, based on biological models but it has proved possible to design them in such a way that they are less susceptible to the frailties of assembly labour.

Engineering thinking affected

This movement is likely to have important effects upon engineering thinking. This is not merely because it is causing a re-examination of the geometry of traditional technological structures – though this is in itself valuable – but because it provokes thoughts which are outside the boundaries of traditional stress analysis.

For instance, how many of us have considered how much our bodily integrity owes to our possession of a sense of pain? If a car or a ship or an aircraft screamed or showed

ILLUSTRATION BY JANE SPENCER

a red light when the stress reached a dangerous level at any point in its structure, such artefacts would probably be much safer and quite a lot of weight could be saved. Serious thought is being given to this concept at present. With modern developments in electronics, the idea is not a silly one.

Then again, engineers expend a great deal of weight and money in achieving what might be called "passive rigidity", especially in things like bridges and aircraft. But, in fact, a giraffe is not enabled to stand upright because it is constructed of materials of high Young's Modulus. Like all other animals, it uses "active elasticity", that is its muscles push back automatically against the loads which are imposed upon them. Birds' wings do not have a "flutter problem" in the sense that aircraft wings do.

I understand that architects are beginning to make use of active elasticity by countering wind-induced deflections by the use of floodable water ballast-tanks in tall buildings such as skyscrapers. But what happens during a power-cut?

Furthermore, in most branches of technology we are accustomed to making a fairly sharp division between "the material" and "the structure". We buy steel or bricks to build ships or houses or whatever. In biology, this division is much less sharp. We should find it hard to define the 'materials' from which our bodies are made. This, again, is likely to influence the concepts of engineering.

One effect of these new ways of thinking (which are really very old ones, of course) has been the publication in America, since January 1990, of a "Journal of Intelligent Materials Systems and Structures". One can see that the biomechanics movement probably portends some very important changes in traditional engineering which may well revert, in a very sophisticated way, to some of the concepts which prevailed before the Industrial Revolution. In which case technology may well become both more interesting and more exciting.

Biomechanics and architecture

But what about architecture and traditional building construction? A steam engine may have little in common with an animal but the designer of an aircraft or a yacht can often draw useful lessons from birds and insects and so on. With masonry construction, there are not many analogies in Nature – possibly only ant-heaps. Examples of "natural" family homes are not very inspiring; few of us would want to live in a rabbit-hole or even in a bird's nest. Moreover, both in engineering, and in most plants and animals one is generally trying to save weight.

In masonry, weight is often an advantage because it keeps the thrust-line in its place and, in any case, most traditional buildings are not required to be portable. Moreover, like ductile metals in engineering, traditional brick and concrete construction is relatively immune to carelessness and original sin on the part of construction workers.

But it can be argued that conventional masonry is becoming prohibitively expensive and that, in a rapidly changing world, there is much to be said for constructions which are lighter and can be made moveable. "To your tents, O Israel; now see to thine own house, David." *(1 Kings XII, 16.)*

Traditional masonry buildings have been in use for at least two or three thousand years; they are blessed by the pyramids, the Parthenon and all those cathedrals. Whereas the conventions of "traditional" engineering are only around 200 years old – being dedicated, more or less, to people like George Stephenson, as we in Britain can see on the newer five-pound bank notes. If the engineering traditions are not easy to break, how much more so will be the architectural ones?

Based on biological models

There has, of course, been a slightly disreputable tradition, parallel to masonry, of wooden huts, thatch, tents, caravans and so on. Apart from the planning authorities, the objections to such dwellings are partly objective and often justified and partly aesthetic and emotional. It is clearly true that these things are often shoddy, ugly and squalid. But are they inherently so? These constructions are much more easily based on biological models than are conventional buildings.

They are, however probably much harder to design *well* than orthodox masonry houses for which there are an enormous number of attractive precedents – although attempts to be "original" within the constraints of traditional masonry are often catastrophic.

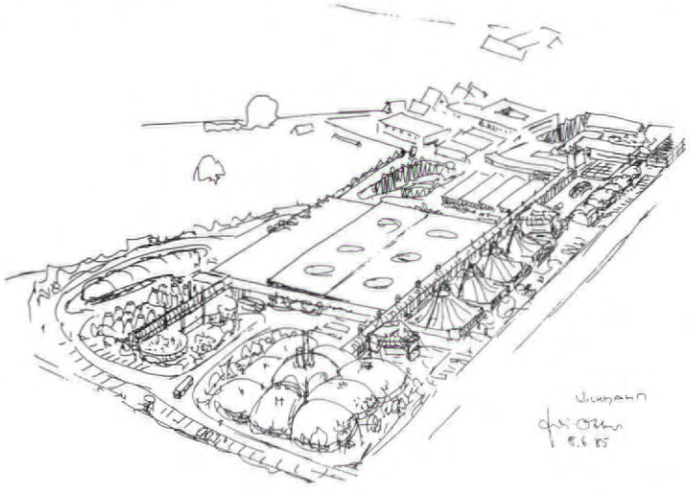
Over the centuries architecture has settled down to rectangular, rigid forms to which we have become accustomed and into which our furniture has been devised to fit. Natural structures are never rectangular and are seldom rigid. But the officers' accommodation in *HMS Victory* and similar ships is in no way rectangular (though it is, of course, rigid) but it is both beautiful and comfortable. Perhaps orthogonally-minded architects might make a study of the curvacious accommodation in modern yachts were every inch of space is used to advantage. Flexibility is rather a different matter. Floors, at least, probably need to be rigid.

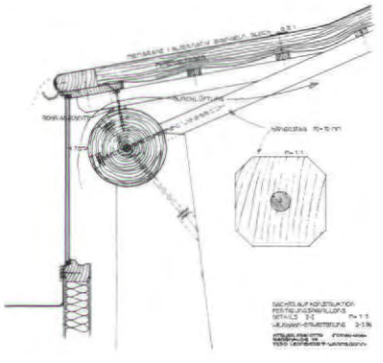
The arguments for unorthodox housing which would be cheap, light, portable and easily altered seem, at least to this naval architect, to be very strong. But it cannot be developed in a shoddy, Philistine sort of way. The models are probably not to be found in Indian wigwams and suchlike. Also, there are few direct models for human houses in Nature. Acceptible forms will require prolonged imaginative and creative thought. Clearly the sources of inspiration are likely to be widespread.

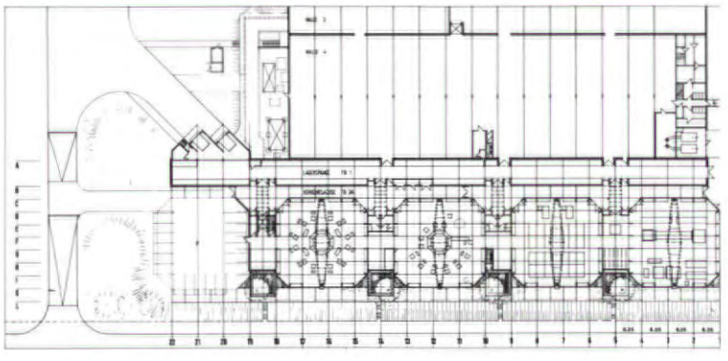
If and when we do go to our tents – or at least to structures using membranes and compression columns – then the biological analogies become much more relevant. (And what about feathers?) And, so far as the objections to unorthodox forms are aesthetic, then biological models may well be helpful.

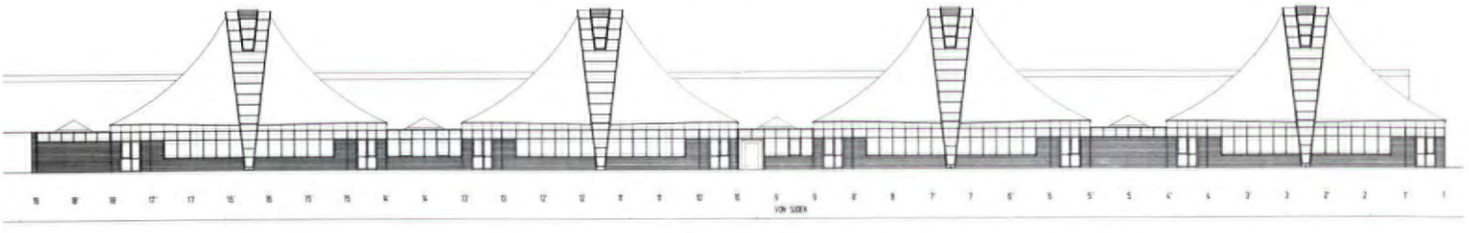
One requirement of innovative creativity is clearly to break away from the tyranny of tradition – which is what the Impressionist painters had to do. But if one breaks away from precedent, where is the imagination to browse? At least partly, I think, in the world of biomechanics where, even if there are no direct exemplars, both the technical and the artistic imagination is stimulated in a largely novel way. It is interesting that the Architectural Association School of Architecture in London has recently been running a course on just these lines. □

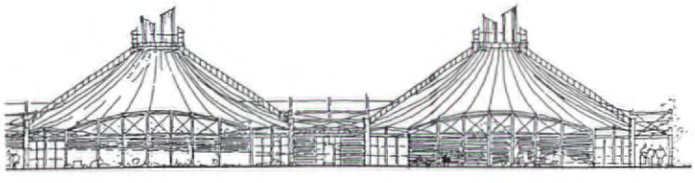
Pictured overleaf: production pavilions for German furniture manufacturer Wilkhahn by Frei Otto, 1987. Otto produced an innovative building complex within the conceptual framework of the company's own timber technology. Plans for the pavilions show Frei Otto's initial studies, the layout of workstations in the pavilions, details of eaves construction, exterior view from east and south; and (bottom) exterior views during development. Otto describes the building as "a new prototype with regard to both its form as dictated by its structural design and its lighting and ventilation".

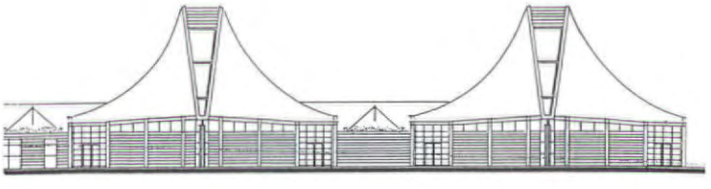


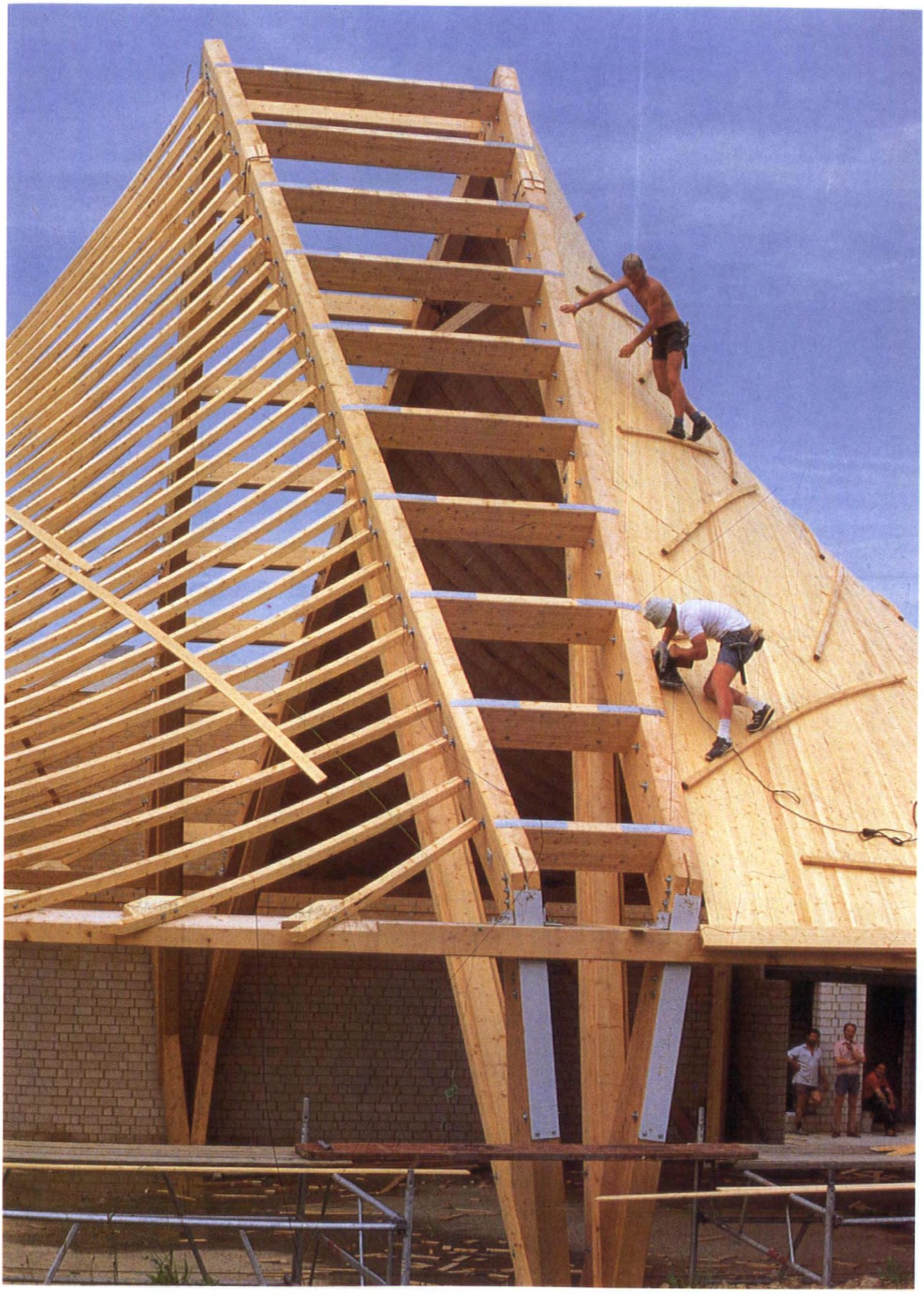












THE NEW PLURALITY

Frei Otto argues against the unnatural and uniform in modern building and urges fellow architects to seize the opportunities offered by a new plurality in architecture to conserve rather than destroy the environment.

What times are we living in? We have had 45 years of peace in many parts of the world – the longest period of peace for a long time – and yet there is discord between ourselves and the world we live in.

Architects have been building against nature for 5,000 years. It has been their duty to protect mankind against enemies, and especially against its greatest enemy – nature. Houses have been their weapons and their symbols of victory.

We still build against nature. We have destroyed nature, and we continue to destroy nature instead of conserving it. Our duty is not to destroy but to conserve. But have we recognised this new task? We prefer to talk about forms and styles. Highly developed construction techniques mean that we can build everything we want to build. The technical and financial possibilities have never been so great. Feasibility is not the problem today but rather the enormous range of options available to us.

As all buildings – since they should not collapse – are subject to the natural laws of physics, certain constructions and building designs are more appropriate for certain purposes than others. However, this fact does not reduce the number of possibilities open to the architect. Even the search for the minimal house, that is, a house which has nothing unnecessary, has led to more than one solution.

Regardless of the means and concepts used for building – the number of possible solutions defies comprehension. It is so vast that every last person on earth could have his own distinctive individual place and could live in peace with himself and with nature, if he so desired.

Against this background, the question arises: why are so many buildings so similar if uniformity is no longer determined by function, construction and economy, as may have been the case in the past? It is the will to be artificial, to be deliberately unnatural which encourages uniformity. Man himself has invented the artificiality of uniformity by restrictions based on social conventions, doctrines, design regulations and aesthetics. But there are no formulas for the acquisition of beauty and the creation of architecture which, when adhered to, guarantee beauty and when ignored result in ugliness.

Obstacles to a free search

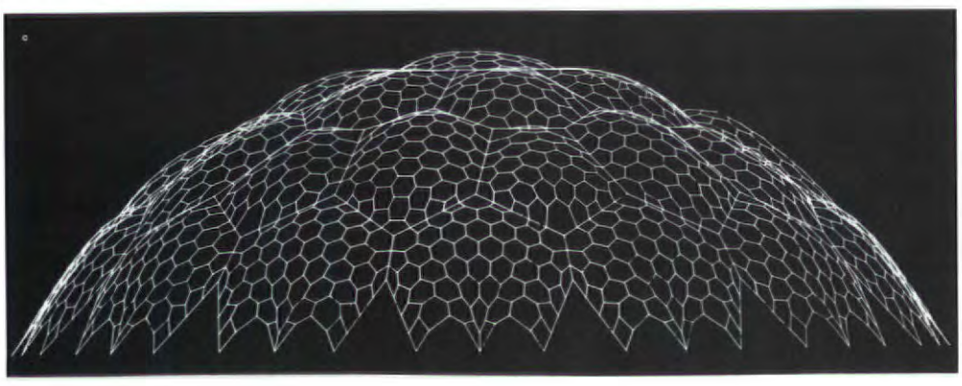
Despite this fact, design rules, doctrines, regulations and even laws are invented over and over again. They are often born in the heyday of a style. They make the process of designing simpler. But they are an obstacle to a free search for form and formation. In our times, they are totally out of place.

At present, an army of theorists among architects and critics are concerned with trends, fashions, styles, forms and so called languages. At the same time, many hypotheses and architectural philosophies, as well as the trends they promote, are thriving as never before in the history of building. Sometimes they are stronger, sometimes weaker. New ones are continually being invented.

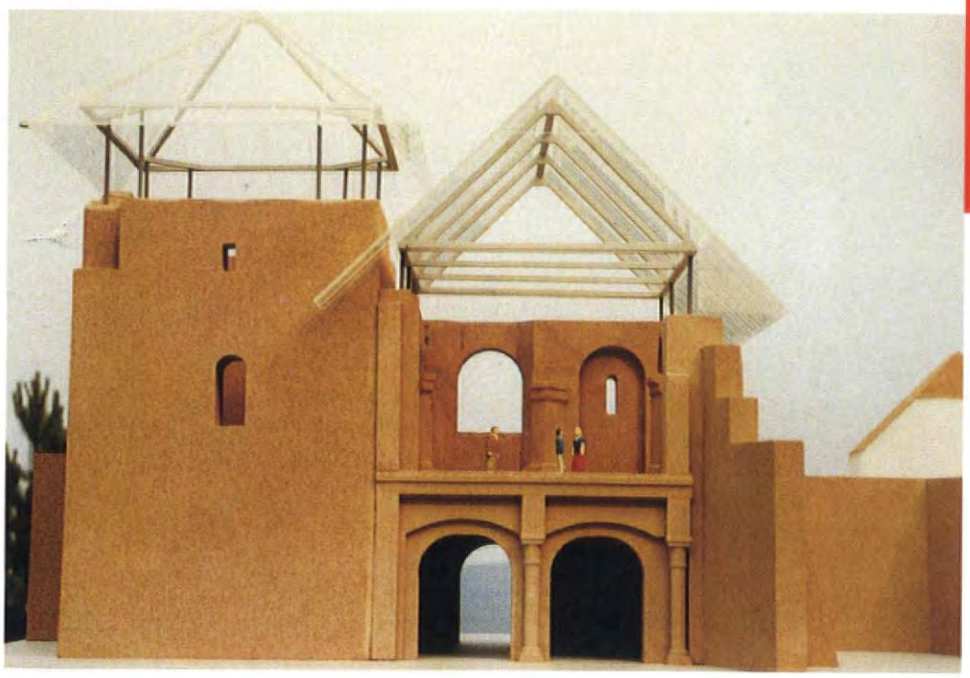
A new awareness of building history has developed as a reaction to the insipid building of the sixties. In the wake of a new historicism, older buildings are being restored. Art Nouveau with its particular sensitivity is once again popular. The Modern Movement of the twenties is experiencing a new vogue after being unpopular for some time. We are now even beginning to realize that the decade of sixties was a period in which truly valuable ideas were conceived without ever being recognized.

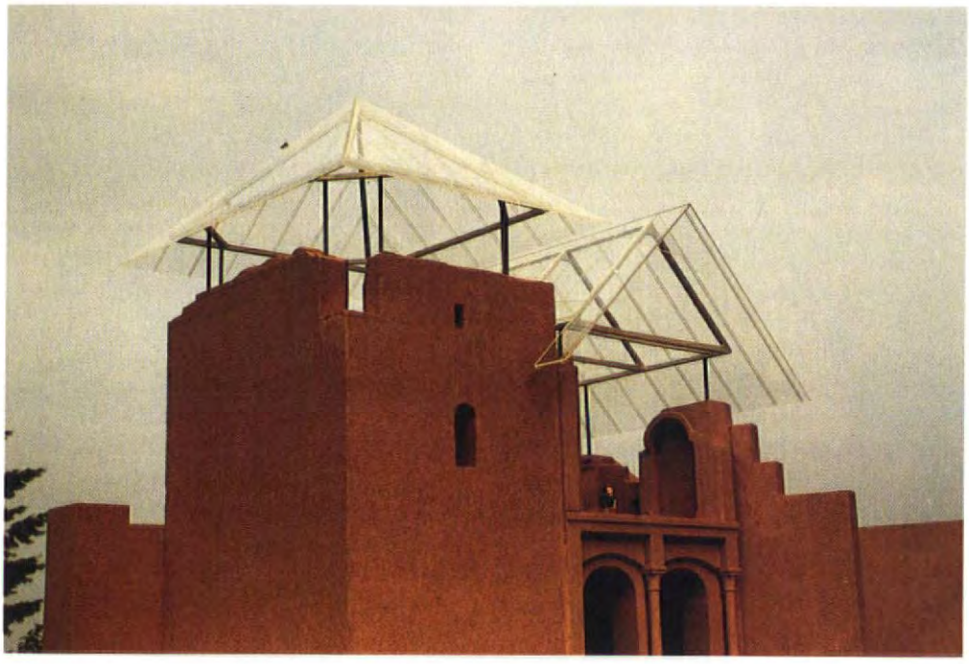
Gradually, adaptable building has developed since about the end of World War II. Buildings are no longer conceived and built as unchangeable entities, but can be adapted to changing tasks. The potential for rejuvenation is built into them.

Below: computer study for Kocommas, Riyadh – a state complex incorporating a parliamentary building, council of ministers and the king's office. The project lasted from 1976 to 1981 and even went on site. But it was never built.



This page: competition entry, 1989, by Frei Otto with consulting engineers Buro Happold to rebuild Barbarrossa's Castle at Gelnhausen, Germany. The historic building had been restored in the post-war years but rainwater was destroying the mortar. Otto's scheme involves roofing the castle with an all-glass structure to reflect rather than replicate the building's history. It is a clever blending of old and new.





Below: Frei Otto's papal canopy for Bamberg, Germany, 1989.

The idea of adaptable building has led many people to again build their individual homes for themselves. A new, unconventional do-it-yourself building culture, borne out by amateurs, has developed and should be taken very seriously.

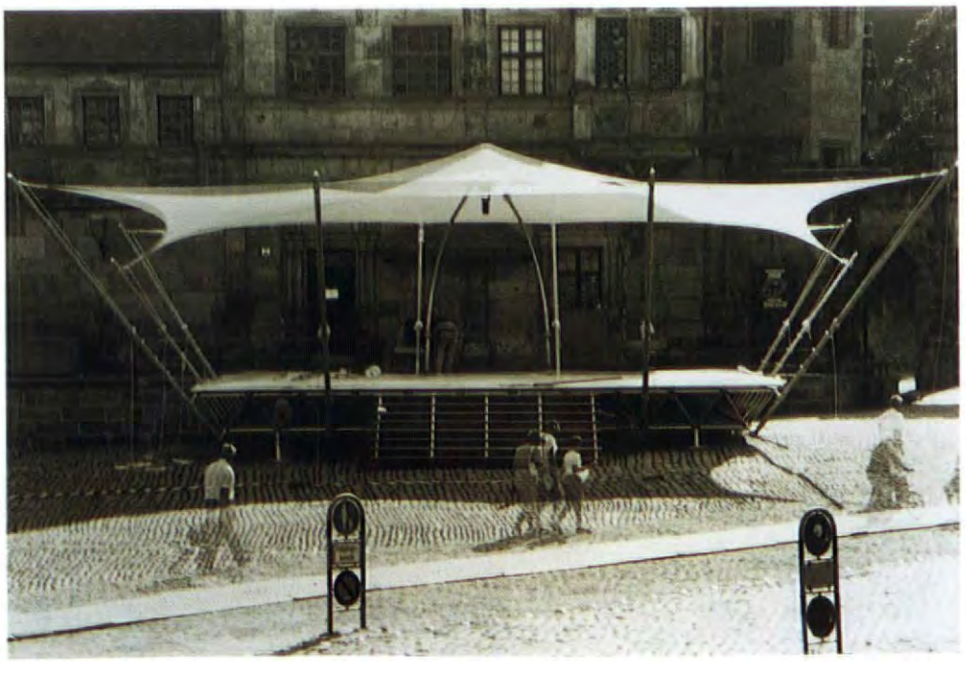
Ecological approaches

Man is becoming increasingly aware of ecological problems and the detrimental effects of buildings. Already, an increasing number of architects is promoting a new ecological approach to architecture. None of the current trends, tendencies and styles of today, from historicism to deconstructivism, dominates alone. None of these movements is weak. Each one cultivates its own techniques and forms. The growing variety of possible approaches to architecture offers the chance to make use of a new freedom. Architects and users are still inexperienced in this freedom through plurality, in this new and open world of unlimited possibilities. They feel safer when they can follow where a few others have led.

This hesitant attitude is understandable. An architect is well integrated into society. As a servant to this fellow men, he cannot follow his inspiration like a painter, musician or sculptor. He must, above all, be aware of and observe human rights and obligations. On the one hand, his own rights are more restricted by external conditions that the rights of any other artist; but on the other hand, he has great possibilities, since he often has to administer large amounts of money, thus exercising power involuntarily. He has a great deal of responsibility. The changing tasks with which the architect is confronted make it essential to reconsider both the profession of the architect and his ethics.

After World War Two, the ethics of architects were linked with the term "humanity". This term "humanity" was an often used and abused formula when plans were to be put into practice. But what does humanity mean in the field of building? It goes without saying that buildings should do no physical harm to anyone. But we need only consider in what ways buildings can do psychological harm to people to recognize the problems faced here. It is even more difficult to answer the question of whether buildings can help people to be humane in the ethical sense. But there are certainly many buildings which, although considered beautiful, influence people negatively and can sometimes even make them cruel.

In the architecture of the fifties, humanity meant creating vast amounts of living space; in the architecture of the sixties it meant emphasizing simple forms; in the seventies it meant reviving past aesthetics. The term of humanity was alienated, because it was increasingly equated with beauty and finally replaced by it. But the doctrine of beauty in architecture is not yet a doctrine for humanity in building. Humanity has no building form.



At the beginning of the sixties the term "humanity", which had increasingly been overused and thus was losing much of its meaning, was also being related to the many varieties of the term "nature" or "naturalness". Some architects finally started to realize that their aims, working methods and the resulting products were, in principle, unnatural.

This minority no longer aims to serve the clients or users of a specific project alone, nor to build for man or for humanity alone, but to attain a new, all-embracing naturalness. The buildings and the people who live in them are seen as an integral part of a greater whole. It is imperative to help people, but man is no longer at the centre of nature. This new view of nature leads to a new understanding of nature, not only by architects. The most recent findings of natural science and an awakened society force us to reconsider. The awareness that vast ecological systems are ailing has a mobilizing effect on us.

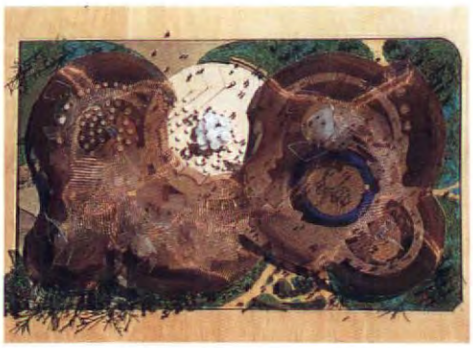
The youngest ecological system within evolution is the big human city which has probably never been genuinely healthy since it came into existence. Not blind conservation of nature, but integration of the natural individual into his environment, into the world in which he lives, is our new task. And this means achieving greater knowledge of the natural processes which lead to the forms of objects. These, in turn, form the overall picture of nature.

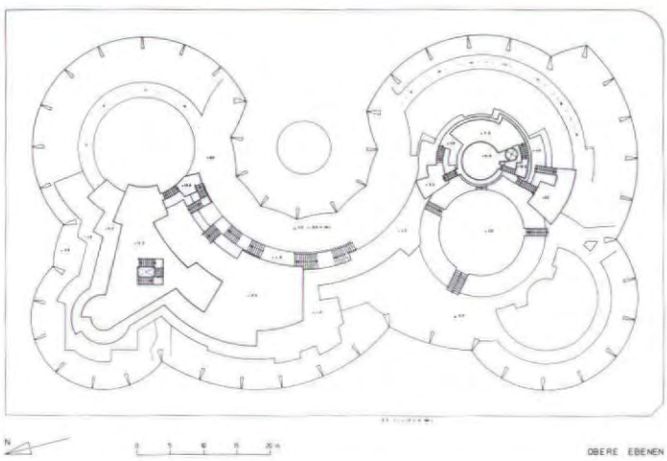
Just as architects of twenties never found the entirely simple and inexpensive "house per se", so the form of the "natural house" has still to be found today; not surprisingly, since only few architects are searching for it anyhow. Most are content to celebrate those forms which they think are ecological or biological. Some architects think that they will find a greater nearness to nature by imitating living natural forms and structures. Most of the time this is bound to fail. Technical objects such as a house do not become natural by imitating forms found in living nature or by using so-called biological building materials.

The idea of plurality

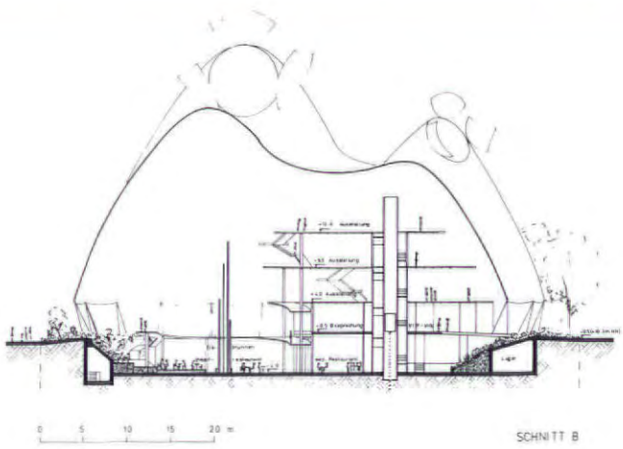
About 25 years ago, the idea of plurality in architecture emerged. Many architects wanted to be able to follow many different paths to new architectural styles. It was the longing for a new variety of styles which was to put an end to the thoughtless uniformity of the misunderstood simplicity of the late Modern

This page: competition entry, 1988, to design the German pavilion for the 1992 Seville Expo. Otto came second. Having already created the German pavilion in Montreal in 1967, it was always highly unlikely that he would be invited to do such prestigious work twice. The scheme, however, represents a synthesis of much of his thinking. In particular, the use of a shell lattice roof recalls the ideas for Otto's pioneering multi-purpose hall at Mannheim.





OBERE EBENEN



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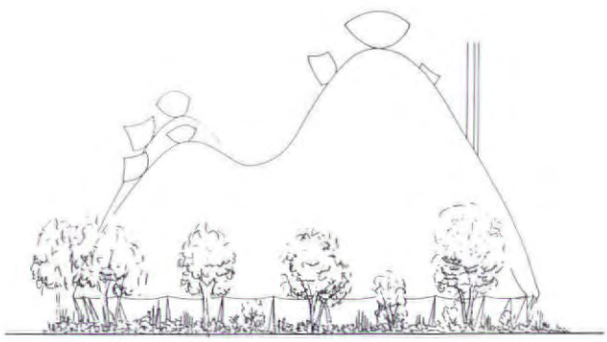
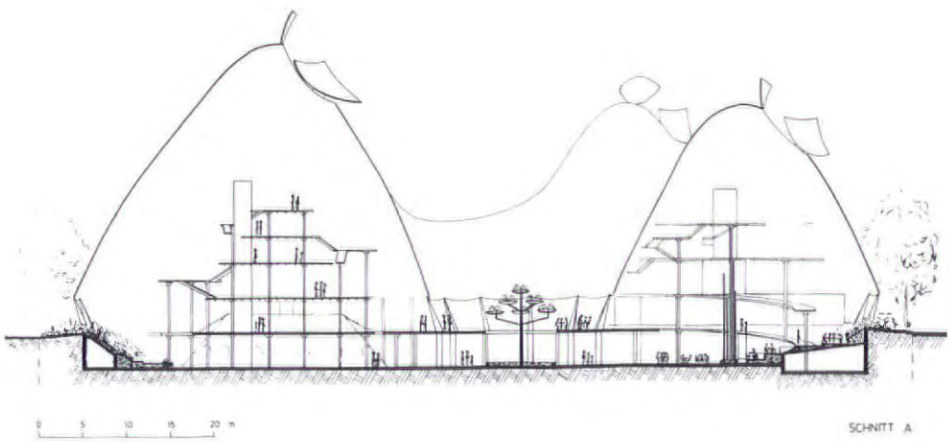




SCHNITT A

Below: Airfish III – design of an airship for a German client. The envisaged market was South America but the airship was never built.

Movement. This longing was focused in particular on those fields of architecture which had been under-represented until then. It was defined by this term pluralism which unfortunately was also abused as an excuse for words of uncontrolled fashionable extravagance. The new age of plurality was initially unbalanced with a one-sided approach.

Today the idea of many roads leading to new architectures is highly topical. It is seen in the sense of a genuine plurality in architecture. The term "plurality" – as opposed to pluralism – indicates that this is no idealizing or manneristic trend which allows anyone to do anything without thinking about it, but indicates an openness for new approaches under a newly formulated commitment to obligations and rights by all human beings who build or have something built.

The new plurality also makes it possible to focus on aspects that have been somewhat neglected previously, for example:

- a new understanding of the terms humanity and nature as an inseparable whole;
- a striving for natural security for every human being in a society which, through tolerance, encourages individuality;
- consideration of natural self-forming processes when designing buildings;
- avoiding unnecessary buildings and building masses, and conserving the energy needed for construction and maintenance;
- conservation of nature, in particular of the biological macro systems and their components;
- adaptable building through the use of adjustable structures;
- do-it-yourself building which may lead to the development of a creative amateur architecture, at least in residential buildings, but with architects contributing their knowledge as consultants;
- a new sensitization of the faculty of perception for quality in architecture, by reviving lost components of the senses;
- integration of contemporary arts-painting, sculpture and music;
- incorporation of the findings of all the sciences, including behavioural research.

The new plurality is not an excuse for selfishness, harmlessness and thoughtlessness. Every human being who builds, be he owner, architect, engineer or contractor, is tied into a framework of duties and rights towards nature and all his fellow men. It is his duty to help promote the development of nature and the observation and defence of the human rights of each individual, to create a safe habitat for people, to practice charity, and to please and appease people with buildings. He must help people as they tackle their new role of conscious integration into the new overall naturalness of cohabitation with flora and fauna and with the immense inanimate nature.

Scope for the architect

The profession of the architect remains as important as ever. It is his duty to search out every possible means of fulfilling his global mission and to lead by example. He is responsible for a cluttered environment and for houses which destroy nature instead of conserving and promoting it. He cannot pass the buck; neither to his clients nor to assistants, advisers or authorities. An architect who cannot say "no" has no right to be an architect.

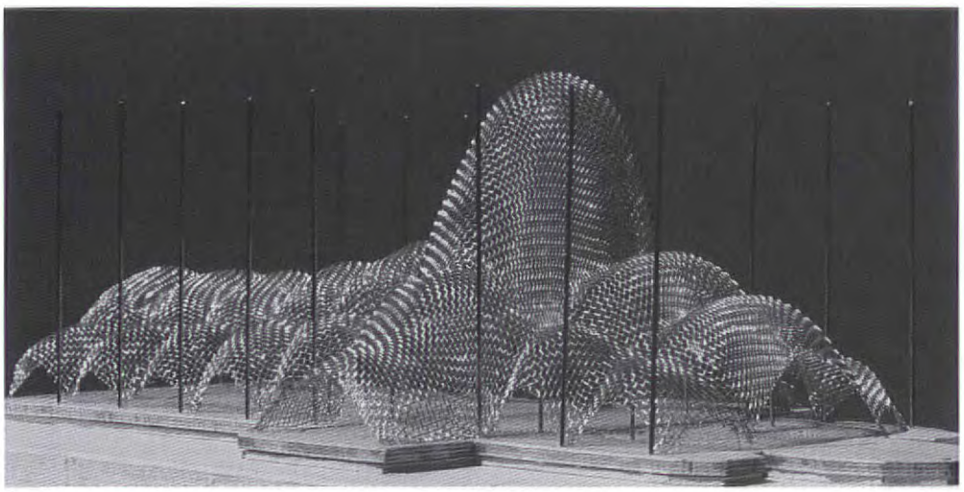
All roads are open to the architect as he sets out to fulfill these duties while making full use of the possibilities at his disposal. He should and he must make use of existing knowledge and techniques and apply them to every new task in a new manner. He must not only search for new solutions, but also invent new techniques and details himself. Obligations and rights lie side by side. It is an architects's right to find his very own solution, to stand by it and to put it into practice. This leaves him a wide scope. Despite his limitations and parameters, his artistic freedom can be compared with that of other artists and is quite considerable.

Consider for a moment that every building is created in a particular place, at a particular time, using different means and intended for different individuals. Modern building techniques allow that no building needs to be identical with another, because identical buildings have no identity of their own.

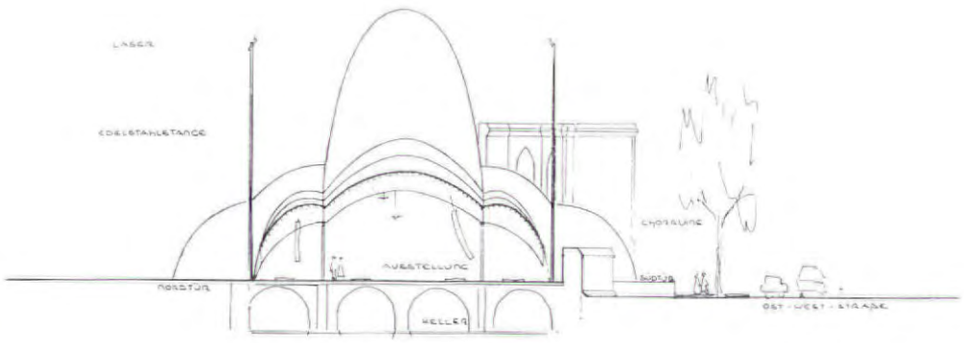
Art and the artificial are still regarded as the opposite of nature and the natural. But these opposites are outdated. However, we architects still lack the philosophical basis which could help us develop a new understanding of nature. Under these circumstances, it is no wonder that the first products of this new age of new plurality are often misunderstood and sometimes even look chaotic.

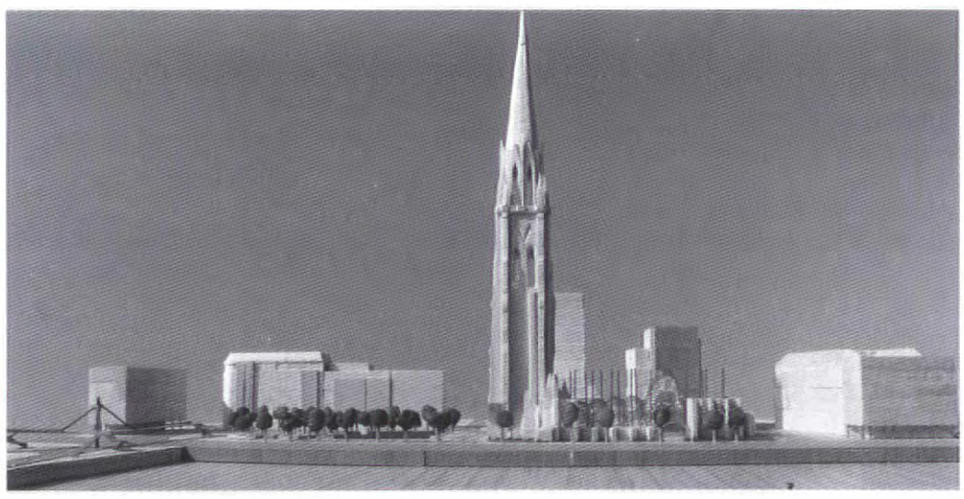
The new plurality leads to the unique building. It does not result in chaos, but leads to a strengthening of those trends which will bring about a higher level of integration and adaptation of buildings to nature and mankind.

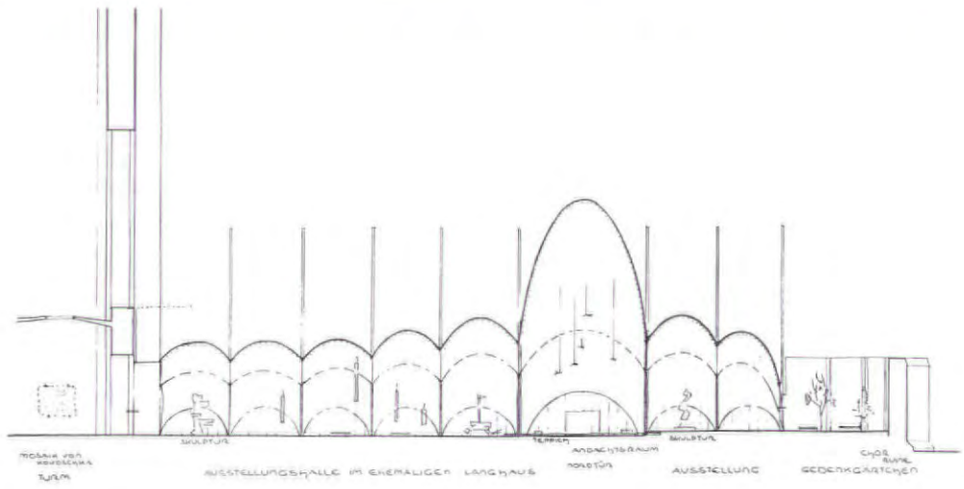
The ability to build naturally has yet to be developed. There is still no natural architecture. But I hope that there will be peace between the man, the builder and the ever-changing nature. It is our duty today to make the many new roads to natural and humane architecture passable. We will only make use of the irretrievable chance of our age if we set to work now, and if we do what has to be done – simply naturally, and happily, with a will to peace and an awareness of what is good and right. □



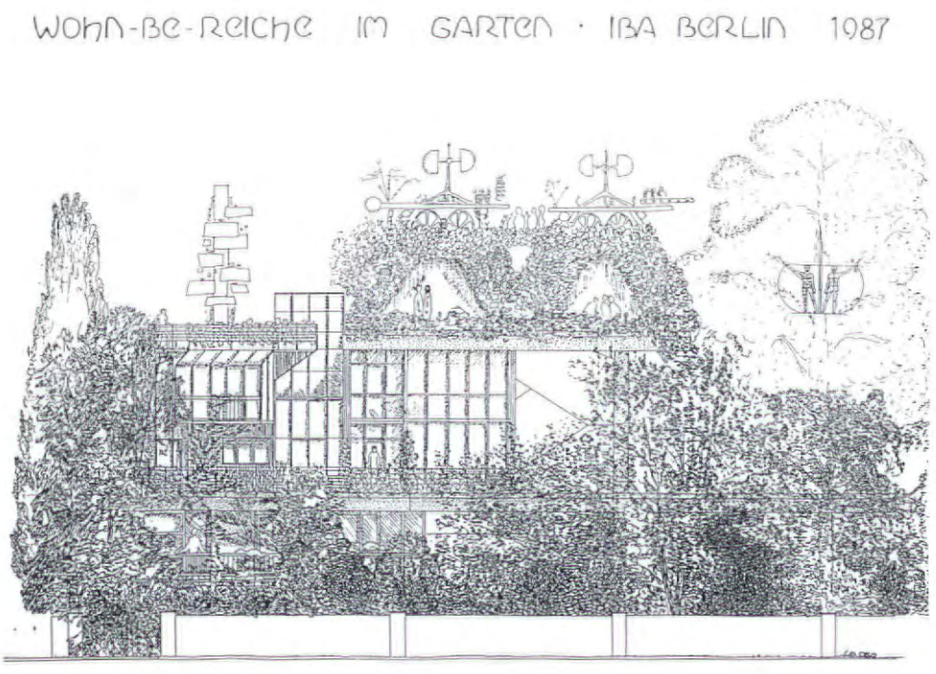
This page: competition entry, 1988, to rebuild facilities within the old shell of St Nikolai Church, Hamburg, which was originally designed by Gilbert Scott. Otto's scheme is utterly contemporary even though it nestles into the traditional masonry substructure of the church. Otto won the competition and, if enough funds are raised, his scheme will be built.

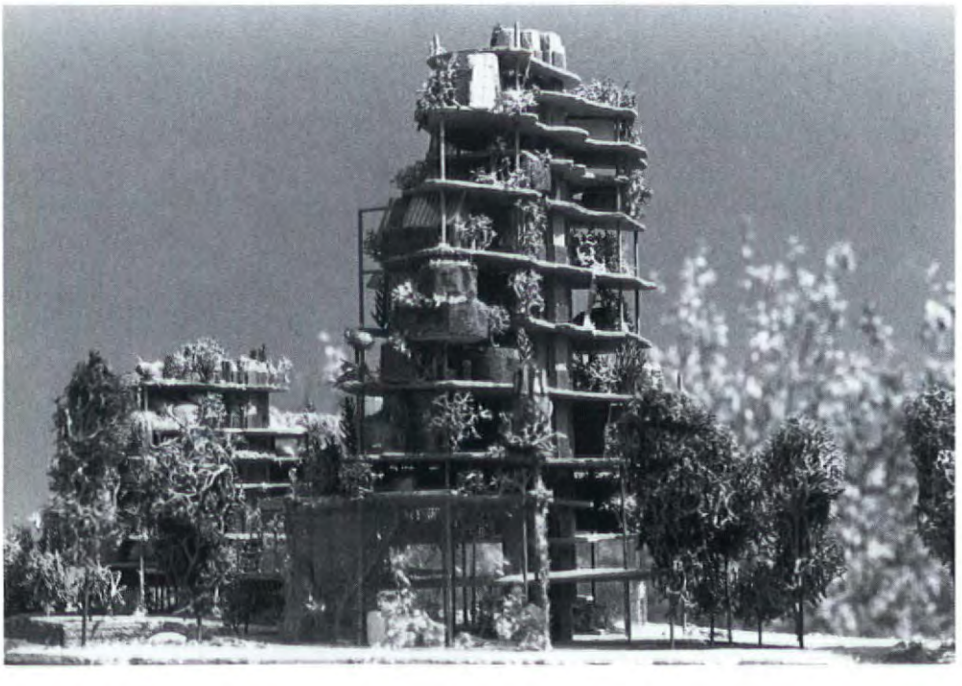






Right: Otto's proposed glass tunnel for a Munich ring road – a stressed structure to combat noise – awaits a planning decision. Below: ecological housing for Interbau, Berlin, 1990.





Right and opposite, far right: Otto as artist. Sculptures in the landscape, 1988. His "extra-dynamic" flags on fibre-glass masts have been influential.

FREI OTTO: A Biography

Frei Otto was born in Siegmar, in Saxony, May 31, 1925. He was educated in Berlin and studied architecture at the Technical High School in the city. At the end of the war years he worked for a short time as an architectural assistant in Chartres but then continued his studies in Berlin 1948-50 before embarking on a journey through the United States to see the work of Wright, Mendelsohn, Saarinen, Mies van der Rohe, Neutra, Eames etc., with a period at the University of Virginia studying sociology and town planning.

He gained his Dr Ing with his dissertation *Das hängende Dach* in 1954. From 1958-69 he ran an atelier in Berlin and became Professor and Director of the Instituts für leichte Flächentragwerke (IL) at the University of Stuttgart 1964-90. In 1969 he opened his atelier in his home town at Warmbronn.

Frei Otto has taught and acted as visiting professor in many places including Washington University, St. Louis, 1958; the Hochschule für Gestaltung, Ulm 1959; Yale University 1960, MIT and Harvard 1962 etc.

He has been involved in the design and construction of many buildings including:

1953-6 Alexandrastiftung, Berlin
1955 National Garden Show, Kassel
1957 National Garden Show, Cologne; Interbau, Berlin
1960 Kindergarten and Church, Berlin, with Bubner
1963 International Garden Show, Hamburg
1967 The German Pavilion, Expo 67, Montreal with Gutbrod, Leonhardt Kendel et al
1968 Flexible Roof, Bad Hersfeld
1971 National Garden Show, Cologne
1972 The roof of the Olympic Stadium, Munich (with Behnisch, Leonhardt and Bubner)
1974 Hotel and Conference Centre, Mecca, Saudi Arabia, (with Gutbrod and Arup)
1975 Royal Ceremony Tent, BP, Aberdeen, Scotland; the Multi Halls Mannheim (with Mutschler, Langner, Arup)
1977 Performance Pavilion and roof for Pink Floyd (with Happold)
1981 Multi-purpose Hall, Jedda, Saudi Arabia (with Gutbrod, Henning, Arup and Happold)
1982- Hooke Park (with Burton, Happold, Fritz and Kanstinger)
1985 The Diplomatic Club, Riyadh, Saudi Arabia (with Omrania, Happold, B. Otto, Kanstinger)
1987 Furniture Factory, Wilkhahn, Bad Münder (with Gestering, Kanstinger)
1990 Ökohaus, Berlin (with M. Kendel, Kanstinger et al)

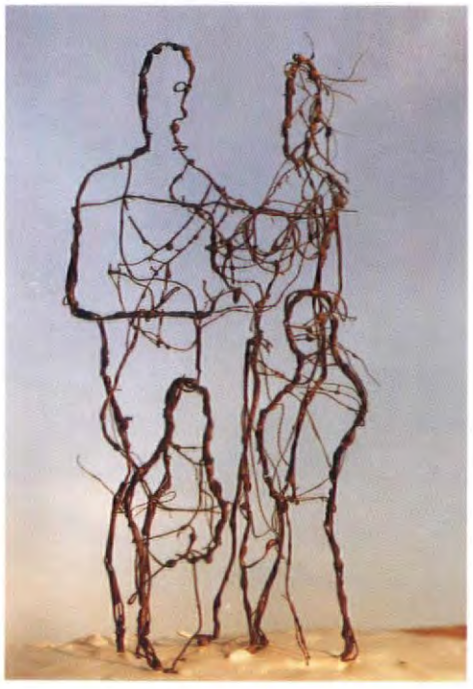
Pink Floyd performance pavilion, 1977.

During his working life Professor Frei Otto has received numerous national and international awards including the Essay Prize of the City of Berlin, 1967, and the UIA Auguste-Perret Prize in 1967, the Paul Bonatz Prize of the City of Stuttgart, and the Architecture Prize of the City of Cologne 1971. He received the Thomas Jefferson Medal of the University of Virginia, Charlottesville in 1974. The Hugo Häring Prize of the BDA 1978, the Deutscher Holzbaupreis (with Mutschler) 1979, the Aga Khan Award for Architecture (with Rolf Gutbrod) 1980, the Medaille de la recherche et de la technique of the Academie d'Architecture, Paris 1982, BDA Prize 1982.

Frei Otto is a member of the Academies of Naples, Paris, and the IAA Sofia, and Honorary Fellow of the AIA and the RIBA. He has received a number of Doctorates including one in arts and architecture from Washington University, St. Louis, and Dr Ing. H.C. from the University of Essen, 1990. As we go to press it is reported that Prof Otto has won the Honda Prize 1990 from the Honda Foundation, Tokyo, Japan.

Publications and books written by Frei Otto include *Das hängende Dach* (1954, 1990) *Zugbeanspruchte Konstruktionen*, Vol I, 1962 and Vol II 1966; *Natürliche Konstruktionen* 1982; *Gestaltwerdung* 1988. Books by other authors include, Conrad Roland, *Frei Otto – Structures*, Berlin 1965, London 1970; Ludwig Glaeser, *The Works of Frei Otto*, Museum of Modern Art, New York 1972; Philip Drew, *Frei Otto – Form and Structure*, London 1976; Berthold Burkhardt (ed) *Frei Otto – Schriften und Reden 1951-83*, Wieweg-Verlag 1984; Karin Wilhelm, *Architekten heute – Portrait Frei Otto*, Quadriga Verlag 1985; Stefan Polanyi et al, *Der umgekehrte Weg – Frei Otto zum 65. Geburtstag*, Verlag Müller, 1990.

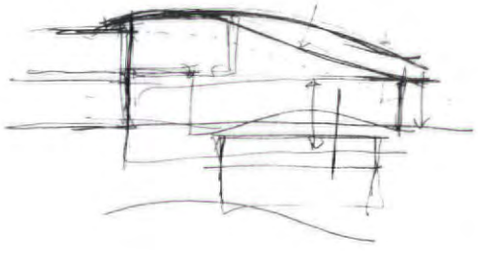
Correction: The SAS building shown in the profile of Ralph Erskine in *World Architecture 6* was designed by Norwegian architect Neils Torp. It was not Erksine's SAS scheme for Bromma.



Integration of architecture and engineering: the new terminal building for Stansted Airport, UK, designed by Foster Associates, to be opened early in 1991.

LOGICAL ANARCHISTS

Engineers are often given a low profile on the building design team. In this article, British engineer Mark Whitby of Whitby & Bird, who works with many leading UK architects, argues for a greater degree of collaboration and recognition for creative engineers.



Above: engineer Mark Whitby's working sketches for Woking pool, architects Faulkner Brown; opposite page, Amsterdam glazing scheme by architect Alan Brookes, engineer Mark Whitby.

The engineering of architecture is a process of anarchy. Wherever engineers have been working with architects since the Industrial Revolution, it is possible to find examples of subterfuge and subversion carried out by the engineer in the pursuit of buildable structures. But these engineers have kept relatively quiet about it. They were silent anarchists.

After the lecture The Engineer: Nursemaid of Magician that I gave last year at the Royal Institute of British Architects in London, and the debate that has followed it, I have become more candid about challenging the entrenched attitudes concerning the position of the engineer within the design team. I am concerned that engineers should clarify their professional position and begin to make a proper authoritative contribution to design as of right rather than by negotiation.

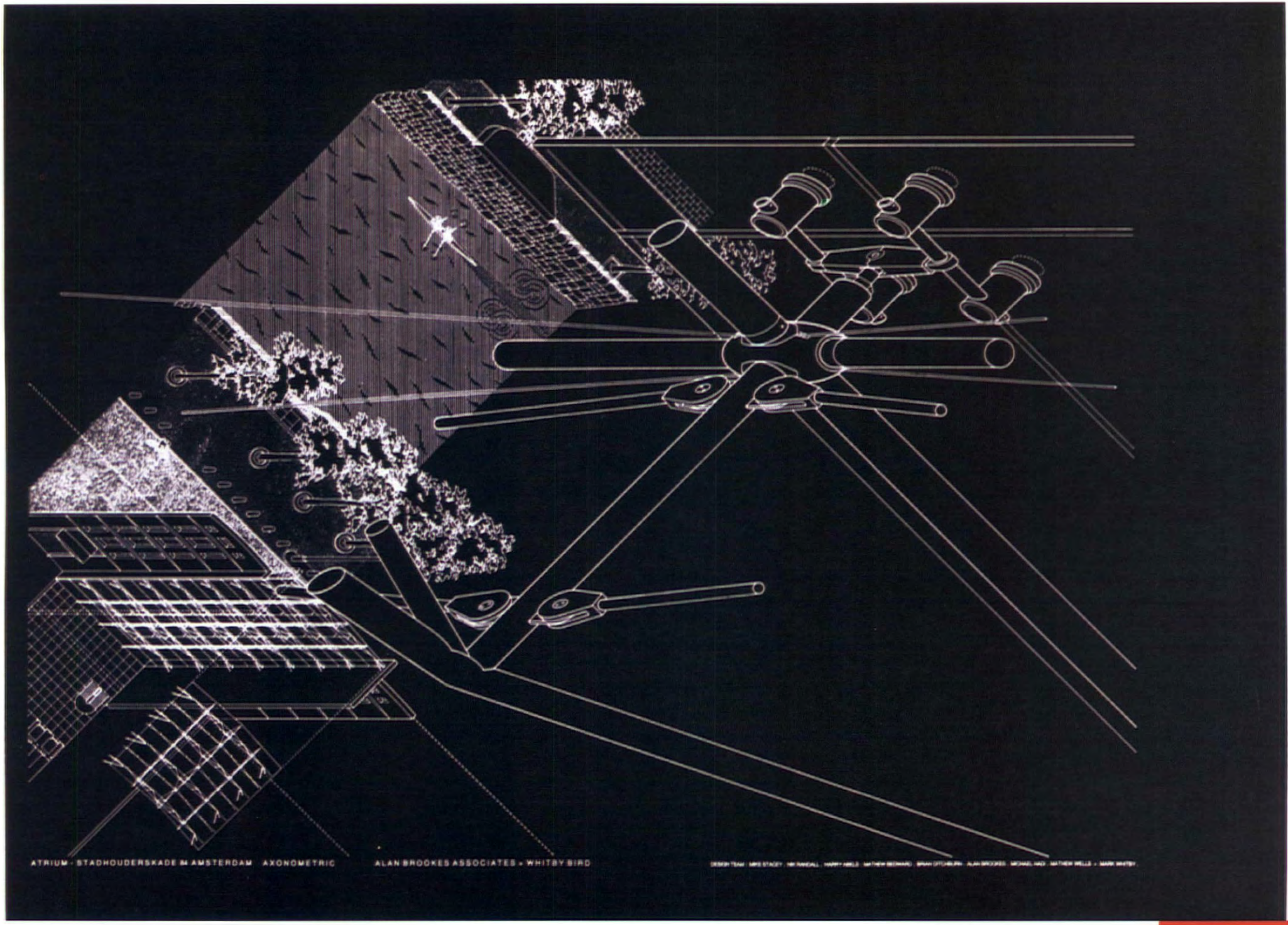
Peter Buchanan, writing in the *Architectural Review* last year on the subject of the education of architects, was instrumental in starting this debate. "The more wilful the architect's approach to structure," he wrote, "the less the relationship to the engineer is one of equals. Instead, the engineer becomes a nursemaid, looking after the architect and getting his playthings built, with the engineer usually travestyling his discipline while humouring the architect."

This was a shrewd insight about a pretty deplorable state of affairs. We have to ask how we got to this state. Part of the reason lies simply in habit and stereotype. Was James Gowan making a statement of fact or a value judgement when he said that "the architect is concerned with art, the engineer with utility". Le Corbusier puts engineers neatly in their place by saying, "The engineer should remain a calculator". Tongue firmly in cheek (I hope), Charles Jencks, after Rousseau, described the engineer as "the noble savage".

Spontaneous beauty in design

Eric de Maré presented a more positive picture of the engineer in his famous book *The Bridges of Britain*, written some 30 years ago. "The architect", he wrote, "is the chief builder often of the most complex structures, conditioned as much by social conventions as by plain purpose. The engineer on the other hand has clearer, simpler objectives and that is why he so often surpasses the architect at the aesthetic level, even though he may be regarded as a less 'cultured' type than the architect.

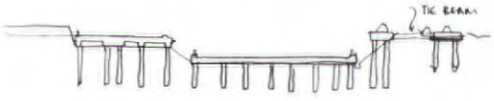
"His very lack of self-conscious


ATRIUM - STADHOUDERSKADE 84 AMSTERDAM AXONOMETRIC
ALAN BROOKES ASSOCIATES + WHITBY BIRD

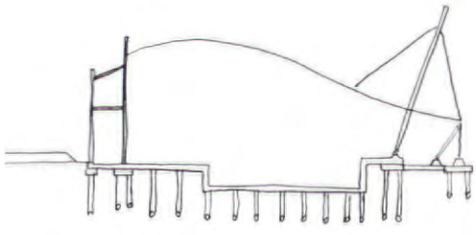
Below: the construction sequence for the Woking pool 1987-88, developed by engineers Whitby & Bird. Right: the completed project.

1. Fill site plus pile plus form, mast base.

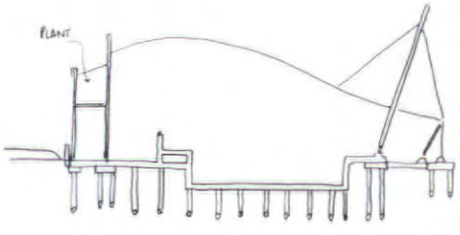
2. Excavate for pool, tie down and plant area.



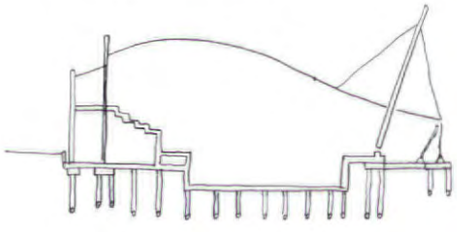
3. Complete floor constructions and erect roof structure.

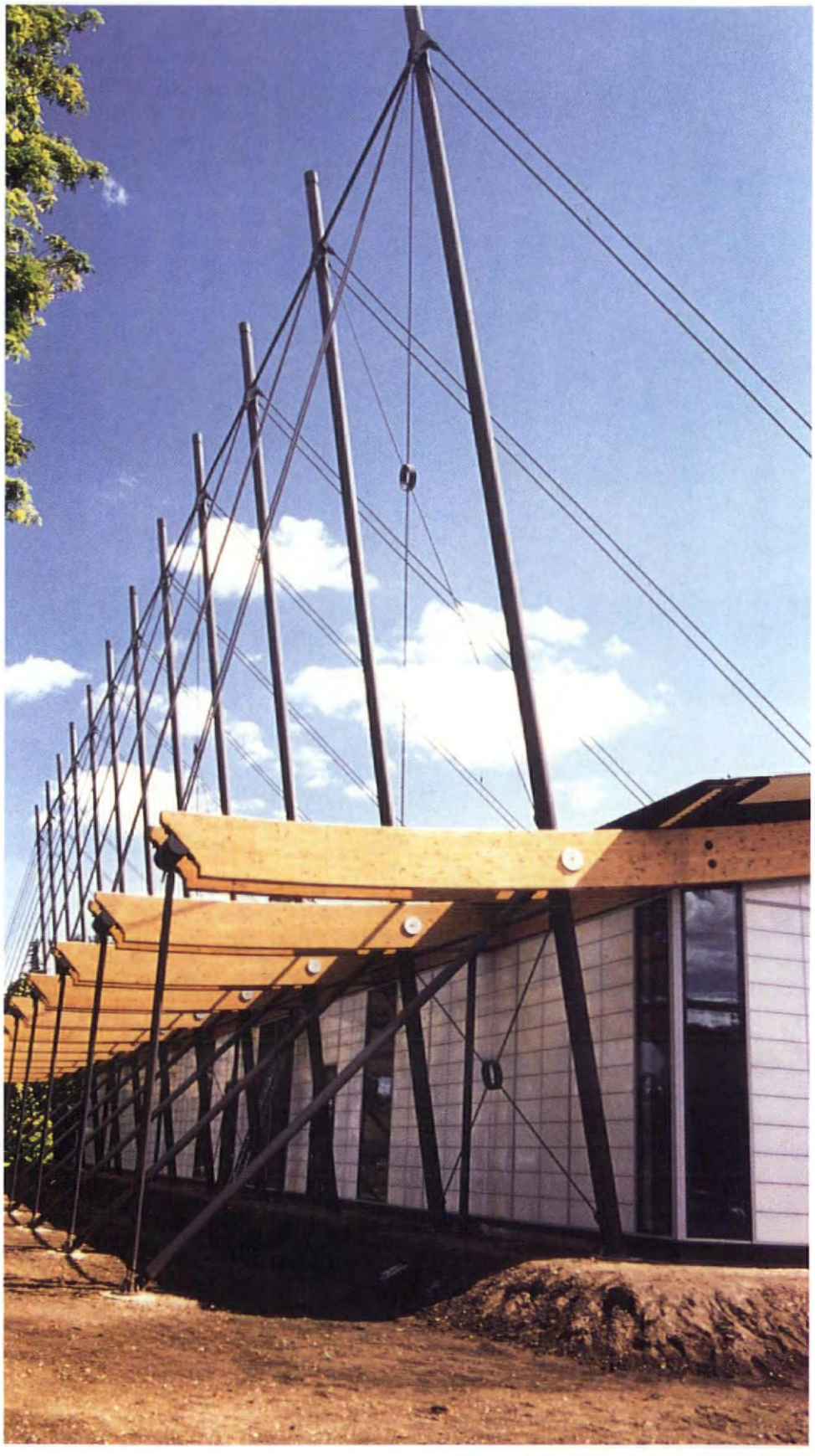


4. Construct balancing tank and perimeter retaining walls. Start high level plant, roof.



5. Form seats and start on finishes.





aestheticism, which can be a hindrance to the architect, helps him to design with spontaneous beauty and to accept without question nature's laws of statics."

I know what De Maré means here, though it's a stunning piece of over-simplification. The engineer, pictured here almost as a child of nature, *can* design with "spontaneous beauty" and he can, of course, design with equally spontaneous ugliness.

Engineers have a simpler, or at any rate, a more straight-forward job to do and, as these comments suggest, are really concerned with problem solving. I would not dispute that engineers do concern themselves with problem solving and bring to the design process a logic based on fundamental laws of physics. What I question is the idea that the engineer is consequently the skivvy or the boffin on the team, the person who will either tidy up the mess or somehow put things together to make them work.

When we face this sort of situation in a design team meeting, we know we are working with architects who simply view engineers as a technical asset at their disposal. In such a situation, we are not expected to propose ideas and are never

consequently in a position where we can offer radical insights into the design or sustained energies into the design development.

We get irritated, not unnaturally, with people who treat us simply as technicians. On the other hand, we get excited about design sessions where we are accepted as integral contributors to the creative process; where we are all aware of the implications of each aspect of the building, bringing complementary strengths to the design exercise and crossing traditional boundaries.

As the architect Eric Mendelsohn pointed out, "The engineer must be as sensitive to the form as the architect is to the structure, as this is the only way for structure and form to challenge each other". This is the crux of the matter: architects and engineers contesting in the making of the eventual solution, generating creative tension to achieve work of integrity.

Integration of the disciplines

The integration of architecture and engineering can be seen in three recent buildings by Foster Associates: the Renault Factory, the Hong Kong and Shanghai Bank, and Stansted Airport. In each one, both architects and engineers have obviously contributed to the aesthetic, and have produced buildings that speak of our time. There are variations, however, in how efficient the engineering contribution actually is, and I sometimes wonder if we can infer from this something about the development of the working relationships within the design team.

At the Renault factory, it seems to me that the engineering logic has somehow got lost in the design process, for while the basic suspension structure is clearly quite efficient, the secondary ties around the columns, which I believe deal with sway, are more difficult to understand and rationalise. I enjoy looking at this building, but I am constantly reminded of Frank Newby's comment, "High tech is the use of tortured structure for decorative purposes."

With the Hong Kong and Shanghai Bank, the structure is much easier to understand, though it is still inefficient structurally, with the loads being taken up seven storeys before being taken down in the columns. Surely the suspension structure could have been an arch above the clear floor?

At Stansted Airport, however, the architect and the engineer seem to have produced a solution that speaks of an essential harmony, between two quite separate disciplines and between the form of the building and the structural solution. Here, I am reminded of Wyatt, Brunel's architect at Paddington Station, speaking nearly 140 years previously, "Form is, in every case, if not dependant on, at least coincident with structural fitness".

At Paddington the grace of the structure was lost in the decoration applied by Wyatt, whilst at Stansted, Foster and Arups have achieved the equivalent to the Forth Bridge, built 100 years before. The form of both is entirely logical in the way that the bulk of the structure is concentrated over the supports, being self-supporting as the construction proceeded. The tension members are lattices or tie rods and the compression members large tubes. Both are an object lesson in structural honesty, efficiency, buildability and naturally, as a result, economy.

Participating in the process

Perhaps it will be argued though that the design of a bridge, although complex in the technical problems it poses, is in some ways a less complicated exercise than the design of a building, because form and function need never conflict. Perhaps this is where Eric de Maré's "spontaneous beauty" fits in? At Stansted, however, the design is obviously the product of both the architect and the engineer. Though irrelevant to this argument, it would be intriguing to discover how the different professionals involved account for their participation in this process.

Possibly at Stansted there is an equivalent subconscious aesthetic working as there was at the Forth Bridge, allowing the supple development of the design to evolve from the constraints of cost, site, function and construction. Most architecture, however, fails to achieve any semblance of the integrity witnessed at Stansted – mostly, I believe, as a result of the architects' "social conditioning", as Eric de Maré called it. This "social conditioning" extends sometimes to a rejection of technology, but equally at other times to its adoption on a scale which dominates the design.

Below: Renault factory, UK, and Hong Kong and Shanghai Bank, both by Foster Associates: architects and engineers combine to create buildings which speak of our time.

This latter case is epitomised in work where the structure is developed from natural form on a scale quite out of proportion to its origins, or where the shape of the structure is dominated by purely structural considerations, as in the case of cable net roofs. Neither allows for the interactive process of design to take place, where form and structure can be subtly modified with the development of the detail and considerations of construction and servicing.

Singular aspect of form

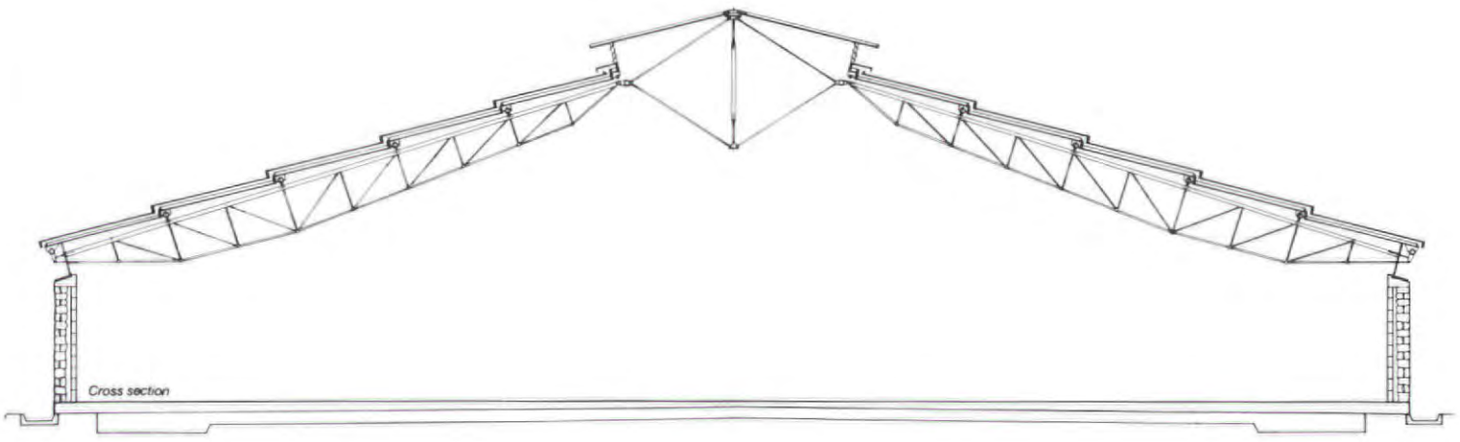
Though perverse, the adoption of technology by architects has its own decided aesthetic equal to other styles that are dominated by the design focusing on a singular aspect of form or structure. All become a focus for the attentive student of architecture and in the case of the structural aesthetic, a manner through which the architect dominates the engineering. However, in doing so, the architect often reduces the design team working on the project to technicians.

Modernism has a status on a par with a

RICHARD WAITE

Opposite page: Whitby & Bird's Olympia & York pavilion at the Chelsea Flower Show, London, 1989. Architect: Flashman Associates.

Cross-section through David Mellor factory, Hathersage, near Sheffield, UK, designed by Michael Hopkins and Partners. A sensitive approach to the problem of designing an industrial building in a national park was enhanced by Whitby & Bird's engineering skills, particularly in relation to the structural framing of the dramatic low-pitched roof.



religion, as Gordon Benson alluded in his adaptation of Chesterton's quote, "People didn't give up modern architecture (religion) because it wasn't good enough, they gave it up because it was too difficult." It is interesting to enquire into the relationship the advocates of this style had with engineers and to note the debates of the time, which were not so dissimilar to those of today.

Herbert Read wrote almost 60 years ago in his book *Art and Industry* "It is the engineers who built the Forth Bridge and the Crystal Palace, who more recently evolved the form of the automobile and the aeroplane, who first unconsciously suggested the elements of the new aesthetic. Their suggestions were picked up by more conscious architects and designers and gradually, in a few pioneer spirits, the old and inappropriate traditions were discarded, and a new tradition based on practical realities were evolved."

Today's engineering, which embodies both the science of structure and the art of construction, retains this subtle discipline to style. This is a discipline which can inform on the design of the building by allowing the broader aspects of building, including structure, construction, servicing and durability to develop and generate the architecture from the space required. All materials have an engineering aesthetic, which has to do with their appropriate use as either elements of structure or as elements modifying the conditions within the space. Sometimes, as in a brick wall or glass screen, they may combine these functions.

It is possible to argue from an historical point of view that the form of buildings such as the Parthenon are derived from the Ancient Greeks' empirical knowledge, based on the use of stone, and that the form of thirteenth century cathedrals is derived from the development of similar structural considerations.

Modern architecture has drifted away from this precedent, and though it is possible that many of the great masterpieces of the twentieth century, such as Mies van der Rohe's Barcelona Pavilion or the Hancock Building in Chicago, reflect an equal honesty to materials, the majority are travesties, whereby architectural clichés are achieved by structural gymnastics.

The suspended brick cavity wall used to recreate classical architecture is probably a good example of this, though many engineers must experience an equal sense of unease when looking at objects such as the pepper pots on the fire station in Shaftesbury Avenue in London, the justification of which is particularly perverse.

Unconditioned experience

This unease must also be experienced by lay people, whose intuitive sense of structure is more subliminal. Their experience of engineering is, however, quite unconditioned, unlike their understanding of architecture, though it is unfortunately, in the case of buildings, generally overridden by the latter. However, as the civilisation of the late twentieth century finally comes to terms with the revolutionary use of materials, it is probable that it will be better able to judge quality in building for itself. As we engineers are experiencing, good architecture will again be born out of the creative tension of the two balanced disciplines of architecture and engineering.

This situation, however, needs nurturing. The engineer as silent anarchist has done little to explain his role in the making of buildings. The public and students of engineering and architecture are bewildered by anybody other than an architect making a contribution to architecture, with the consequence that any engineer who does is liable to be labelled as an architectural engineer, designer or even sculptor.

This process has done nothing for the status of the engineer and is in part responsible for the fact that the education of many engineers is about the teaching of technicians. The teaching of architects and engineers on the same courses is a step towards rescuing this situation, although in many cases these courses create an unhealthy tension between the disciplines as the process of educating architects and engineers remain so different.

Engineering education must come to terms with the enormous changes that have occurred in engineering as a result of computing and the conceptualisation of structures, which makes it now more possible for the engineer's education to parallel that of architects.

In the future, engineers must recognise and advertise the contribution they make. As buildings result from the design skills of both architect and engineer, they must be designed in collaboration. The product will be a greater harmony of function, form and structure. □

A unique experiment in timber architecture has been developed at Hooke Park College in Dorset, England. Peter Dormer discusses the conservation and profit-making implications of the new organic structures designed by Frei Otto, Edmund Happold and ABK, which utilise wood trimmings.

OUT OF THE WOODS

This article is about conservation and capitalism. It is also about architecture and design. Above all it is about *making money.*

We value architects because they can lift mundane shelters into things of beauty, things of status, things that make us as individuals and as societies feel a whole lot better about being human. Architecture can add value to the mundane. This value is aesthetic and, sometimes, moral. It is also always a financial value. Generally speaking, a beautiful building is more valuable than an ugly building because more people want it, therefore its market value is increased.

Some of the readers of *World Architecture,* especially those in the former communist countries of Eastern Europe, might bristle at this argument. Some readers remain communists, others are socialists (the nuances of the difference here are unimportant). After all, although, happily, we have seen the spread of democracy, we have not – in spite of what some foolish Americans have asserted – seen the death of socialism. Socialism remains a coherent set of beliefs. Enough countries in the world – Britain, France, Italy, Israel, for example – have socialist parties that from time to time take part in government. Socialists may feel annoyed that in every debate in a capitalist democracy, the argument turns not merely upon money, but on *profits.* But capitalist enterprise, including the enterprises of creating beauty or even doing good, is based on the individual being rewarded.

Now that the world is worried about the environment, the question in capitalist countries, especially in the USA and Britain, is how do we make a profit out of nature and protect it at the same time?

New approach with timber

The need for profit, the concept of adding value, and the managing of the environment are at the heart of Hooke Park College, a training centre in Britain established to train people in the management and the development of woods, forests and timber. Hooke Park is of interest to engineers and architects because a team consisting of Frei Otto, Professor Ted Happold, Richard Burton and William Moorwood (ABK) has created a new approach to timber architecture. Hooke Park shows the possibility of making money from what is currently disregarded as waste material. Hence Hooke Park is also of interest to conservationists.

None of what is happening at Hooke Park would have happened without the leadership and vision of one man, John Makepeace who is renowned for designing and making furniture. He is famous also for finding and rescuing a minor stately home and establishing a school to train artist – craftsmen working in wood – mainly furniture and wood consumer products rather than sculpture. Students also learn to run businesses. The School for Craftsmen in Wood began in 1977 and thrives today with a worldwide reputations. (One ought perhaps, to point out that Makepeace was not born a wealthy man or an aristocrat.)

With the School for Craftsmen in Wood, Makepeace has created an enterprise that is self-sustaining. He has learned at first hand about the principles of "adding value" to something: thus, as he says, a tree might be regarded as only fit for firewood with a value at say $30 a ton but suppose a part of it or a lot of it can be used as building material then its value might be $600 to $1,000 a ton. And if it could be utilised into furniture then it may become worth as much as $6,000 a ton. To create this increase in value you have obviously to invent, innovate or design new ways of using a material that others have hitherto ignored.

Added value in purposeful way

What changes a raw material into something valuable is human intelligence and creativity (as well, of course, as the inherent virtues of the resource). There are many virtues with timber including one that is often neglected – its great tensile strength.

Industrial designers and stylists of consumer products understand the concept of added value very well. Take a pot of jam as an example: put it in a large plain glass jar with an ordinary label and its value is little – it looks cheap. But put it in a smaller jar, give the jar an interesting shape, attach a special, nicely decorated label suggesting superior quality and place it in a prettily patterned box and the result is added value. You can sell the same jam at ten times the price as before. That is capitalism: addressing the market, recycling old ideas, repackaging the familiar.

John Makepeace, however, is adding value in a more purposeful, more serious and, as far the community is concerned, more beneficial way. His ambition is to save woodlands and forests by making them profitable. At the same time he hopes

Training centre, left, and prototype house in construction at Hooke Parke: the experiment has created an organic, irregular aesthetic approach in which doors and entrances, walls and windows take on unconventional shapes and angles.

Top: Hooke Park training centre. The fundamental structure of the architecture is composed of a series of long roundwood thinnings. Both the physics of compression and tension are utilised in this building which joins three vaulted modules together. Above: Hooke Parke itself, a 330-acre mixed woodland with an abundance of raw material.

that his efforts, and those of others, will give us new aesthetic delights, as well as useful goods.

At the moment Britain produces a surplus of low-grade timber which gets used for burning. But it also imports 90 per cent of its wood and wood products. This cost $12 bn in 1988. Makepeace is demonstrating that much of the wood Britain burns can be used much more profitably.

The Parnham Trust, under whose auspices the School for Craftsmen is run, has bought 330 acres of woodland – Hooke Park. Here Makepiece has set up his Hooke Park training college in the forest, creating a 600 square metre training centre and a small house. Both buildings were designed by Otto, Happold and ABK using wood thinnings from the surrounding forest.

The Hooke Park buildings are not log cabins: the roundwood thinnings of Norway Spruce did not permit that kind of "heavy" construction (the sizes of the timber are 50 mm to 150 mm in diameter. The training centre is a structure which exploits the bending potential of the thinnings – it is a structure in which both the physics of compression and tension are utilised. The fundamental architecture of the structure is composed of a series of arches made from long roundwood thinnings. The roundness is retained, thus retaining the strength the wood had when it was a tree. The lateral arches are joined together by a series of horizontal arches and the structure is covered with a polymer fabric.

The span of the lateral arches is 15 metres (the building is 12 metres long) and the form of the building is unusual: it is like three shells joined together so that from the outside the effect is of a three-humped beached whale. Inside, with light falling from the rooflight that runs full length down the centre of the building, the atmosphere is rather religious, church-like.

The roundwood timber arches were freshly cut greenwood treated with boron salt solution, wrapped in plastic sleeves to maximise the diffusion of the salt. Computers were used to analyse the shapes of the arches and their distribution because these arches are each slightly different from one another.

A new joint developed

Although it is the training centre that catches the visitor's eye first – because it is so big – the house was the first building to be erected using thinnings and is, in its own way, especially innovative. It is a tension structure which incorporates a new kind of joint. This was developed because joining wood that is only 50 mm in diameter demands highly efficient joints. A conical hole is drilled in the end of the timber and filled with epoxy resin, the conical hole exposes all the fibres which are orientated longitudinally and these maximise the efficiency of the joint. A threaded steel rod is beaded in the resin to permit the connection with the next piece of timber to be made. These joints were tested on the prototype house, the first building to be made from thinnings at Hooke Park.

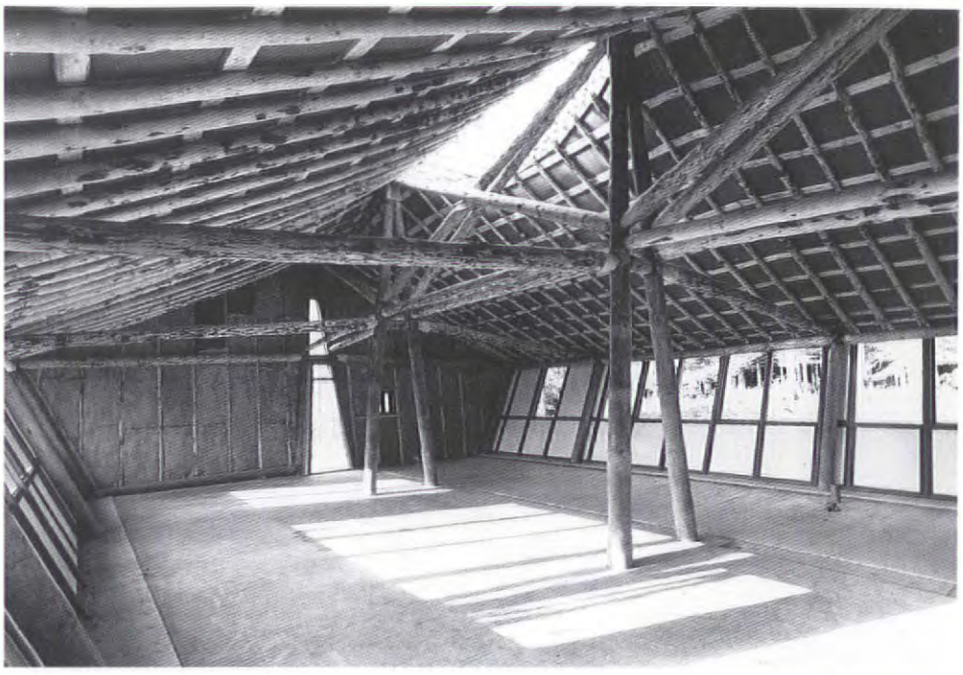
The use of resin as a barrier-cum-cushion is a technique that the team used also in the construction of the training centre. Metal to wood joints have traditionally been spots for structural failure in wooden framed buildings.

However, the major structure, the risk-taking structure, is the training centre and here much was learned about using

thinnings as the building progressed. There were many breakages at first as the thinnings were bent into shape but experience paid off so that by the time the second and third stages of the centre were reached, breakages reduced considerably.

John Makepeace wants the students who will use the centre to think up new, profitable businesses making use of different kinds of wood and thinnings. He wants them to think in terms of mass manufacturing and he envisages a manufacturing project that places the workshops on site, in or next to the woodland, using a combination of advanced manufacturing methods and design to create high value furniture, tools, domestic goods and toys. Indeed, he wants the college itself to set up in manufacture in order that the college properly pays for itself and the Hooke Park woods themselves become self-sustaining and profitable.

What has bee proved at Hooke Park already is that roundwood thinnings, hitherto regarded as fit only as fencing posts, can be used as a structural building material. More research is needed but a fundamental point has already been made empirically and not floated as mere speculation.



The prototype house at Hooke Park: the first building to be constructed in the programme and an innovative tension structure for which a new type of joint was developed.

Effect on aesthetic expectations

However, although the science of the project is interesting, what is also fascination is the radical effect such a proposal has upon aesthetic expectations. We are used in an industrial culture to neatness, perfection and order. Now the workshops at Hooke Park do present you with order but it is the order or assymmetry. There *is* a kind of perfection but it is organic, it is not regular. Thus one is looking at an aesthetic which has a very different kind of dynamic to those aesthetics which radical artists, designers and architects have asserted earlier this century such as de Stijl, Constructivism and Suprematicism – which were basically the aesthetics of the panel and the 'I' bean or rectangle and line.

Some aspects of all the Hooke Park buildings, including the experimental house, are somewhat expressionist in appearance. Since these are tension structures, the doorways and entrances, the walls and the windows take unconventional shapes and angles.

A door might lean outwards and be wedge-shaped and one has a curious mixture of references ranging from the designs that you'd expect in a space station to images that you'd associate with the Brothers Grimm. Such references are not, however *post-modern* – they are not the result of irony or clever architectural quotation – they result from the logic of the structure itself.

I suspect that Eastern cultures, the Japanese for example, will find the Hooke Park aesthetic easier to like because they have a tradition (in their pottery, for example) of seeing beauty in organic irregularity as well as in the dignity of man-made finesse. However, as interest in the Hungarian architect Imre Makovecz demonstrates, there is in Europe a growing audience for an organic aesthetic which is inherently green. And to be green is to add value and to make profits. □

WAXING OVER WRIGHT

Frank Lloyd Wright's 1938 Johnson Wax Company building at Racine Wisconsin has been called "a cathedral of commerce". But aside from its architectural significance, its custom-designed furniture is now regarded as the forerunner to modern office systems. Edgar Tafel (above) was site architect on the project. He recalls how Wright got the job of designing the furniture.

Above: site of the Johnson Wax Adminstration Building, Racine, Wisconsin, showing later tower addition.

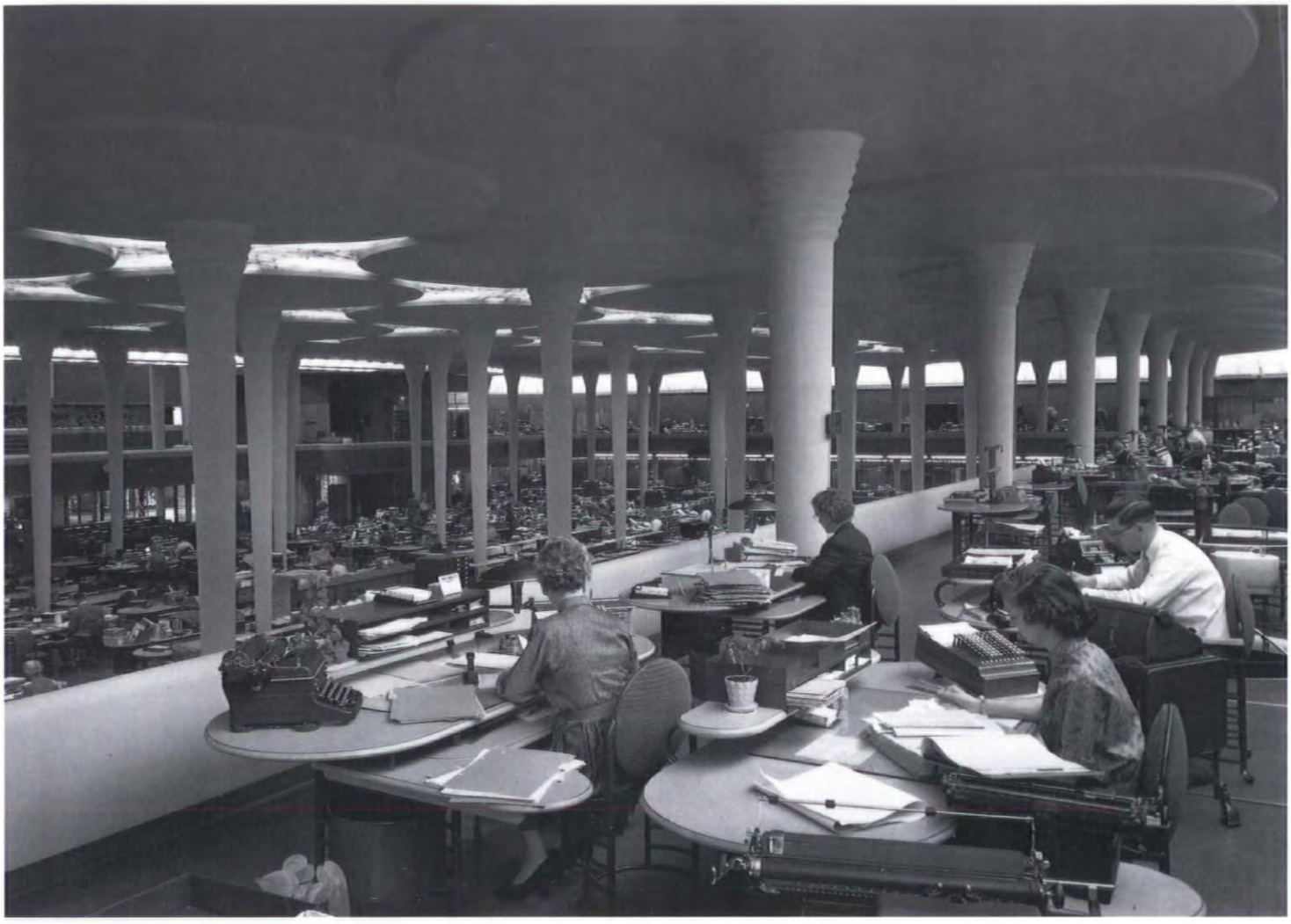
By 1938, the Johnson Wax Company administration building, in Racine Wisconsin, was well along in construction. I had been there for over a year, supervising from the foundation up, and I attended client/architect meetings all along. Either I drove down for a day with Mr Wright from Taliesin 150 miles away or stayed for the whole week, when he came for client and progress meetings.

Not long after the commission was secured, Wright and three of us took a trip from Taliesin to Pittsburgh. Soon after the start, he changed the course: "Let's go to Buffalo and see the Larkin Building." In Buffalo, we had his conducted tour, and he remembered all the details, down to his design fireproof furniture. He even remembered the name there of the company in Milwaukee that did the Buffalo millwork. I located them upon return, and they were engaged to do a wooden mockup of the standard desk, as a full size model. This firm later built all of the special pieces for the Johnson woodwork executive offices, right down to the specially designed walnut plywood panelled toilet stalls.

By the time the building was nearing completion, almost everything had been designed and decided upon, with the exception of furnishings and landscaping. At one of the meetings with Mr Wright, Johnson and his general manager were anxious about the furniture, and asked the architect what to do about the problem. Mr Wright said it was simple to answer: "I will design it."

As simple as apple pie

Designing furniture for his own buildings was as simple as "apple pie" for Wright. He had designed the furniture, all steel for the fireproof Larkin Building in Buffalo, NY



At work in the Johnson Wax Building: the functional, multi-level, softly curved furniture, designed by Wright himself, proved to be a new way to look at the work environment and the business procedures in it. This early example of open office planning set an agenda and methodology which future office systems would follow.

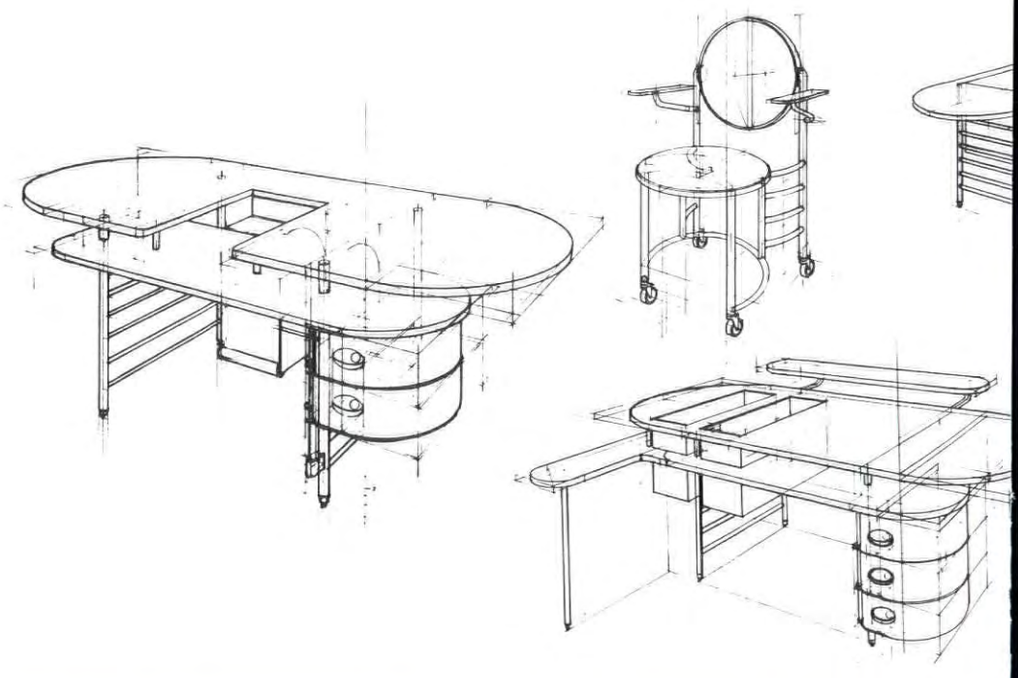
some 37 years earlier. Now, he could easily design more fireproof furniture for another fireproof and air-conditioned building. At that meeting, he said to me: "Edgar (always emphasis on the second syllable), go to the department heads and find out what they need". And I did.

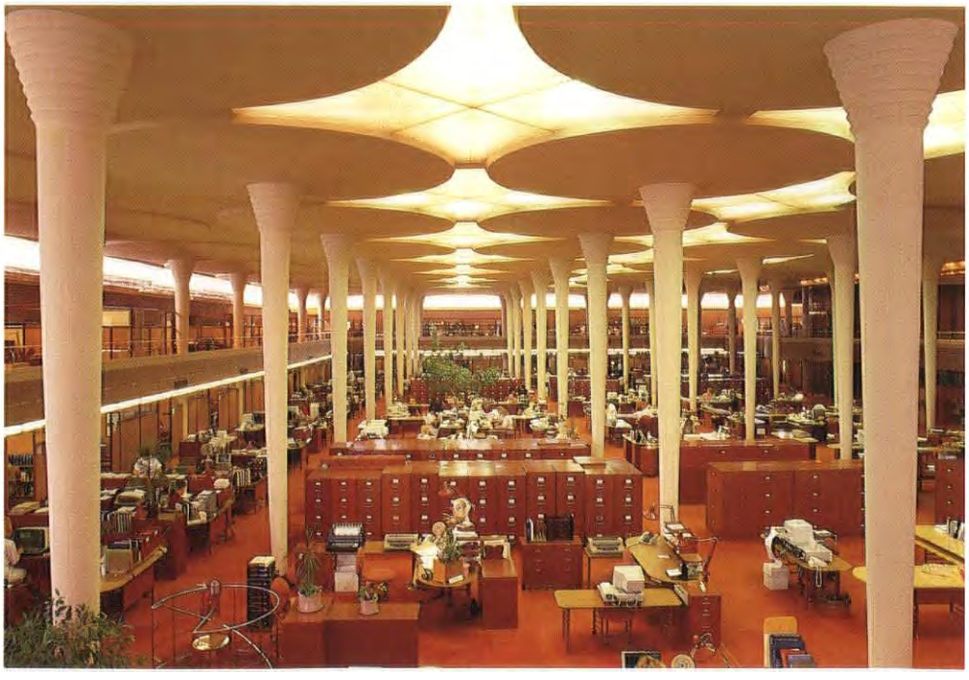
"It is quite impossible (for me) to consider the building as one thing, and its furnishings another," Wright said. In the Johnson Wax design, he took off with continuity of the building's theme: round columns flaring up as mushrooms, wood tops for human warmth of materials, thin metal tubing for legs and horizontal supports. To get away from normal or usual drawers, he devised a horizontal swinging drawer he entitled a "til". Thus, with a block long interior office space on one level, the desks floated like lily pads in a pond. The desks could be rearranged at will, and the general pattern kept floating.

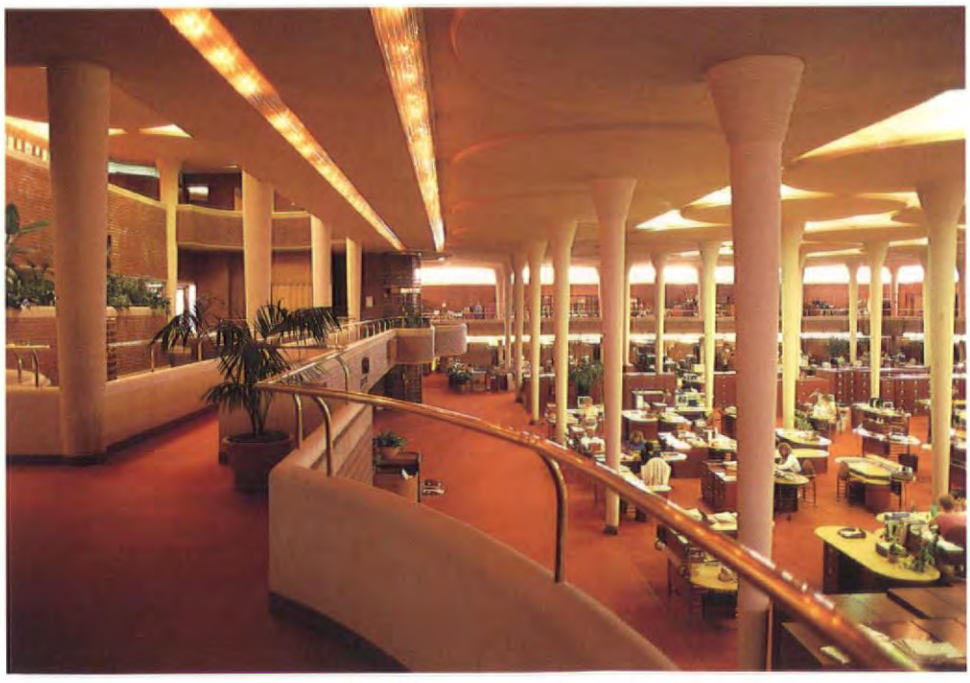
Back at Taliesin, Mr Wright soon designed the desk and chair, in elevations, sections, specifying the metal tubes, with the light birch wooden tops – wooden, because Johnson's chief product was furniture wax. The drawings were presented to the general manager; and when asked who would make the items, Mr Wright stated (he always stated): "McArthur".

McArthur, a salesman in the furniture industry, was the brother of an architect who had been a Wright draftsman and who, in the later part of the 1920s, had arranged for Mr Wright to be co-designer of the Arizona Biltmore hotel. Some coincidence arrives here, and as Johnson's general manager had come from Grand Rapids, he knew people at the Metal Office Furniture Company. It was logical they

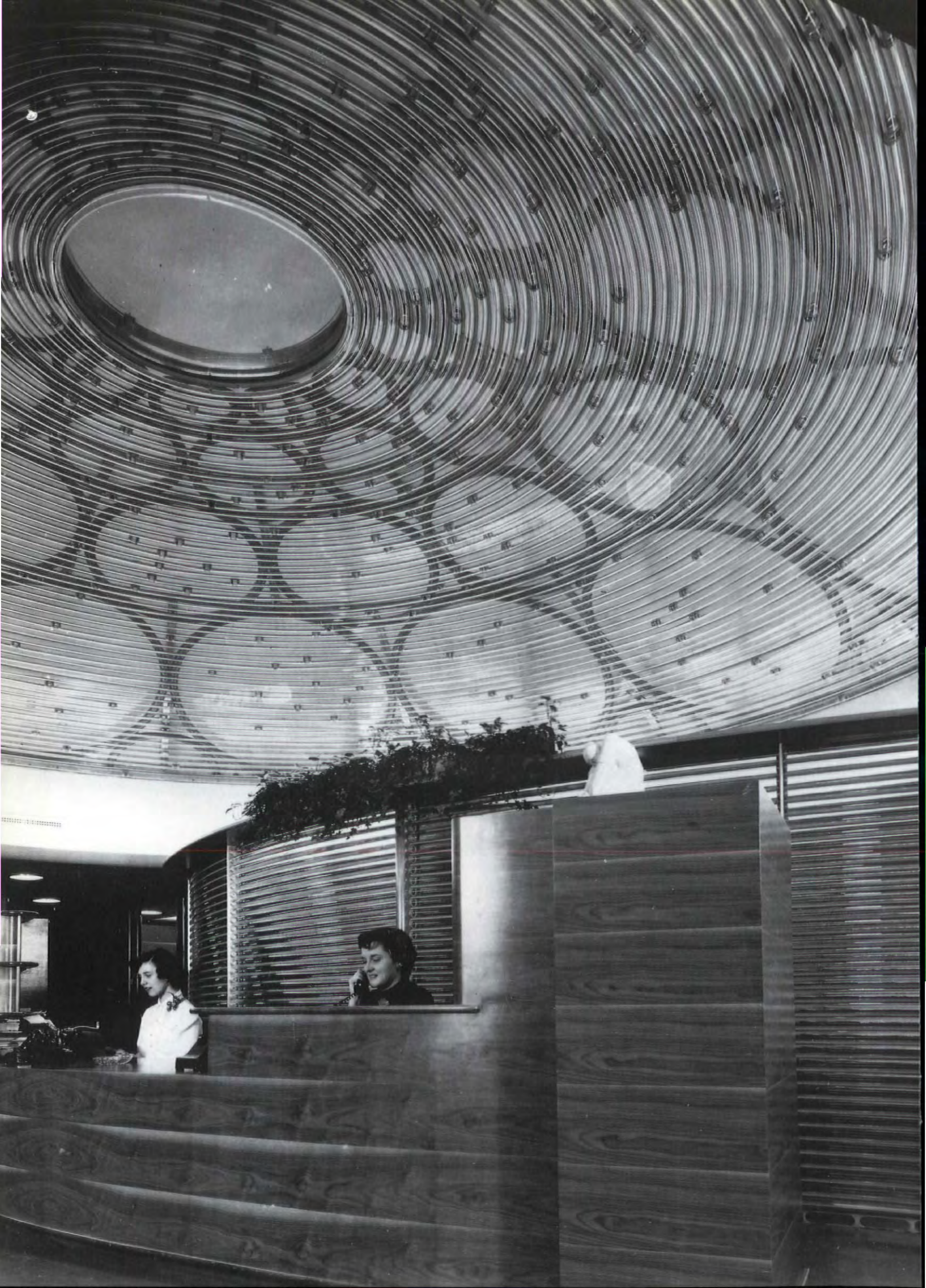
The style of the furniture directly reflected the architecture of the building. There were many different designs to suit each element of daily business. Innovative in form, colour and materials, the furniture pieces were made by craftsmen of the Metal Office Furniture Co, forerunner to Steelcase. In particular Wright avoided using conventional desk drawers; instead he devised a horizontal swinging drawer he called a "til". His three-legged chairs, though, proved unstable.







The beautiful, hollow-core mushroom columns defined the interior space as much as supported the roof. Wright regarded the transition from designing the building to creating the furnishings inside it to be as easy "as apple pie". Natural wood tops were specified because the company's product was furniture wax, but in later years these were replaced by Formica because staff "got tired of constant waxing".



Opposite page: reception area at the Johnson Wax Administration Building, with circular motifs echoed in the furniture designs. Below: jewel in Steelcase's crown, Wright's desk and chair made from cast aluminium and magnesite.

could make the items. And, of course, Mr Wright had had experience furnishing a fireproof building . . . etc.

Discovering office procedure

Somewhere along the line of this design process, Mr Wright told me to meet with all the departmental heads in order to find out how the office procedures worked and to make a list of each section's requirements. I did this under the direction of the general manager for Johnson Wax. The plan for the new building was visualized. It would incorporate spaces from several fireproof small buildings that had been put together in a haphazard way. In the new building, the mail would come in at the receiving door, be sorted out nearby and then "flow" from one department to another in logical continuity so that it would be processed. Executive mail would go upstairs to the executive floor, and the business of each department would be so coordinated that all bills and outgoing mail would leave by the same doors through which incoming mail arrived.

After I worked out the design and diagram with Mr Wright, it went to the general manager and to each department head for checking. Then a list was compiled for ordering the furniture. Today it would be called on "office landscape", but then the process was simply a matter of solving the problem of getting the proper flow and the right furniture for each element of daily business.

When the furniture finally arrived, it was simple to send each piece to each department. There were many special designs – some with, some without, typewriter access; some plain tables, others with sunken filing systems, and so on.

All the president's chairs

One day during the process, Mr Johnson told me – as president, he didn't ask, he *told*, and I was, after all, still a youngster in my twenties – that he needed special chairs and a table for his private office. I blocked out the items and Mr Wright went along in his customary way of making changes and adding features. These chairs were larger in dimension than the ordinary worker's ones. He instituted four legs in the president's chairs rather than the (unstable, it turned out) three-legged ones for the others.

Two years ago I went to the building to do part of a documentary film, and noticed the tops were now Formica. When I asked the manager why they had abandoned the natural wood, he stated "we got tired of constant waxing". Recently, I was at the Johnson Wax Building exhibit in Washington, recalling each photo and drawing. I felt whisked back into an important part of history. □

Edgar Tafel, FAIA, born New Yorker, alumnus of Walden School, attended the Department of Architecture at NYU, and was further trained under Frank Lloyd Wright at the Taliesin Fellowship for nine years. During his apprenticeship, he became a senior job architect for such renowned buildings as Fallingwater, the Johnson Wax Building, Wingspread, and other projects.

During World War II, Edgar Tafel was employed in engineering on a war construction programme in northern Arizona, later served in Army Photo Intelligence in Calcutta, heading a drafting unit. After the War, he established his office in New York City and has designed over 80 residences, townhouses, 35 religious buildings, college campuses, apartment buildings, factories and interiors of various nature, including law offices and stores for Julius Blumberg and Dalton.

Edgar Tafel arranged for the purchase of Wright's Francis Little House, which he incorporated in his design for the Allentown Museum. He set out the Wright exhibit for the Metropolitan Museum of Art in New York and is the author of *Years with Frank Lloyd Wright*, now a Dover paperback and in its fourth printing. He is a member of the Taliesin Council. □

CONCEPT

INTERNATIONAL FORUM OF YOUNG ARCHITECTS PUBLICATION

The International Forum of Young Architects is a worldwide organisation for joint professional activities aiming at the stimulation and promotion of avant-garde trends, concepts and projects in the field of architecture.

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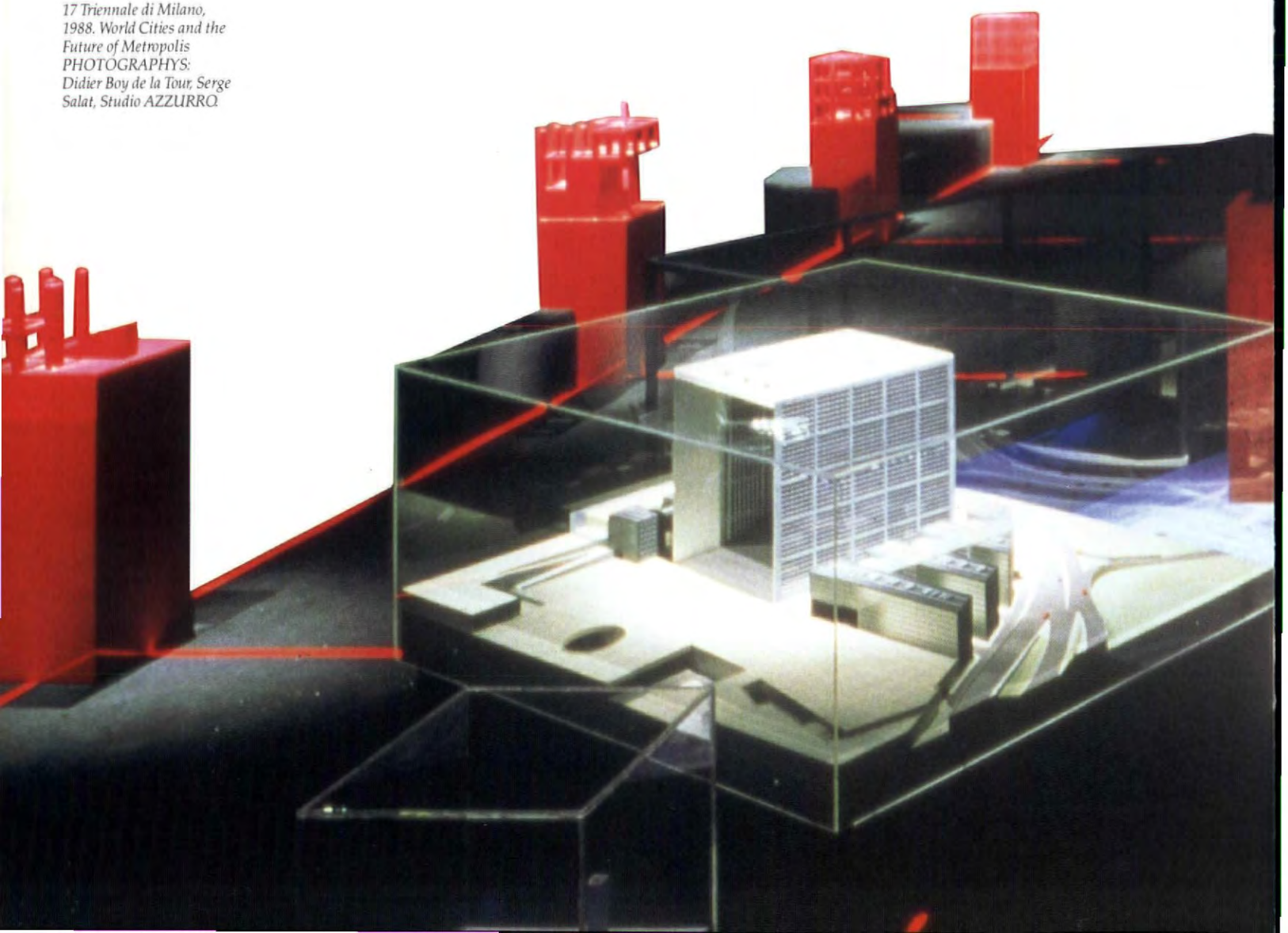
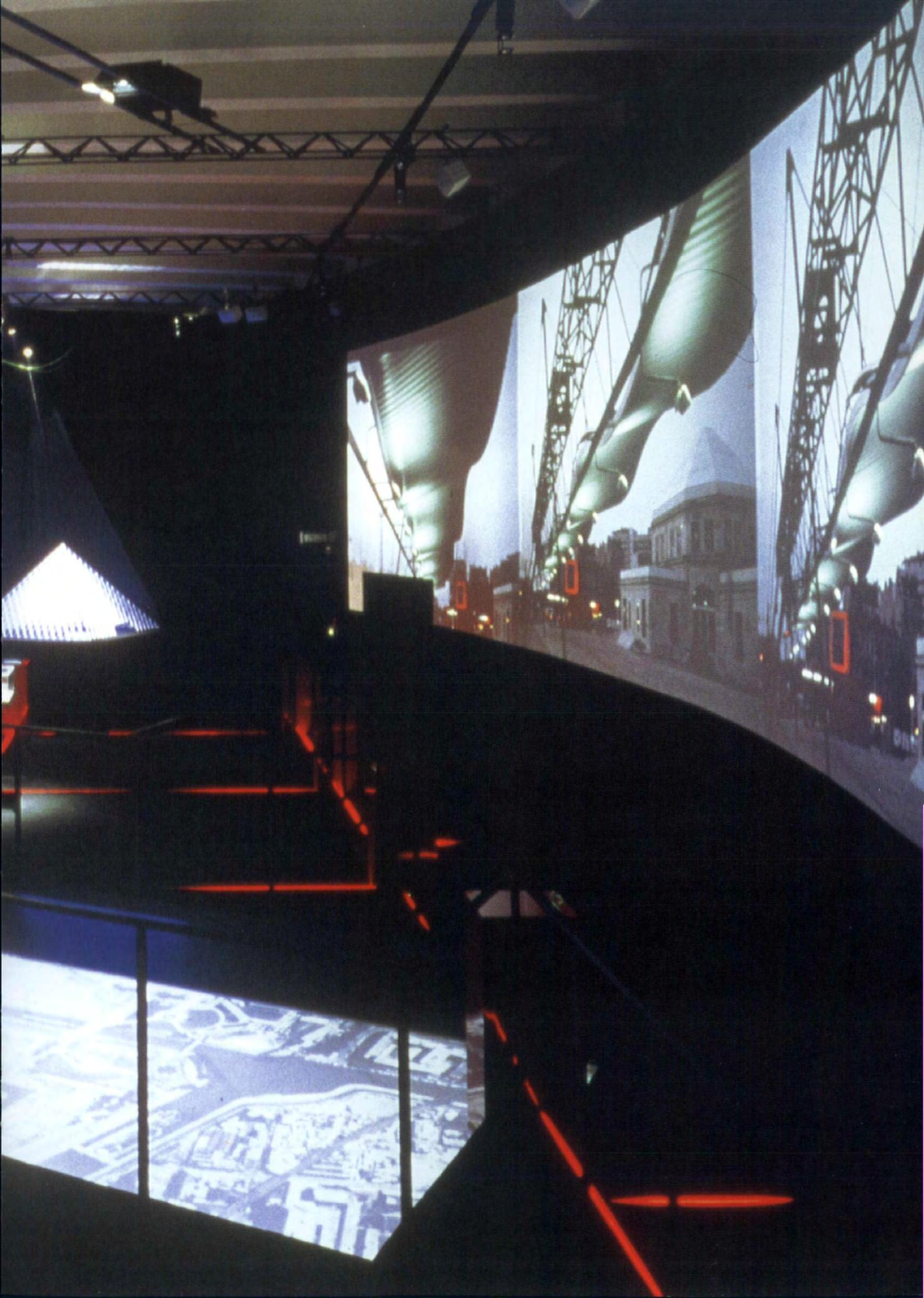
ARCHITECTURE OF THE VIRTUAL

Two young Parisian architects – Serge Salat, graduate in the Ecole Politechnique in Paris, and Francoise Labbe, graduate in history of art, have created numerous architectural conceptual spaces, which were received as works of art. In particular their performances were shown at the following exhibitions as:
LE PONT FLOTTANT DES SONGES – in the Centre Georges Pompidou, 1987;
WORLD CITIES AND THE FUTURE OF METROPOLIS – on the 17 Triennale di Milano, 1988;
ARCHITECTURE DU VIRTUELLE – in the Institute Francaise d'Architecture, Paris, 1989;
ALEPH 1 – on the 5 Biennale of Architecture, Sofia, 1989;
ALEPH 2 – L'Europe des Creatures, in the Grand Palais, Paris, 1989;
THE BRIDGE – in the International Center for Contemporary Art, Catania, 1989.



17 Triennale di Milano, 1988. World Cities and the Future of Metropolis PHOTOGRAPHYS: Didier Boy de la Tour, Serge Salat, Studio AZZURRO



The Mirror of Metamorphosis

Six Works of Serge Salat and Francoise Labbe – Instead of Manifesto.

In 1988, when we started designing architectural spaces for the XVIIth Triennale di Milano, we wanted to create a disconnected and fragmented space, to draw the audience into a magic mirror, to create an indefinite time where future, present and past could evolve simultaneously.

In the space we created, each object was caught at the very moment in which the transformation occurs from past to future, from materiality to image, from nature to artificiality.
We designed the space as a theatrical stage, surrounded by a huge circular and panoramic screen. The screen was big enough (3 m high) to delude the spectators into the belief that it was in fact representing the real horizon. All the while the stage was kept intentionally in darkness except from the floor and a few models which were slightly lighted. It was also abstract.
The fake reality of the screen quickly overcame the reality of the stage. As a result, the spectator looking at what should have been a fiction (the screen) was in fact locked inside the fictitious world (the stage) and looking at reality (the screen). As in Alice in Wonderland, *the logic we know was totally inverted as if we had gone through the screen in the same way as Alice going through the mirror.*

The clue to the exhibition Architecture of the Virtual *which we designed in 1989 for the French Institute of Architecture was the progressive dislocation of a square grid. The superposed and off-set patterns of architecture were supplanted by the pattern of the video image. Delocalized, floating, indefinitely de-multiplied and telescoped, this latter pattern was setting the stage of a new logic of pattern founded on dissemination and unreality.*

Several spatial strategies were set to work:

- *kinetics*
- *successive blowing-up and spatial explosion*
- *collision between different images and patterns*
- *telescoping*
- *disappearance of the image in the pattern*

The themes of scaling, ambivalence, continuity and the infinite, of reversal between inside and outside, figure and ground, of the sanctuary and the initiatory journey were the starting point of our later scenographies and museum designs. The Argentinian writer J L Borges gave paradoxical spaces the name of "Aleph".

These spaces can be fictitious points of the Universe in which all the other points could be seen as well as infinite libraries like Babel's.

The Aleph space was first created in Sofia for the Vth World Biennale of Architecture. It was then completed and moved to Paris at the entrance of the Grand Palais. For thousands of visitors, moving into this space was like going through a magic mirror and an initiatory maze.

In the Aleph space all directions stretch to the infinite. Each figure is symmetrical in relation to an infinity of parallel planes, as if we were immersed into a four-dimensional space. All the figures are transparent and luminous. Moving images are endlessly demultiplicated. Their ambiguous localization calls forth a moving border between order and chaos.

The spectators, after having crossed a maze of infinite paths opening at each bifurcation into vertical vertiginous wells, reach the centre of a sphere of light multiplied to infinity in all directions. They see innumerable images of themselves locked in an infinity of spheres disappearing into a boundless space. This paradoxical world creates a reversal between reality and fiction similar to the theatrical stage and screen reversal of the Milano Triennale. The spectator loses all sense of his own reality. What is then real, himself or the demultiplied images of himself locked in the infinity of spheres?

The spectator is prisoner in a maze where time endlessly turns off towards innumerable futures. He experiments a blowing up of time, the feeling to be lost in the obscure forest described by Dante in the Divine Comedy. To infinity the spheres dissolve into chaos. Matter becomes vortical and swirling. As in the mathematical theory of fractals, each part taken separately is as complex as the whole.

The Aleph project was developed on a large scale for the International Exhibition of Sevilla, 1992. Our built project for the International Centre for Contemporary Art in Catania places side by side a large exhibition space and an Aleph space. An infinity of vertical luminescent blades disappears in an endless depth crossed diagonally by innumerable luminous bridges.

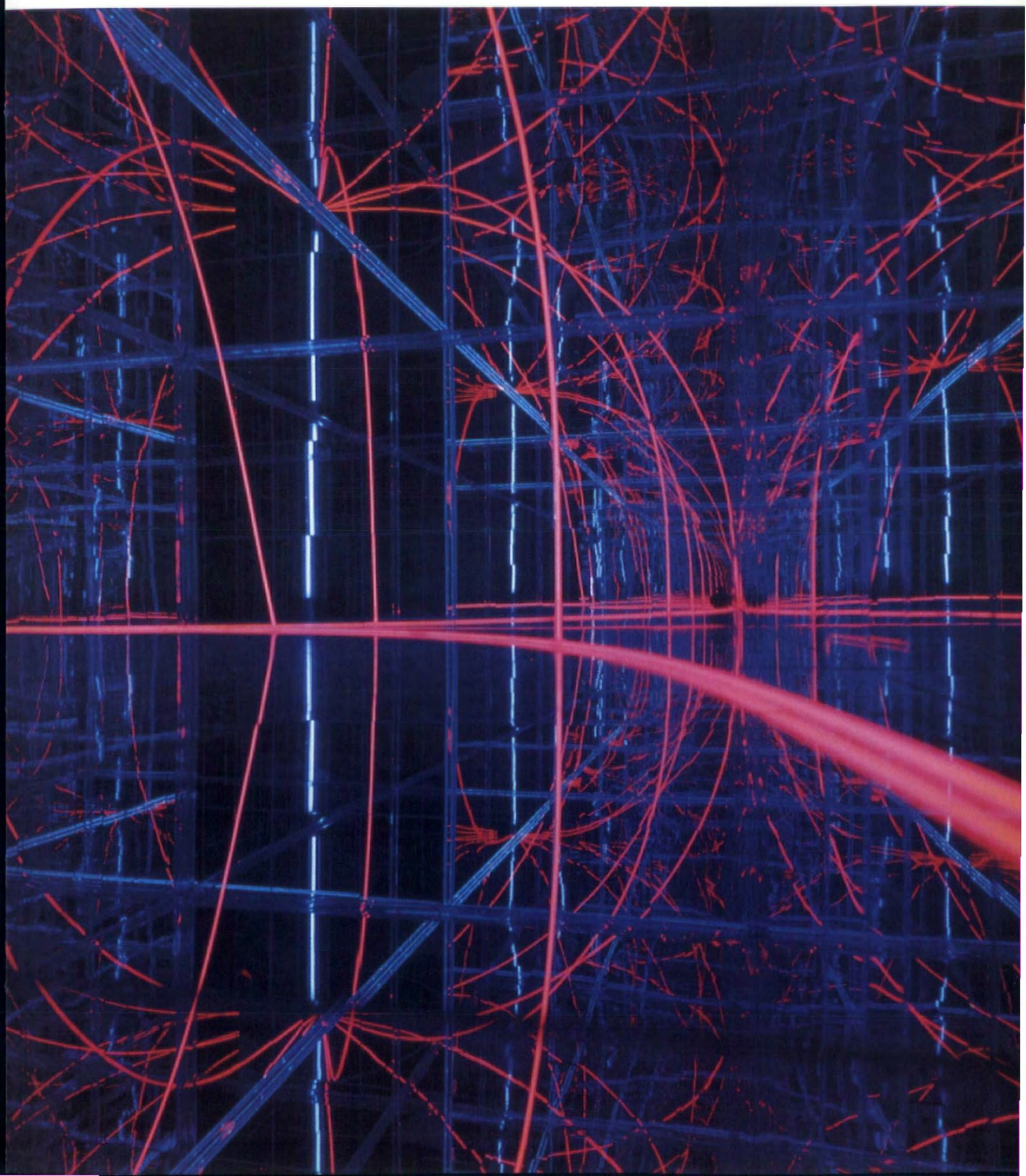
The Aleph space results from the meeting of:

Architecture: *nine square grid, figure-ground ambivalence, metamorphosis of space*
technology: *transparency, virtuality, simulation*
mathematics: *fractals theory*
literati and philosophical fictions: *Dante, Leibnitz.*

Experiencing the reversal between reality and fiction and with the Aleph space, we tried to go further than present-day deconstruction in architecture by challenging the concept of space-time as it has been inherited from the Renaissance. These six projects are not only textual manipulations. They deconstruct both time and space. The dislocation and disjunction processes, the displacements of meaning introduced in architecture by Bernard Tschumi and Peter Eisenman go on to a new space for architecture. This space is layered, folded, chaotic and vortical as the space described by contemporary mathematics.

SERGE SALAT

Aleph 2 Space Europes des Creatures, Grand Palais, Paris, 1989. Fragment of the performance.



Transforming the Reality into an Architecture Image

Serge Salat and Francoise Labbe interviewed by Radian Gyurov

RG: Exhibitions generally aim to impress their visitors with something new: concepts, information, and even some kind of new ideology. What was your idea behind this exposition? What was your intended message to the people, both experts and non-professionals?

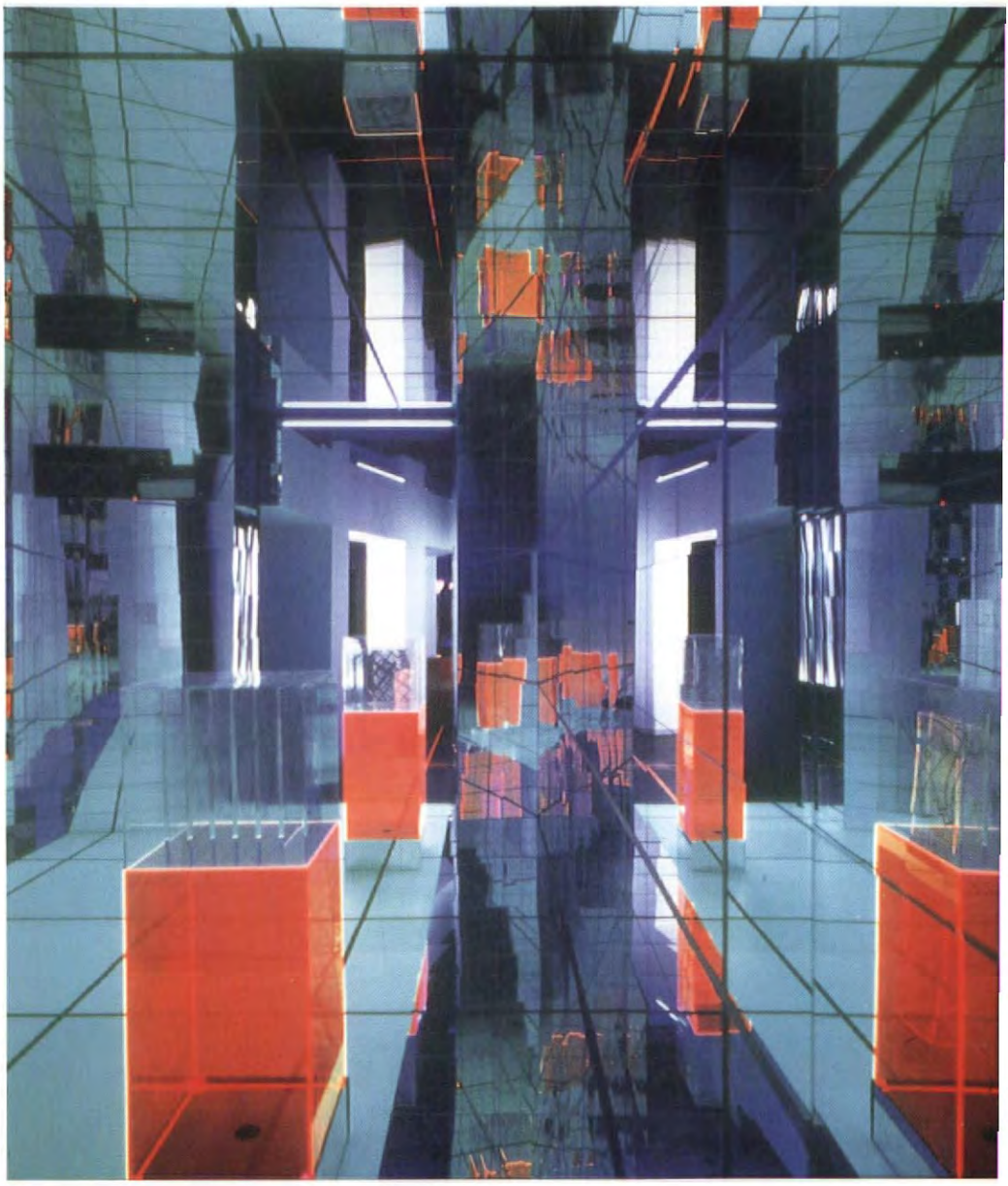
FL: It was our great wish to try to make the visitors to our exhibition become participants and not merely be witnesses of an actual event, of a specific performance. Architectural exhibitions usually present their subject as something two-dimensional, as external forms only. Standing before two-dimensional pictures, we are looking at reproductions that are much smaller than the original. It was our intention to attain quite the opposite effect, a reversed impression, and thus to show architectural objects in a more sensitive manner. As a matter of fact, architecture is not a two-dimensional art but a three dimensional one. Moreover, architecture as a whole is something one can penetrate into: it consists of spaces surrounding you, where you move, live and work. In contrast to traditional architectural expositions, rather static and presenting only a glimpse caught by the photographer, architecture in reality is full of life and dipped in the stream of time. It is an art dealing not only with space but also with time; it involves motion and change. And the more we penetrate into a particular type of architecture, the better we can see

that all perspectives are changing and telescoping, and light is changing too. In fact, with our exposition we have tried to illustrate this effect, to reproduce reality in a kind of miniature imagery. This approach is still often used in Japan, in the traditional tea-rooms, where visitors become participants in the typical atmosphere with their bodies, emotions and senses; at any moment they are aware of their actual position in a concrete space.

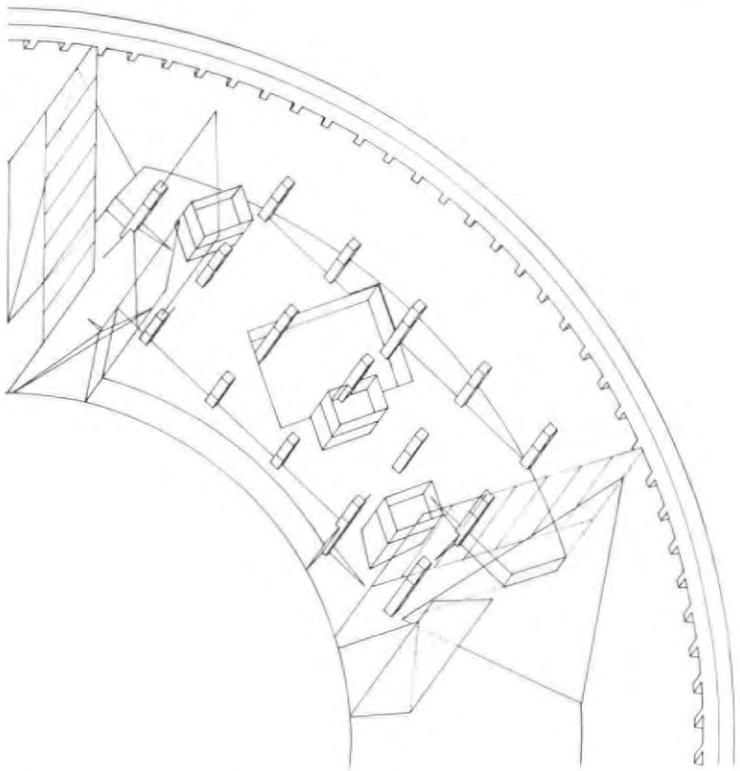
RG: Your exhibition has already been presented in Milan and Paris. Have you changed something afterwards? Have you inserted any new ideas in the exposition presented at the INTERACH '89 Biennale in Sofia?

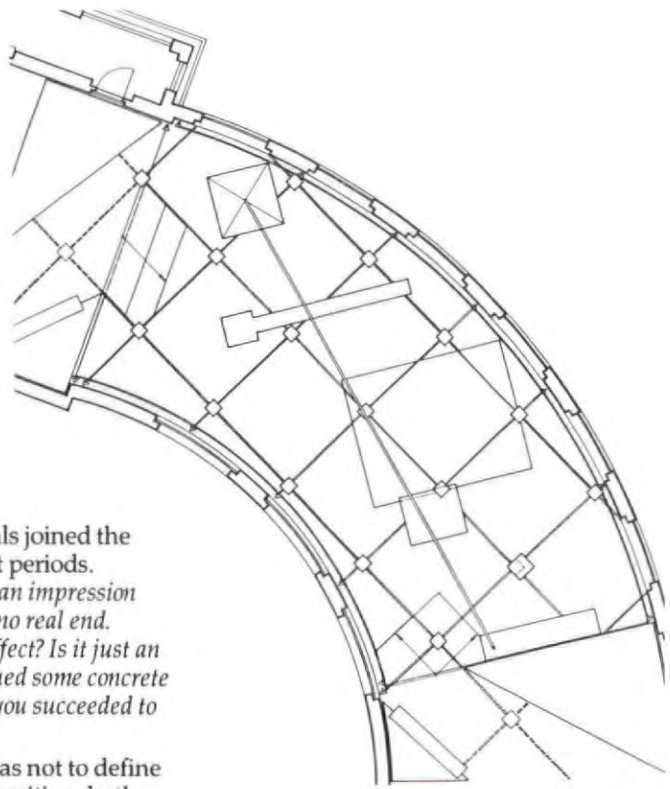
SS: The exposure actually consists of two sections mutually complementing each other. The first one is a large multi-plane series of photo-views. Unlike similar expositions, this section was from the very beginning thought of as an audio-video performance. As a matter of fact, we had a lot of problems in the process of realization of our idea. We had to use and combine the skills of a great number of different professionals: photographers, musicians, engineers, etc. In the first version of the exposition, which was presented in Milan, there were a lot of three-dimensional models along which the visitors had to walk. It was our intention not to let them stay for a long time in front of a particular model but to keep them moving. Unfortunately, this idea was not successful. The impressions were much too strong and the images on the screen were too attractive to let people simply pass by.

In Sofia we exploited another idea. There are two screens – a vertical and a horizontal one. For me the second one is more important because the visitors step on the images projected on the floor and walk among them. The visitors are actually absorbed in that atmosphere of changing pictures; they feel the motion through space and time: a time changing, transforming or preserving itself. They are involved in a fictitious space that replaces real space. The images are real and at the same time elusive, fluent and ephemeral. The diverse frames, the constant movement of images on the vertical and horizontal screens materialize the exploding of different scales of perception and the experience of spatio-temporal dimensions. The Milan exhibition was an open structure organized in a series of transformations, of endless passages. The



Left and right: Architecture du Virtuelle, Institute Francaise d'Architecture 1989. Fragments of the show; Axonometry of the performance space.





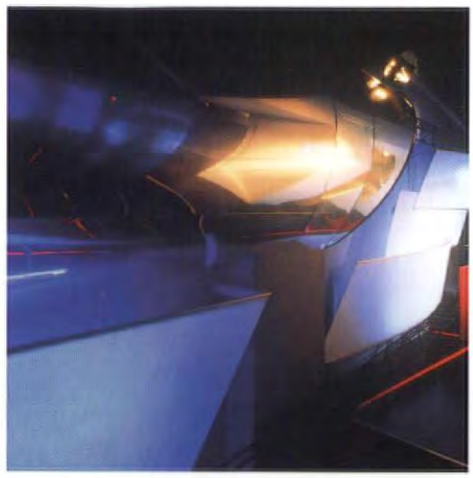
new exhibition suggests a series of reversible inversions; real and imaginary, actual and virtual, object and simulation.

RG: As you mentioned before, the exhibition was realized by the coordinated efforts of many different specialists. How did you come to the idea to use such a multi-professional team? Did it have to do with technical problems only or with some concrete conceptions?

SS: If we perceive an exhibition as a medium, then one might say that most of the traditional expositions have till now not made use of the abundance of means for exerting direct influence and impression. An exposition can in fact present an integrity of music, photos, scenography and other arts. This is a turning point, a possibility to create something new and of a much higher quality than before. Technical advance provides the opportunity to experiment, to look for new prospects and alternatives. I believe that a modern exposition should be the result of combined and coordinated efforts of architects, artists, designers, photographers, musicians, etc. One of the earlier versions of our exhibition had pictures painted especially for it. The architect Bernard Tschumi designed the so-called 'socles folie' of the La Vilette park in Paris. We developed the specific network and united it with the socles. One of the main principles employed was the decomposition of the socle itself. From it was derived the idea to make five new sculptures (not reproductions). So far we can estimate that the exhibition was a result of collective creative work. My personal involvement as organizer of the whole process was particularly interesting and exciting. I am happy to tell you that the final result was much more successful than was expected. But at the same time I would like to state that this was no monolithic work: different professionals joined the creative process at different periods.

RG: The exhibition provokes an impression that it has no beginning and no real end. How could you explain this effect? Is it just an experiment or have you pursued some concrete idea, and if so, how far have you succeeded to implement this idea?

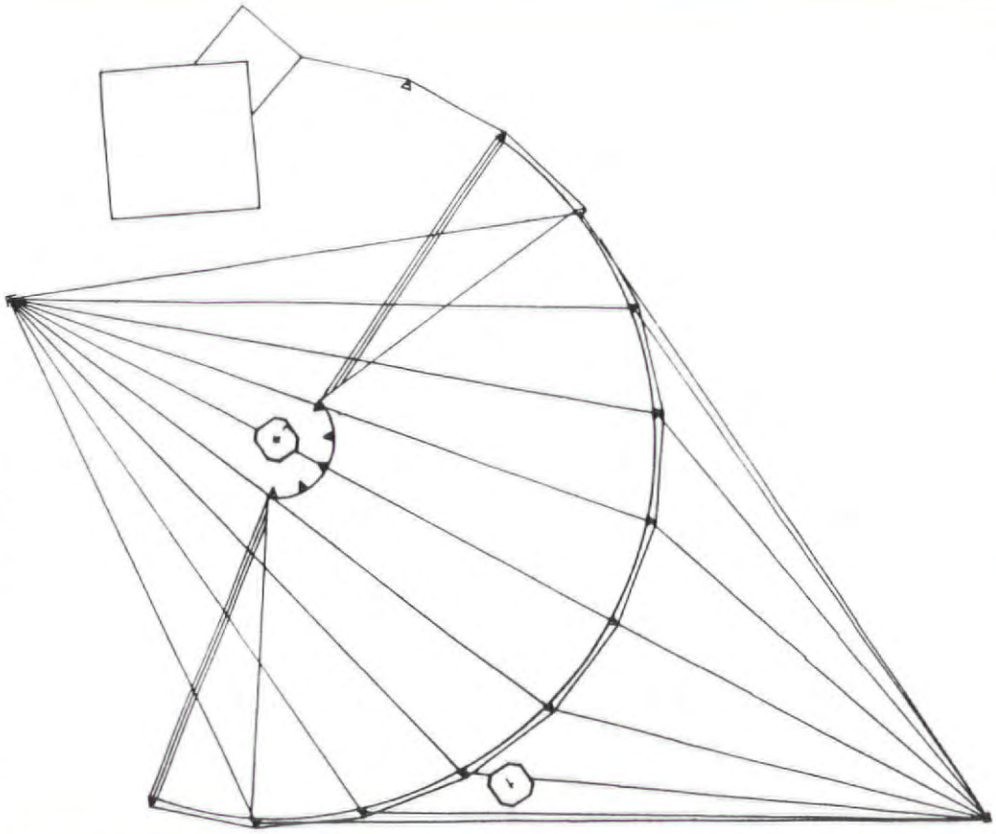
FL: One of our first ideas was not to define any strict borders to the exposition, both concerning its physical aspects and philosophical interpretations. It should have no limits, because it was founded on a paradoxical logic – that of simulation, of a transfer of appearances, of a limitless patterning of the virtual. The exhibition has in mind the new social and historical circumstances characterized by a dispersed and differentiated reality. In the 'black box' one can find also the contrast between the new and the old, between the actual and the virtual, between reality and fiction. In the classical world, the rules of composition keep the forms away from coming into conflict with each other. They are harmoniously coexisting in an integral whole, thus forming a geometrically stable structure. Contrary to this harmony, our exhibition was designed to provide space for freedom of development and was aimed to show the new paths of the virtual in a form which was more interrogative than definitive. The scenography elucidates several types of transformations: from the natural to the artificial; from the past to the future; from space to time; from stability to speed; from the monumental to the immaterial. The structure of the exposition is much more complex than a simple matrix. Each of the transformational sequences is a subject to its own logic. Each object is in a state of instability. There is a process of disappearance of the image in the pattern. The intense fragmentation, the collisions between the individual patterns, the unfixed objects suggest the dissolution of the borders of the modern metropolis.



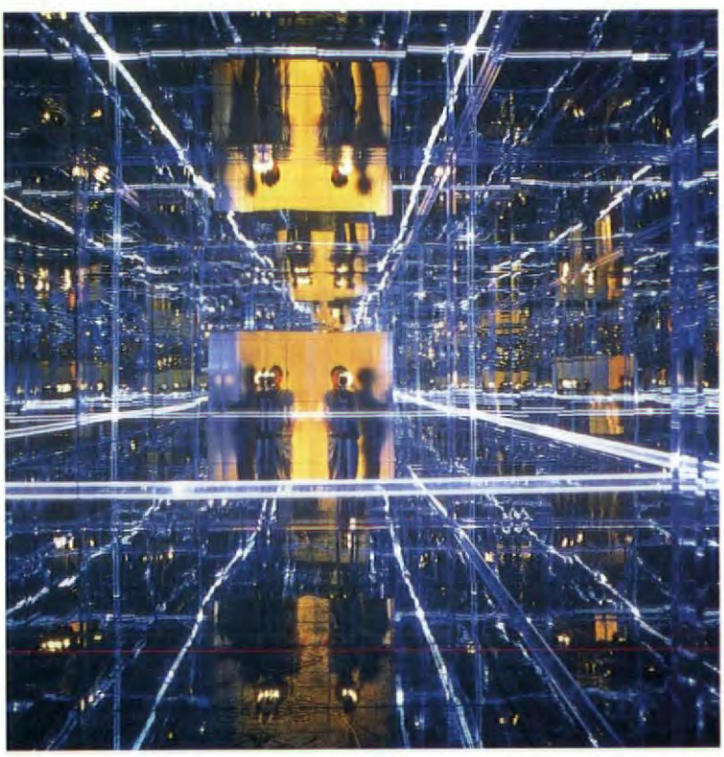
Left and right:
17 Triennale di Milano, 1988.
World Cities and the Future of Metropolis. Axonometry, plan, fragments.
View of the stage.

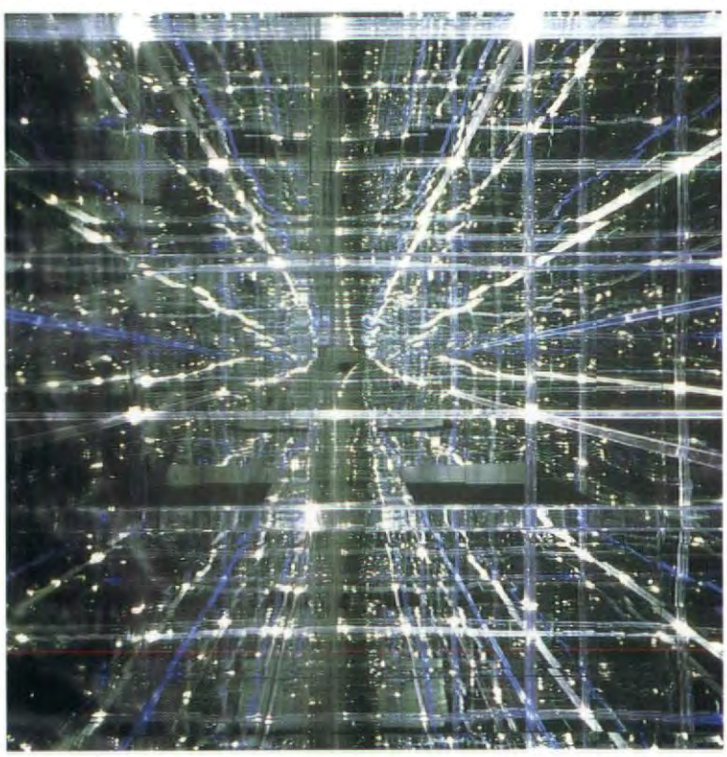
The problem is to define the actual borders of a metropolis. Do they really exist and where can one detect them: at the 'town walls' or somewhere in the periphery? When we speak of airports, the real borders of a metropolis are to be found in the main international big cities. In our exposition, the metropolis was perceived as an infinite network of 'black boxes'.
SS: I would like to say, as well, that the entire exhibition is a negation of the traditional principles about beginning and end. Thus, our film does not show any strong continuity between the individual pictures. It rotates in a circle and includes 13 parts. Each part is fully independent and can be shown apart from the others. It tells a story without beginning or end. One story begins, then it is gradually replaced by another one, and so on and so forth. There is only a vague feeling of integrity and everything is in permanent motion.
RG: Has music any specific role in this case? Do you use it just as a background or as a tool to increase the impact of the pictures and of your ideas?
SS: The music is original, composed especially for the exhibition, and it follows the same ideas and scenographic principles. The music, like the exposition itself, can be deconstructed too.
RG: Would you tell us something more about the idea behind the 'black box' or 'black cube', as you call it, and its particular role in the exposition?
SS: In the Milan version, the 'black box' did not exist. The idea about it appeared later in Paris. It was inspired by the linear structure of the building in which the exposition was presented. It had a long passage with a lot of rooms on both sides. We had many problems to situate our exposition in this long corridor with one entrance and one exit only. So we came to the idea of creating an endless room as a contrast. Initially it was planned to be a grid leading to the endless. Inside, fractal pictures and videofilms were moving. This grid exploited the non-coincidence between being and sense, between man

Left page:
Aleph 1 Space,
World Biennale of
Architecture, Sofia, 1989.
Plan, fragments.

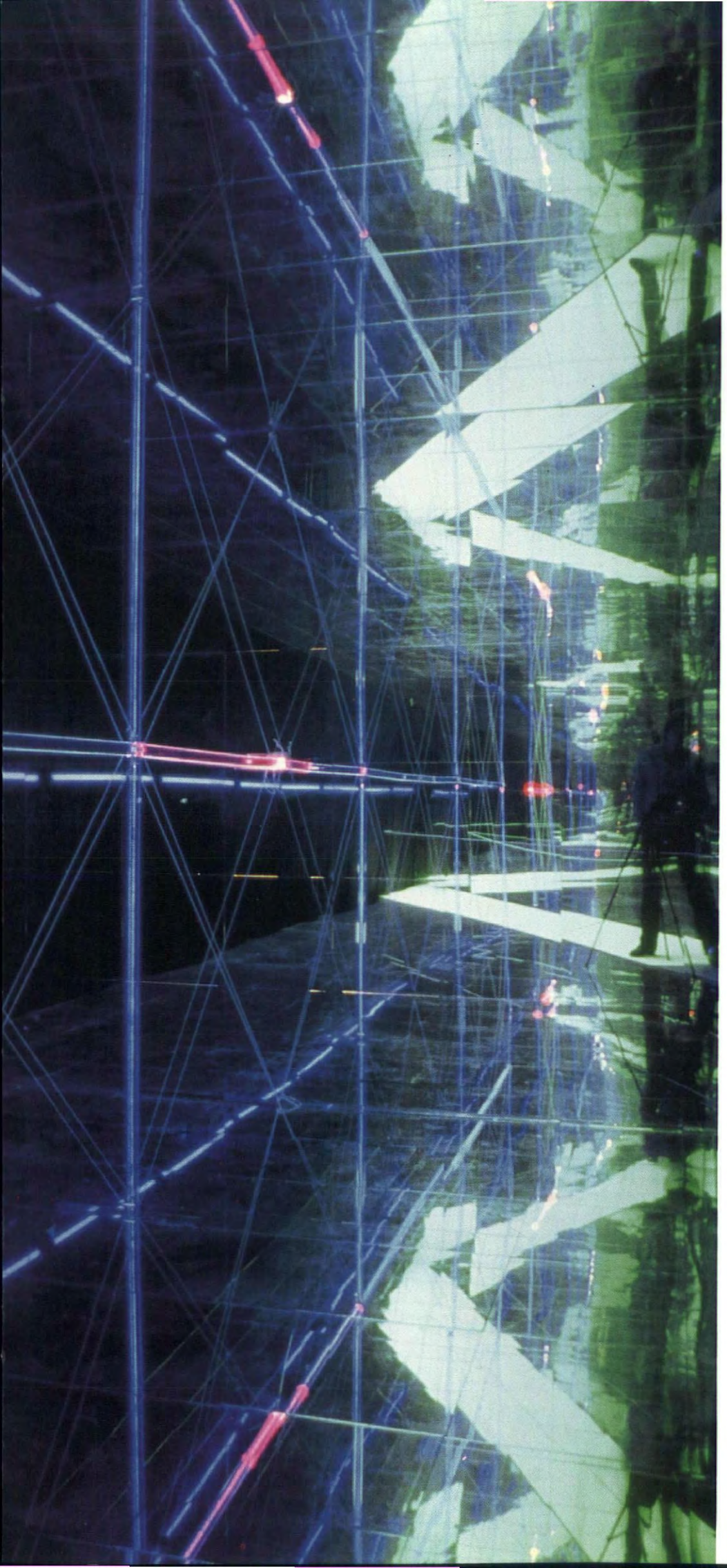


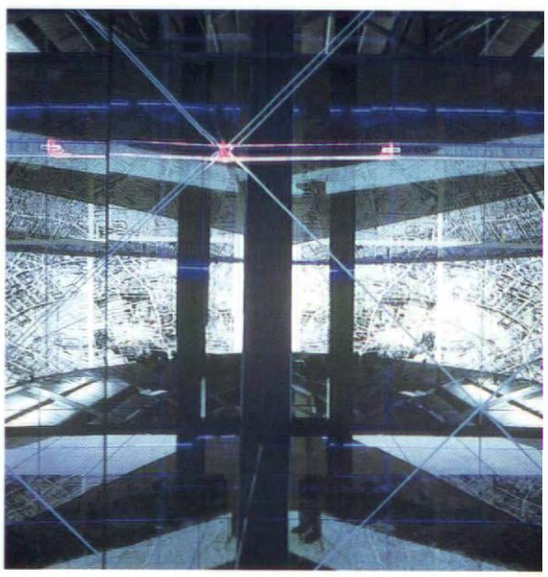
and object. The 'black box' or 'black cube' was another version to the 'mirror room', without films or fractals. The main idea lies in the contrast between two city maps of Paris – one from 1739 and a contemporary one. The latter is a typology of an endless four-dimensional hyper-cube. The fourth dimension is not that of time. It is well known that in some mathematical models space has seven dimensions, one of which is always privileged. In the 'black cube' we have implemented another strong idea – that of the virtual, of the invisible, of the potential, the idea of the unsteadiness of





the subjects in the universe. The cube created by us is only 1/8 of another one which was deconstructed. When we enter the small cube, the mirrors create the impression that we are in the bigger cube.
RG: Does this mean that you have invested a great number of ideas in your work, and that the visitor can perceive them through his own imagination and individual experience?
SS: The exposition created by us is extremely rich in ideas. There is no single interpretation for a given event. Many explanations can be given and they depend on the individual's professional and intellectual experience. I have already mentioned some of the ideas but I can add some more: eg the idea of the contradiction between the geometrical and natural development of a metropolis. This idea was also included in the 'black cube'. Within the cube, reality is transformed into a transparent film. One gets the feeling that this is an universe in which the material disappears. From the outside, the cube looks like being material and solid but inside it this solidity vanishes. Light takes the place of matter and density. It divides the inner space by means of lighting points.
RG: Besides being an architect, you've also got mathematical education. How far has your mathematical experience influenced your exhibition?
SS: It helps me to get deeper into the philosophy of life and to gain some wider explanation of specific events of the universe. I have tried to develop and implement in this exhibition some notions about the 'fractals'. The fractals lead to a new understanding of the universe.
15 years ago scientists found that matter does not always follow the laws of classical physics: these laws are valid only for definite objects. In architecture, such are all geometrical bodies that can be clearly defined. But in space there are shifts and movements due to specific casual connections. In fact, all objects have their external and internal borders: these are nothing more than lines. On the other hand, the point, the line and the plane are terms belonging to the vocabulary of modern architecture. Fractals are specific mathematical figures, two-dimensional (like a line) or three-dimensional (like a plane). When we enlarge a given figure from the inside to the outside, its external borders remain the same, but they increase

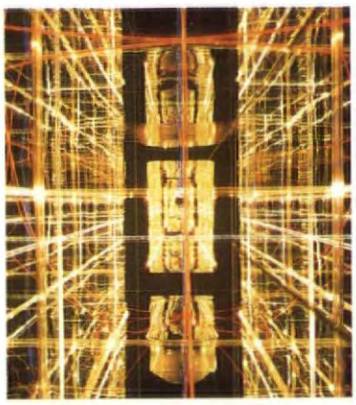


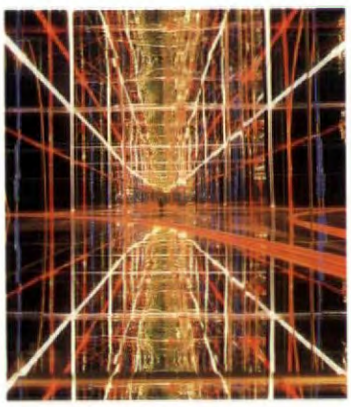


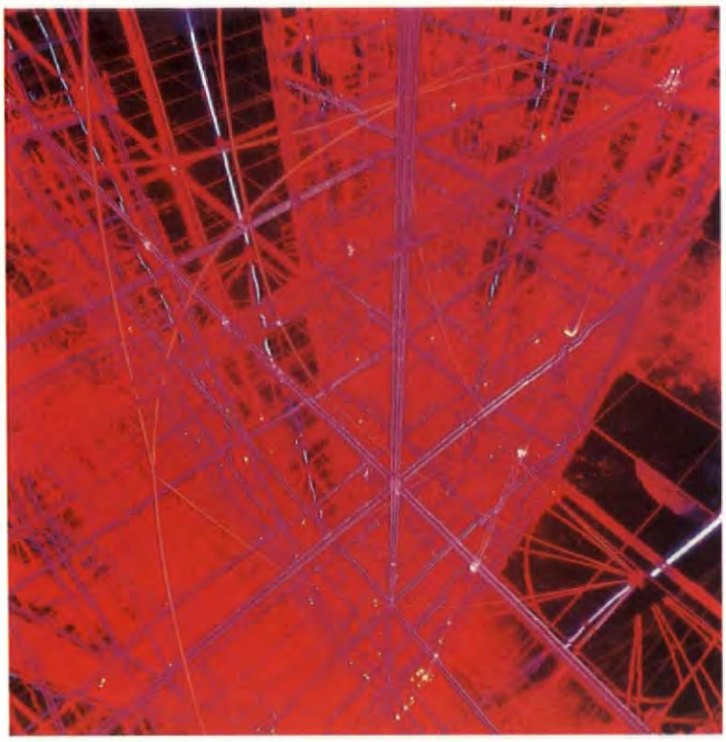
Right page:
Transitional Space,
International Center for
Contemporary Art,
Catania, 1989 – 90.
Fragments, axonometry.

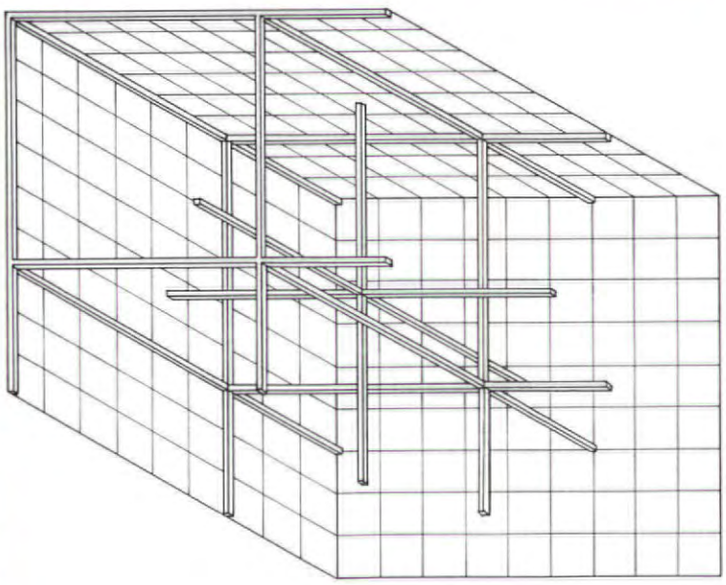
Left and right:
Aleph 2 Space – L'Europe des Creatures, Grand Palais, Paris, 1989. Fragments, axonometry.

Right below:
Aleph Project for Sevilla World Expo' 1992 (with P Andrew). Perspective image of the space.









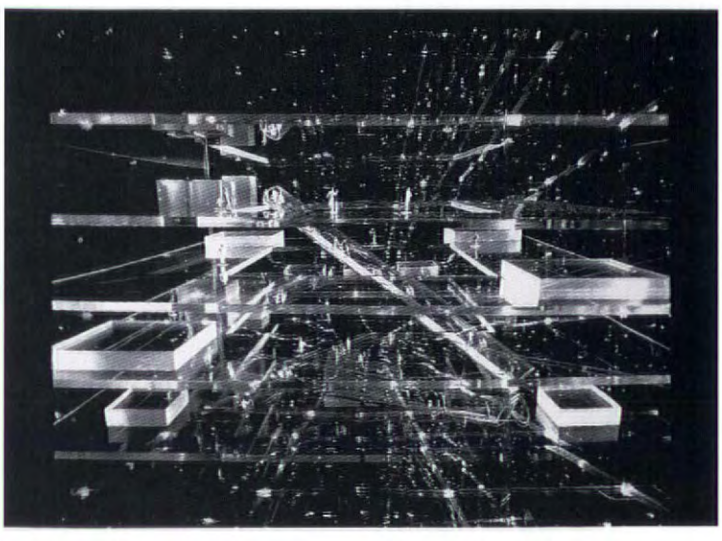
their grade of complication and fragmentation. This is an endless process, typical for the whole universe.

RG: Which are the sources of your architecture? To what extent do you consider work to be linked with modern art and modern art ideology? Which styles of modern architecture have exerted the greatest influence on your projects?

SS: It might sound a little utopian, but the first modern style of European architecture, the style of the thirties, was related to the economic and technological advance, to the machines. Melnikhov and Chernikov were among the representatives of this style. Modern architecture was further developed by Le Corbusier and his 'living machine', and by the Constructivists. Some 20 years ago, there was a crisis in architecture: this was the so-called period of historicism and post-modernism. It gave birth to another trend – deconstructivism, which is more interesting to me than the preceding ones. It was based on modality and internal spaces. De-construction does not destroy the structure. The latter undergoes a change, a de-centring which creates new opportunities. De-construction is not a transgression of the norm. In the architecture of Bernard Tschumi, the norm is reinscribed, reaffirmed, it becomes a fiction. This is an architecture of contamination, of deviation, of dissemination, and not of decline or disintegration. De-constructivism is much nearer to the changes that will take place in life during the next century. The dominant technology of the 21st century will be that of image transmission in 'real time'. The new metropolis will be a mosaic of fragments of spaces, a theatre without memory, floating, devoid of existential density. Between reality and fiction, the architecture of de-constructivists is a source of limitless virtual combinations.

RG: Do you think that there will be soon a general change in architectural exposures? What would you change in the first place?

SS: In Japan, there was a fantastic exposition called 'Tokyo in Tokyo'. The sponsors asked seven architects and designers to create a special environment. Actually, there was no physical image of Tokyo. There were only conceptional models with which visitors came into contact. I cannot really say something more concrete about the future of architectural



exhibitions, but I think there would be only two alternatives: to keep them conservative and intended only for a narrow circle of professionals, or to transform them into a kind of total art. In the latter case visitors would be attracted in the same way as by a concert, a theatre performance. But this would not be a common rule, as it requires a lot of effort and professional devotion. I hope that architectural expositions will soon become attractive for a wider scale of public: not only for experts and professionals because architecture is undoubtedly a social art and concerns all people. We have the chance to try to bring architecture in contact with new information technology. This will open new horizons for experimentation and inventions in this sphere. □

POST-FRANCO FERVOUR

The product designs of Spain's Josep Lluscá reflect the country's new-found creative assurance.

BARCELONA: Josep Lluscá is the kind of contemporary designer who makes it difficult to believe that Spain was ever culturally isolated from the rest of Europe. The innovative elegance of his product designs – notably lighting and furniture – reflects an underlying assurance that could easily be Italian. Meanwhile his client list today contains many Spanish companies who appear only too willing to embrace radical design solutions.

Lluscá was born in 1948 and studied industrial design at Barcelona's Eina School. In 1969 he went to Montreal to further his education at L'Ecole des Arts et Métiers, afterwards studying packaging design in Bordeaux.

By the late 1970s he was back in his native Barcelona where he has remained. The stranglehold of Franco severely limited the Spanish design profession, but when Spain finally entered the EEC there was a sudden need for Spanish manufacturers to respond to competitive markets; rather against the odds, they found designers like Lluscá were both ready and able to help them.

"In 1956 an association of industrial designers was formed here," Lluscá says. "In 1961 we got our first school of design. Industrial designers were trained, and there was a great deal of discussion about contemporary design – but no one was ever employed to do it! So when the manufacturers finally needed us, we were there."

Lluscá's recent products include numerous office tables and chairs, an elegant reworking of the pressure cooker (still a much-used piece of kitchen equipment in the Mediterranean) and an elegant bottle-lamp capable of focussing its beam externally, or projecting it into the translucent bottle for a softer, diffused light.

Innovation of form is occasionally matched by unexpected use of materials. A table with a high-tech synthetic finish turns out, on closer inspection, to be made of wood. Lluscá uses a lot of wood, occasionally treating it in a surprisingly plastic way. "I found a manufacturer who makes tourist souvenirs out of wood," he explains. "Using computer-controlled machines he can make quite complicated shapes."

Aluminium is very cheap in Spain – Italy goes there for its supplies – and Lluscá uses it frequently. "It's inexpensive and flexible, so I use it whenever I can," he says.

This year Lluscá won first prize in a local competition to create a monument to celebrate IBM's financial contribution to the Olympic Games.

Initially inspired by North America, aided by Catalonia's intrinsically generous cultural atmosphere, Lluscá has played a significant part in accelerating Barcelona's advance to the forefront of international design.

"There are only two kinds of studio," he explains. "Very large or very small." He has opted for small so that he can personally control every project." Today we are five in number," he says. "We're currently working on 15 to 20 projects and that is the maximum we can do."

Josep Lluscá, Marmellá 4-6, 08023 Barcelona, Spain. Tel: + 93 212 02 18. □

Left: Andreu chair range designed by Josep Lluscá (below) for manufacturer Andreu World. Inspiration, he says, came from chairs by Gaudi and Charles Eames, the human body, the fencing foil and nationalist theory.

Below: Lluscá's Bolonia table lamp, made by Metalarte. The halogen light has a focussed beam and an ability to fill the base with diffused light.

Stained glass made by Goddard & Gibbs Studios in Shoreditch, London: utilised in multi-media Malcolm Poynter's designs for a Tokyo restaurant.

JAPAN'S CLASS ACT

Stained glass with ecclesiastical roots goes east in an unusual restaurant project with Dali-esque themes.

TOKYO: The Japanese may distil ersatz Scotch and grapple with the mysteries of golf, but high technology is no substitute for the peculiarly Western craft of stained glass decoration. The masters of the micro chip have taken to heart the work of leading British practitioners, Goddard & Gibbs Studios, in an unusual design project for a Tokyo restaurant.

The interior of the eaterie, Toshio, designed by multi-media artist Malcolm Poynter, and featuring recurrent Dali-esque themes of eggs and scrolls, exhibits no Oriental influences at all: even the food is Italian. The building was adapted to take the 12 windows – a total of 226 sq ft of intricate stained glass work – which are its dominant feature.

Poynter's sketches of creatures and symbols culled from the study of astrology and alchemy were freely adapted by Goddard & Gibbs designer Harry Cardross. While the finished work is untraditional, both in its theme and in the use of powerful colours like bright golden pinks and dark turquoises, Cardross used a combination of the time-honoured techniques practised at the Shoreditch, east London studios since the company was founded in 1868.

Portions of the glass were variously painted, treated with acid, or stained. During staining – the original process from which stained glass took its name – a mixture of sulphide of silver is applied to the glass, turning the white areas any shade of yellow from pale lemon to deep orange.

Aciding is used on "flashed" glass – white glass to which a fine topping of coloured glass has been added during manufacture. The surface is then treated with hydrochloric acid and those parts of the glass which have not been coated with a protective layer of Brunswick Black will be eaten away to expose the white glass beneath the colour. The result is a coloured pattern on a white background.

Part of the art of stained glass production is in the choice of different types of glass. Cardross and Poynter spent much time examining Goddard & Gibbs' stocks, selecting streaky opalescent glass to convey the eggs, while streaky glass gave the figures the requisite moulded effect. The eyes of the face in the largest window are made of mirrored, reflecting antique glass in shades of grey and green.

"I wanted to do something different," Cardross explains. "I worked from fairly rough designs. Unusually, there were no finished sketches at all. The figures were based on old woodcuts of anatomical drawings from the seventeenth century. Poynter ripped the pages out of old books and brought them in to me. Many of them are reminiscent of mediaeval myths, especially the mandrakes which are meant to shriek when pulled up out of the ground."

The Studios' staff are happy to pay court to the fantasies of commissioning clients. A retired headmistress ordered six square feet of window depicting scenes from Lewis Carroll's *Alice In Wonderland;* an ex-patriate colonel wanted his Bahrain villa decorated with views of St George fighting the dragon; and an ex-Beatle not only reglazed his mansion with intricate ornamental glass but asked for a cheeky bathroom window bearing the slogan "George Harrison's Wash Room".

But the roots of the Studios' work – and of the stained glass industry itself – lie in ecclesiastical stained glass. It is thought that the craft was the result of a tenth century merger of the glaziers' art with that of the enamellers. Some of the oldest extant stained glass is in Augsburg Cathedral and dates from the mid-eleventh century.

"Techniques haven't changed for 600 years, except in some refinement of tools and materials, and the fact that kilns are gas rather than timber-fired," explains the Studios' Haig Walsh.

Goddard & Gibbs Studios, 41-49 Kingsland Road, London E2 8AD, UK. Tel: + 071 739 6563. □

Pieces of eight: Supervisions from ATS of Singapore onscreen.

SUPERVISION ON COMPUTER

Eight views of design on screen single out new CAD software from the ATS ComputerCentre for attention.

SINGAPORE: The reason why ATS ComputerCentre has established an international reputation in developing computer-aided design (CAD) packages for architects can be traced to the company's antecedents. ATS grew out of architectural and engineering firm, Ang Thian Soo & Partners, diversifying into software development in the late 1960s and software distribution in the early 1980s.

Its ground-level experience of building and interiors projects has given it an insight into developing CAD software which meets professional needs. It launched Supervisions this summer, which combines drafting, design, modelling, shading and true 3D capabilities in a single package. One important aspect for designers is that it offers eight interactive viewports so that the user can see eight different views of a design on one screen.

ATS claims that Supervisions allows architects to perform many of the functions on a microcomputer which were previously only available on minis or mainframes.

ATS ComputerCentre, 10 Anson Road, # 03-05/07 International Plaza, Singapore 0207. Tel: + 65 225 8311. □

LIFTS AIM HIGH-TECH

Personal computers have brought a new meaning to elevator planning – as the work of KONE in Finland demonstrates.

HELSINKI: The steady rise to pre-eminence of the Finnish KONE Corporation, one of the world's leading elevator companies, during an 80-year period of acquisition and expansion contrasts with the historical development of the invention on which its success is based.

The unfolding story of the elevator follows a now-familiar technological pattern. Once the seductive principle of being able to hoist loads was established (crude man-powered lifts were already in use by the time Cheops' pyramid was being constructed), progress was glacially slow until the invention of the steam engine in the nineteenth century.

This, and the refinement of pulley wheels, unleashed rapid improvements in an invention whose most momentous achievement was to make possible the skyscraper, with its far-reaching implications for the future development of cities.

Even the interior disposition of more modest buildings, such as hotels, was radically altered by the advent of the elevator: accommodation, once necessarily limited to lower floors, could now be extended upwards.

In 1853, Elisha Graves Otis addressed the elevator user's most fundamental fear by cutting the rope of the car in which he was travelling in order to demonstrate the safety mechanism which prevented it – and him – from plummeting to the ground. Ironically, it was the opposite danger (that of being catapulted through the roof) which for many years posed the more likely mishap statistically.

A variation on the traditional counterbalanced elevator system was offered by the paternoster – a slow-moving, vertical endless loop of open cars into which the passenger would step whilst the system was in continuous motion. However the escalator – introduced in 1901 – was eventually to offer the same sort of function with rather less chance of misadventure.

Meanwhile the traditional elevator moved rapidly through a series of refinements destined to lead to today's advanced elevator planning systems. KONE today is devising four-part elevator planning systems software for personal computers.

KONE's TRAFCAL aids interval and handling capacity calculations; ALTS simulates elevator traffic and LTA (Lift Traffic Analyzer) is for use on site surveys. The fourth component is a combination of computer program and specialised equipment for measuring door-to-door performance times.

The company believes that the personal computer has enabled the development of elevator planning tools which could not be thought of some 10 to 15 years ago. They make it possible to develop and test new microcomputer group control algorithms much faster and more thoroughly than during earlier product generations.

Elevator technology has progressed from the early days when service was at the mercy of the lift operator to modern computer-controlled elevator planning. Lift manufacturer KONE has equipped two major Paris buildings in La Defense – Tour Fiat and "Le Cube" – with elevator systems to optimise space, performance and cost.

In elevator planning, both for new installations and modernisations, the new tools give well presented, comparative performance data to enable the right elevator choice. When new elevators are completed, call time statistics built into the control system software enable verification of system performance in everyday use.

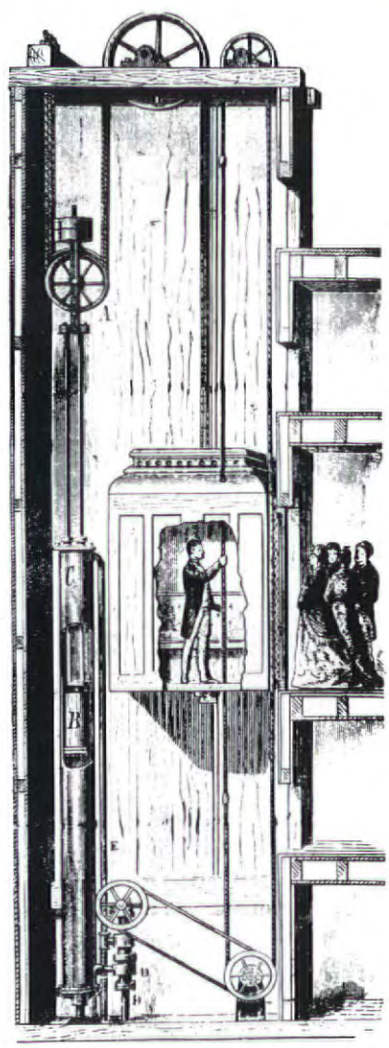
Today KONE, which was established in 1910, has become a major international force in the elevator business. Employing more than 20,000 people, it has its own production facilities in 18 countries and associated factories in ten more.

Such sophisticated planning is just one indication of how a leading elevator manufacturer seeks to refine the efficiency of an invention which has now, to all intents and purposes, been successfully rendered both safe and efficient.

Another is KONE's commitment to the scenic lift – that extrovert expression of elevator technology which is now to be found in innumerable international shopping centres, banks and department stores.

By continually developing drive systems and micro-chip controllers, KONE has managed to integrate more and more pre-engineered components into the scenic lift – which by definition may have to accommodate a number of very specific design features.

KONE Elevators Research Center, PO Box 6, SF-05801, Hyvinkää, Finland. Tel: + 358 14 271. □



THE ROUTE MASTER

There's far more to leading Italian auto stylist Giorgetto Guigiaro than just designing cars.

TURIN: A major exhibition on the work of Giorgetto Guigiaro held this summer in the Museo dell'Automobile in Turin has reminded the international design community that Italy's most famous auto stylist designs far more than just cars.

Guigiaro will forever be known as the creator of the Volkswagen Golf and the Fiat Panda, but the exhibition, which is set to visit Paris and Tokyo after Turin, also showed his versatility in designing products – especially for interiors applications.

Guigiaro, who comes from a family of painters and began work in Fiat's styling centre at the age of 17, is renowned for combining a rich sculptural finesse with a flair for technology. The results were evident in the many interiors products on show which married sensuality to technical detail.

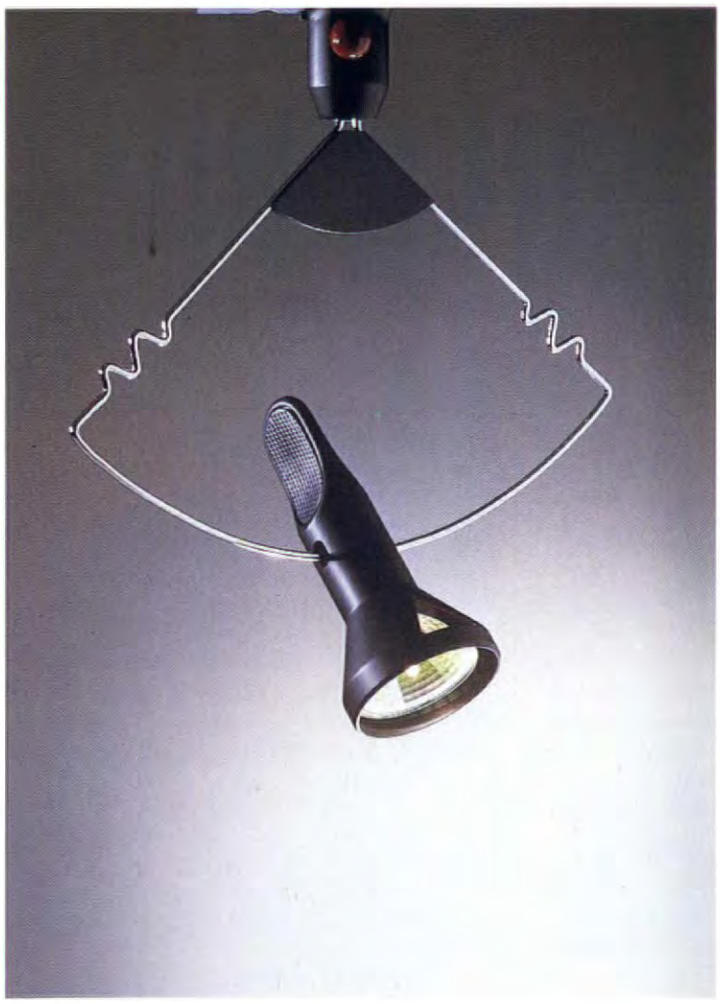
These ranged from a low voltage lighting system for Italian manufacturer Luci to a public seating unit made of folded and perforated aluminium sheet resting on aluminium extrusions with a concrete base. Guigiaro has also been working for Schindler in Austria on a new-style escalator which offers architects more modular possibilities, and with the Turin authorities on a stylish restaurant in a tram – dubbed the Ristotram. This is set to tour the city's tourist attractions with a string quartet on board.

Guigiaro's interiors-related product work is channelled through Guigiaro Design, a consultancy run by his cousin Giulino Molineri. Guigiaro's main business, Ital Design, which he launched in 1968 in partnership with former Fiat engineer Aldo Mantovani to develop new cars, meanwhile powers on with work for leading auto manufacturers over the world.

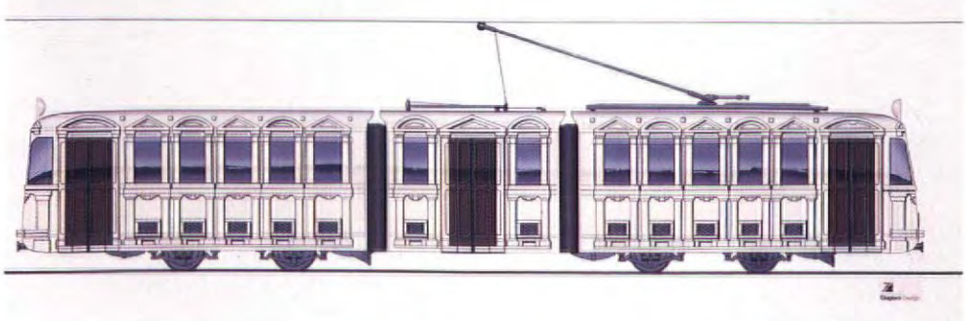
Guigiaro's latest preoccupation is a response to worsening traffic pollution – the urban electric car, which he says can be owned by city councils and used within prescribed city limits. The idea is that you leave your private car outside the city centre and activate the electric car with a credit card. After use, you simply return it to the city boundary collection point.

The private car as public transport is typical of Guigiaro's audacity. He recently launched his own futuristic Jaguar prototype at the Geneva Motor Show without Jaguar's permission, "as a design fantasy". And seven years ago, he created the world's first aerodynamic pasta as a publicity stunt for the newly formed Guigiaro Design. As the Turin retrospective showed, he clearly hasn't lost the taste for success.

Guigiaro Design, Via Duino 128, 10127 Torino, Italy. Tel + 011 619 24 52. □



Turin's famous son: Giorgetto Guigiaro (above) has developed a number of interiors-related projects – including heavy-duty public seating, a low voltage lighting system for Luci, and a restaurant-in-a-tram (below) for the Turin city authorities.



Below: Frank Lloyd Wright. His drawings convey his persistent energy and compulsion to communicate conceptual ideas

THE FRANK LLOYD WRIGHT ARCHIVES

WHOSE ART IS IT, ANYWAY?

The Art of Drawing: Master Drawings from the Frank Lloyd Wright Archives
By Bruce Brook Pfeiffer
London, Thames and Hudson, 1990, £45.
Review by Dennis Sharp

This fine, lavishly illustrated publication is basically the catalogue for the exhibition held at the Phoenix Art Museum, Arizona in 1989. It draws extensively on the great collection of Frank Lloyd Wright's work held at Taliesen West in Arizona. This collection is curated by Bruce Pfeiffer who, amid an avalanche of Wright publications recently, also found time to edit and correlate it.

It is divided into nine major sections and covers Wright's entire working life. It contains some 300 examples of his graphic work and quantity never outstrips quality, either in terms of the production of the book itself or the wide range of examples chosen. It is a magnificent publication marred only by a rather pedestrian text. As the drawings show, Wright throughout his life remained a remarkably consistent high flyer and his drawings convey his persistent energy and compulsion to communicate his conceptual ideas.

Wright's drawings fall into five main categories: conceptual sketches, preliminary studies and presentation, development and working drawings. With the exception of the latter category, examples of all genres are shown. Thus it provides an opportunity to observe Wright's creative process at work through the act of drawing. This inevitably raises the question of who drew what and when? But it does not give much away on that score. Occasionally Wright's assistants and students are dutifully acknowledged but the consistently changing graphic style – which so obviously at times is not Wright's – remains obscure.

Admittedly, it is not always recorded in an office who does what. But I would like to have come away with a feeling that I could recognise drawings by people like Schindler, Neutra, Walter Burley Griffin or the hugely talented Marion Lucy Mahony on whom the text of this book is rather perfunctory. She did after all work with Wright for nearly a decade before eventually marrying his part-time assistant Griffin.

If these drawings are going to be called "Master" works then the question of attribution of course becomes extremely important as there can be no other art in which the artist (rather than, say, the apprentice) can be so completely overshadowed by a professional entrepreneur, particularly one as single minded and powerful as Wright. That apart, the book is to be enjoyed and one can thrill at Wright's continuously fruitful relationships.

Here are to be found examples including the fine line drawing for the Winslow House in River Forest, Illinois, 1893, a clutch of Unity Temple drawings from Oak Park, Illinois from 1904, the impressive coloured drawings for Falling Water the building which Wright himself referred to as "one of the great blessings to be experienced on earth," and the ambitious St Marcos in the Desert, 1928, which was never built.

The book also highlights a number of problematic interpretative issues that occur with architectural projects, including those that remain merely on paper and those that had a long gestation period. The latter could not be more pertinently illustrated than by the drawings for the Guggenheim Museum in New York. This building is always thought of as a late 1950s design. However, the design idea as this book shows was conceived as early as 1943. It went through many modifications and revisions but the salient fact remains that this building dates from the war years. It still remains eternally fresh.

Fortunately the publication does not stick just to the flashier side of Frank Lloyd Wright's work but also includes some really detailed and quite fascinating construction and detail sketches. These all enhance the book's unquestionable value. □

SENSUALITY OF THE SPANISH

Spanish Design and Architecture
By Emma Dent Coad
London, Cassell, 1990, £20
Review by Michael Wolff

This survey of Spanish design and architecture is a firm, square hardback with difficult-to-read type on the cover and an uninviting demeanour. When you flip through it, for a general impression, it seems to have little relationship with the essence of Spanish design. The book talks about the radical, witty and confident quality of Spanish design and contrasts it with its own conventional and restrained style. I found it disappointing and dispiriting.

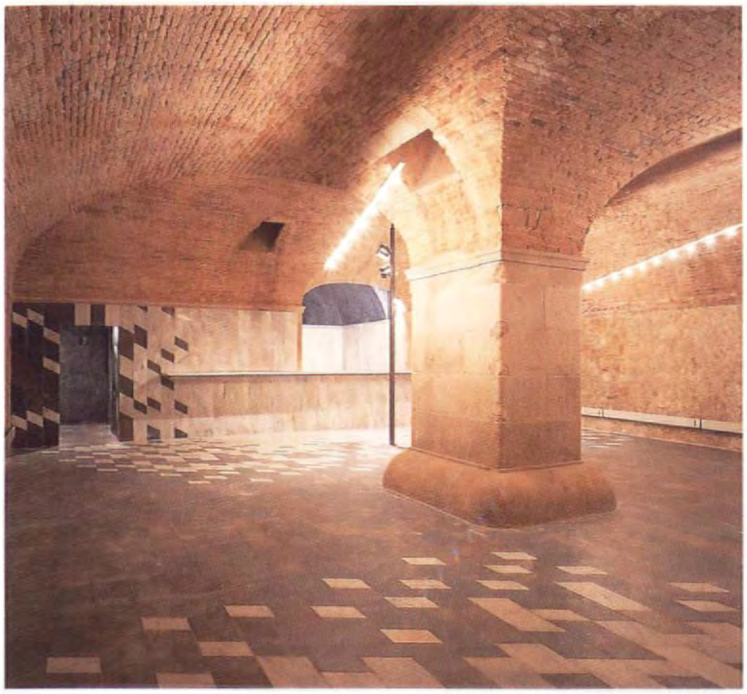
No art director or designer appears to have taken responsibility for the design of the book itself, which is I suspect, why it lacks presence, conviction and finesse. Both typography and photography are dreary and off-putting, and misrepresent the spirit and excitement of its subject. This is a shame because Emma Dent Coad's book is interesting and it is worth pushing through the mediocrity of the presentation to enjoy some of the delight and sensuality of Spanish design and architecture.

Jordi Guesta's and Jesus del Pozo's clothes are wonderful. Port Said, the publishers, have commissioned some magnificent illustrations, and there is a witty design scheme by Mario Eskenazi in the graphics section for Zoptic, as well as other examples of his work.

And anyone who is interested in the particular quality of Spanish architecture will find this book useful, although it is unfortunately no substitute for a week in Barcelona, where the hams, the ice cream cones, the cafés and restaurants, the little old shops, the trees, the door handles, the tiles, the street graphics, the drain covers, the taps, peeking in people's windows, the clothes, the children and ambling around the history of this astounding Spanish city give you a rich, vital and satisfying experience of the essence of Spanish town life and design.

The quintessential book on Spanish design is still to come. □

Opposite page: Spanish architecture worth preserving with Emma Dent Coad's book to discover. (Top left) Museo Picasso extension in Barcelona's Meca palace, refurbished by Jordi Gracres and Enric Soria. (Top right) Barcelona apartment interior designed by Carlos Riart. (Below) Gaudi's Stone Quarry building on the Paseo de la Castellana.



JORDI SARRA

Below: Aldo Van Eyck, beguiling a British audience with an assessment of his own position in modern architecture.

HOLLAND'S BRIGHT STAR

Britain's highest award for architecture, the Royal Gold Medal, was presented to Dutch architect Aldo van Eyck at the RIBA in June. Report by Dennis Sharp.

From the start it was going to be a very special evening; the atmosphere was electric. Aldo Van Eyck knows as much about playing games as anyone. It was no surprise, therefore, to those who have heard him perform previously to see the 71-year-old 1990 Royal Gold Medallist turn up for the presentation in a red suit with red socks and a bright green shirt carefully picked to match the blue of the Gold Medal's ribbon.

With a mischievous smile he sat placidly on the platform looking a bit like old Picasso and utterly bemused by this very British occasion.

Heightened by the recipient's informal appearance was the contrast presented by the formal, despectacled, stiff collared, strident RIBA President Maxwell Hutchinson who soon set just the right tone of adulation in his opening remarks, judging – as ever – the occasion to be one for a generous promotion of Van Eyck's achievements.

"Maestro," Hutchinson declared, "you are one of the brightest stars but you do not travel alone", offering an appropriate reference to the fact that Van Eyck's own presentation had been preceded by a long list of distinguished Modernists, including Stirling, Foster, Rogers, Piano and Meier. Co-sponsor Peter Carolin provided an elegant and accurate assessment of Van Eyck's position within modern architecture.

No sentimental views

Van Eyck was about to take his audience through the challenge of the past, the present and the future – that Joycean *Anna-Livia-Plurabelle* – but with no sentimental Modernist or narrow regionalist views.

It sounded initially like a recall of his thoughtful early writings of the 1960s. In fact it *was* his early writings from the 1960s. His views on the international and contextual avant-garde base appeared not to have changed all that radically. He was keen to point out where its origins lay, and what 'Modern' meant to the great pioneer artists of this century who, he said, were open to international ideas and wide cultural influences.

Architects, he claimed, kept aloof from these expanded horizons and unlike the painters, who were concerned almost entirely with creative invention, they retreated into technicisms. Today, there were even worse things to retreat from including static antiquarianism and a swing from the addiction to change, which had been a notable characteristic of the avant-garde, to the past.

He claimed that the essence of the past is never achieved by looking backward: "History is no longer behind us". It is involved in our present and our future. The past represents a retreat from the present. Classicism and Post-Modernism were enemies of creativity, with – using a useful British analogy – Quinlan T mimicking old music, "but out of tune and in the wrong key", and Robert V with his "Corinthian rash", sending the National Gallery slipping away to the left instead of standing self-contained.

The Humana monster

As far as Michael Graves was concerned, Van Eyck particularly disliked the Humana Building which he described as "a monster". Monsters, also, were those raiders of history: the eclectomaniacs and the typofiles. To fix types is rather like producing recipes: it is monotonous and it usually produced a rotten cocktail mix. Furthermore, it draws the architect away from the real need to treat each case on its own and "to probe real necessities".

We have to stop squinting at Rome, he said, and learn to play our own tune. Reminding his audience of his "Time and Space" theme, he said we can no longer regard time in the old way and that damaging the past means jeopardising the future.

He also expressed concern that the hi-tech tendencies – which he was not prepared to attack with the same enthusiams as chaotic Deconstruction or antiquarianism – should not be today's only alternative. Hi-tech, too, he claims, possesses an eclectic element which often obscures what he calls the "sound technology" that is so clear in simple, charming, true inventions. He advocated "some tech", thus avoiding the pitfalls of over stylization and the expensive kind of hi-tech that appeals only to the rich client.

Buildings, he said, had to be seen to be right in their use and that the "mute" requirements on and around the site would lead to a realistic interior organisation. He advocated the anti-eclectic position in architecture which appreciated the spaces as much as the forms. "We want buildings that breath like we do", and we need to create an image of breathing.

In terms of design he also suggested that "openness" demands the architect's attention. This openness will capture the light and the intrinsic quality of "cheerfulness" but not in any simple sense, and would show through in any good building. There was nothing gratuitous in this analysis. He avoided showing slides of his own work although with a knowledge of his recent buildings it was not difficult to envisage examples of the things he was speaking about.

Representative exhibition?

It was a salutory experience therefore to later visit the well-designed and respresentative exhibition in the RIBA of his work if only to confirm the sheer constancy and the integrity of what he had just mentioned so eloquently on the platform. It is a decisive modesty and confidence that comes through in his work and in his hard-hitting critical invective.

Van Eyck is a wise old owl who, even when he departs from or loses his way in his own richly- worded script, is capable of simply nodding to his audience with a "you know what I mean" and a beguiling smile. They knew. "Architecture is a cause, not just a profession," he declared in his final remarks. "Open up the windows and let the foul air out." □

STALIN'S REVENGE

Pierre Vago argues that the old conflict between the Ancients and the Moderns has now been replaced by a media bunfight in which anything which sells is permissible.

The Pritzker Prize (which brings with it a good number of dollars!) has been awarded this year to the Italian architect Aldo Rossi. Everyone will know his social housing at Gallaratese, a 182 metre long bar, the show-building at the 1980 Venice Biennale, called the Theatre of the World, the building in Berlin (which I myself find rather ridiculous), and his reconstruction of the Theatre at Genoa (which I find hideous).

Nor can I forget his well-proclaimed admiration for the Stalin Allee in Berlin. But his fame preceded his buildings. And so, in this year of grace 1990, an international jury has rendered posthumous homage, via an intermediary architect, to the inspiring genius of "socialist realist" architecture.

This is not an isolated case, an error committed through inadvertence or lack of information. We have not entirely forgotten the violent polemic between Konrad Sage, a past President of the German architects' association BDA, and Leon Krier, on account of the latter's admiration for the architecture of the Third Reich.

This same Krier is offered us as a model by that architectural Beau Brummel, Prince Charles; at Seaside (on the Gulf of Mexico), the "influential theorist" has built his own house, a sort of neo-hellenistic temple in miniature, set upon a mini-Acropolis.

It's piquant to recall what Leon Krier wrote in *L'Architecture d'Aujourd'hui* some years ago: "The individual house is a dream as absurd as it is cruel – social isolation, pollution of the landscape, destroying the countryside as it destroys the town." (We must not here confuse the two brothers, both born in Luxemburg: Robert, born in 1938, who later became Austrian, and Leon, who was born in 1946 and lives mainly in London. The two brothers are often associated and in 1975 jointly received the Architecture Prize of the City of Berlin.)

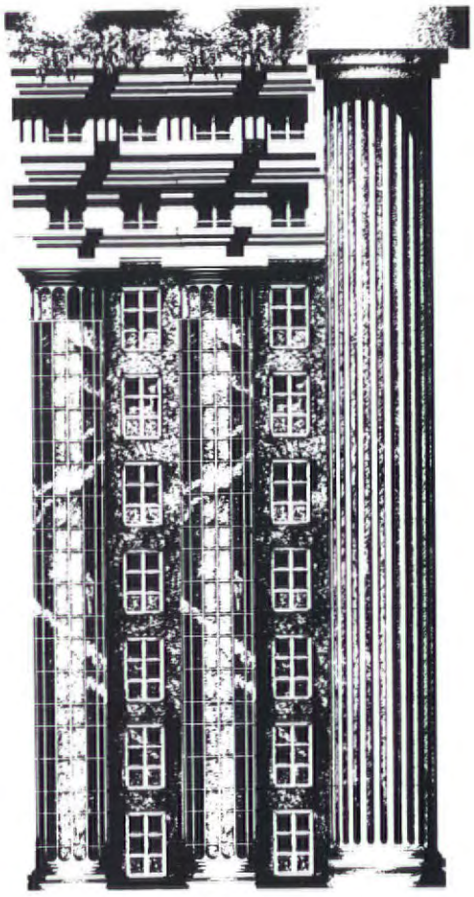
Is it just coincidence that with these two admirers of Stalinist and Hitlerian architecture, one is obliged to mention a third "Big Man", that charming Catalan, who, after a brilliant beginning, then deviated towards another form of neo-socialist realism, which, despite the clever argument put forward by my dear Vittorio Lampugnani, I will describe as "fascist"? It didn't surprise me to hear that the most powerful Romanov had asked Bofill to build a town (if the scoop doesn't turn out to be wrong . . .) in the USSR.

More surprising is his success in certain countries where neither culture, tradition nor environment would seem to afford an easy reception to such imports. When talking of media prizes, we should not forget the young one who received a contentious award at the Buenos Aires Biennale. If we can describe Mario Botta's work as "post-modernist" (in spite of my repugnance at the word, which, in my opinion, doesn't mean anything at all!), he nonetheless escapes from the reminiscence and nostalgia whose time had passed, we thought, but which are reappearing in many parts of the world and in many different spheres, including politics.

Happily, there are also encouraging signs: the prize-winning projects in the big international competitions – one of the most recent is for the Library at Alexandria – and the prestige projects built, or in the course of being built, in France, to mention only the most well known.

What one can say, in any event, is that in the world of the arts (including architecture), there reigns the greatest confusion. Earlier, there was conflict between Ancients and Moderns, Yesterday against Today, Beckmesser against Walther, Artusi against Monteverdi, Burnham against Sullivan, Lemaresquier against Le Corbusier. Today, the shambles is total: everything is permitted, anything that sells is okay; independent and well-qualified criticism is drowned-out by the so-called media. Painting and sculpture have become financial values. An artist's stature is measured by his market price; the art-lover has been replaced by the speculator.

Twenty years ago, my friend Gildo Caputo, at that time director of the prestigious Galerie de France, complained that some of his "clients" didn't even bother any longer to come to the gallery; they would telephone him – "Gildo, I've got five million to invest . . ." And things



Below: Bofill monument – neo-socialist realism or just plain fascist?

have got worse since, as is confirmed by Leo Castelli, whom I knew well when he was in Paris before 1940, arriving from his native Italy, before going on to become one of the biggest picture-dealers in New York: there are no more collectors, just investors.

In architecture and town planning, we see striking parallels. "Ignorant in matters artistic", most politicians, controllers of the purse for public projects, turn to the press, to radio and to television, which are more interested in incident than quality.

In the newspapers one reads declarations by mayors who flaunt the "big names" (the well known names!) – they've got to carry out some spectacular project. That's why so many architects are obsessed with media exposure. And this perversion corrupts the younger generation, who see their only chance of a future in fame at all costs.

Is the situation irreversible? I hope not. But this requires a real understanding of the situation, a profound and serious clarification of fundamental principle, of those basic criteria without which there is neither education, nor criticism, nor judgment. □

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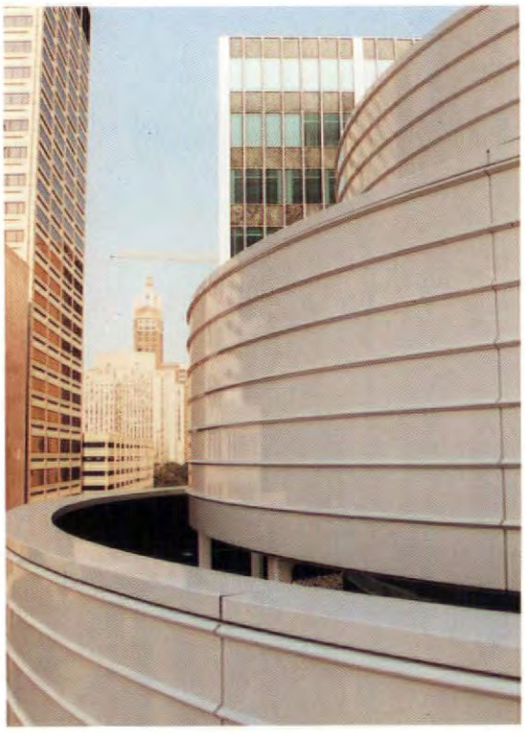

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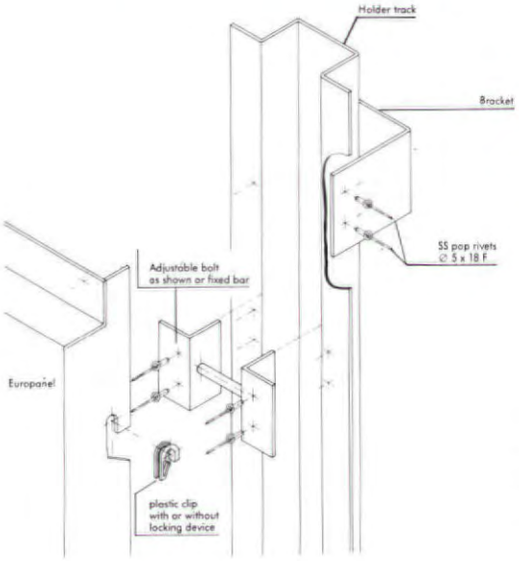

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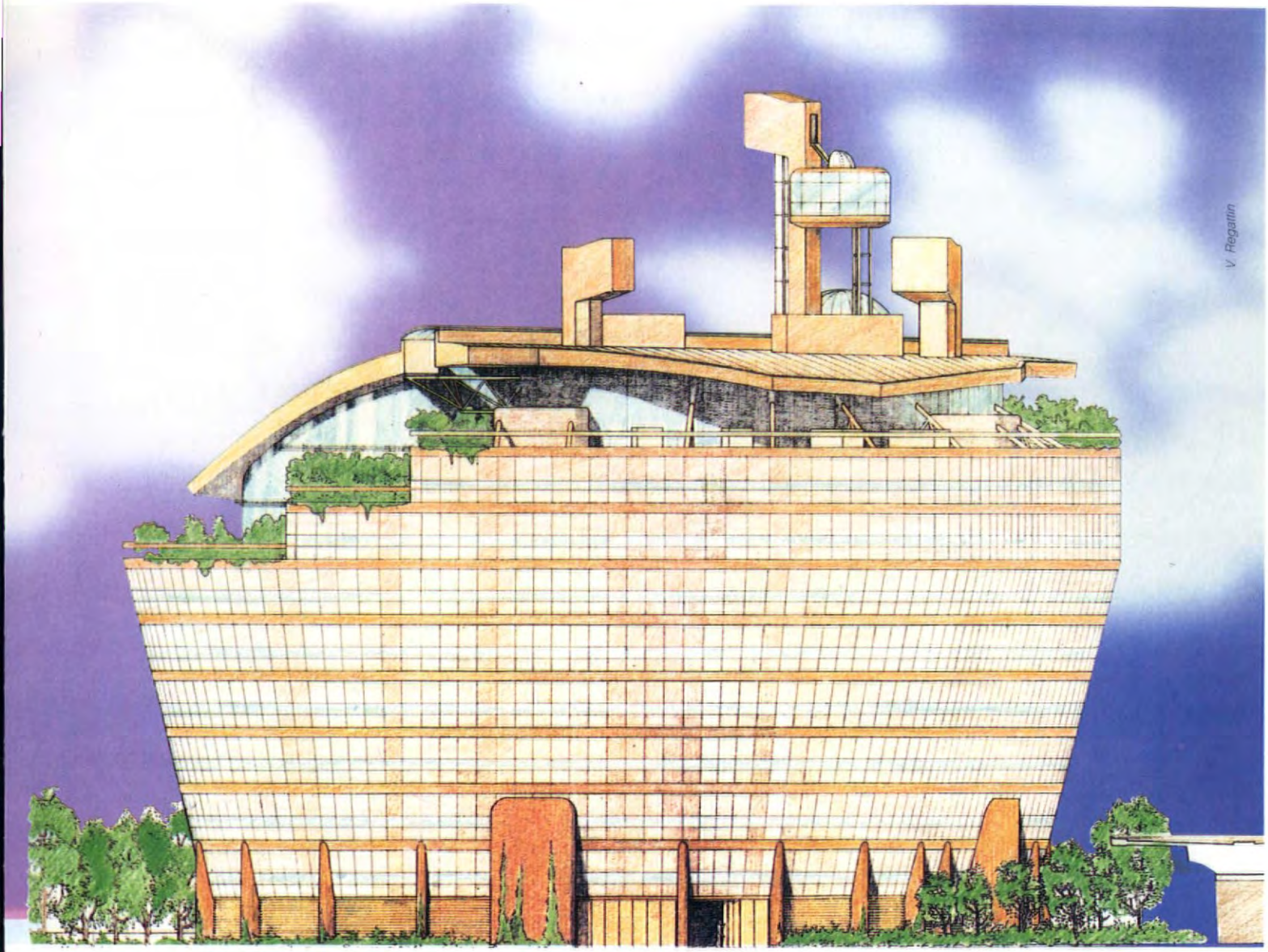

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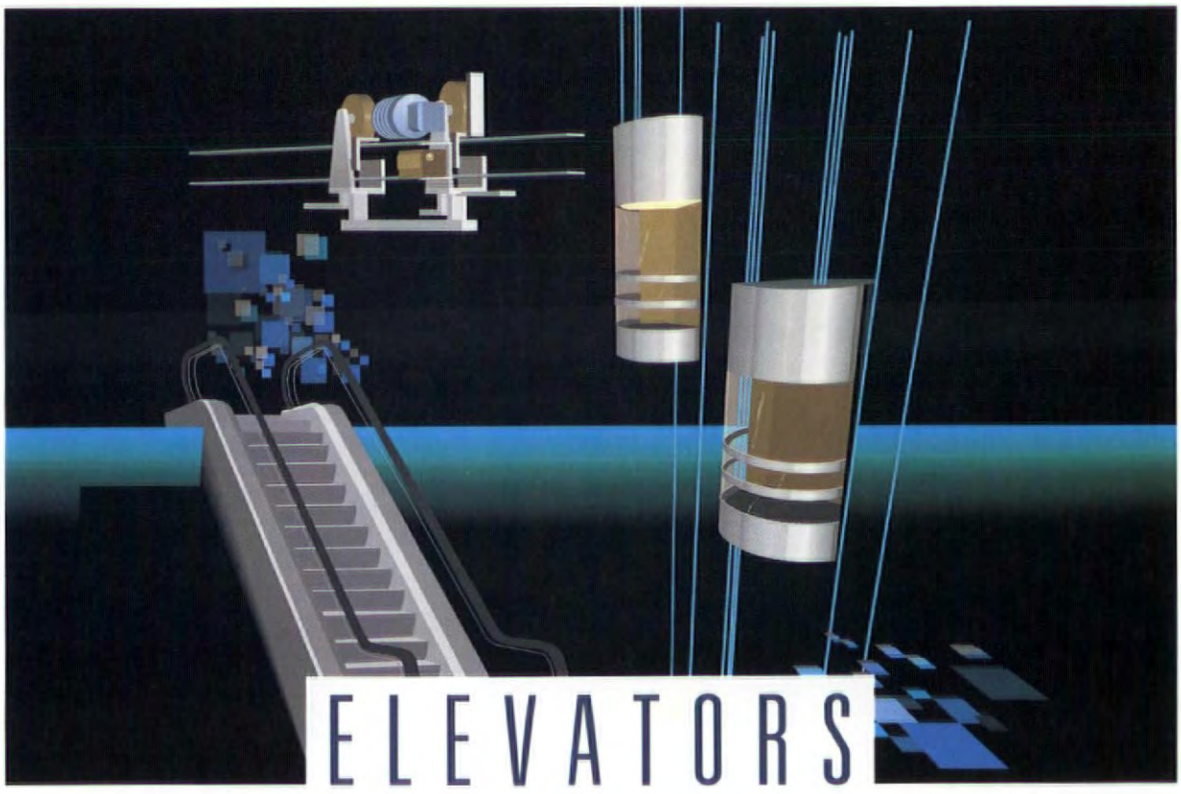

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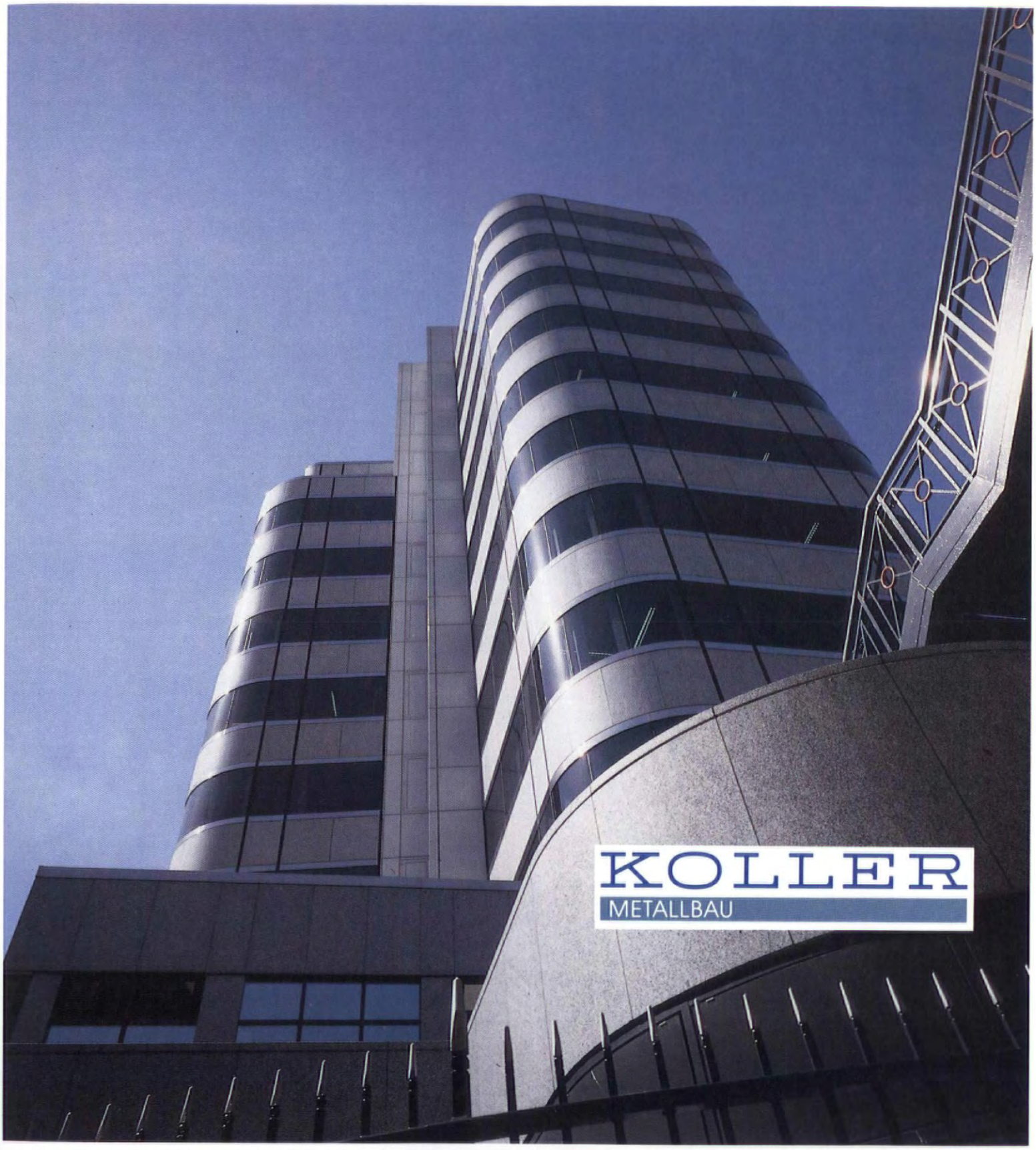

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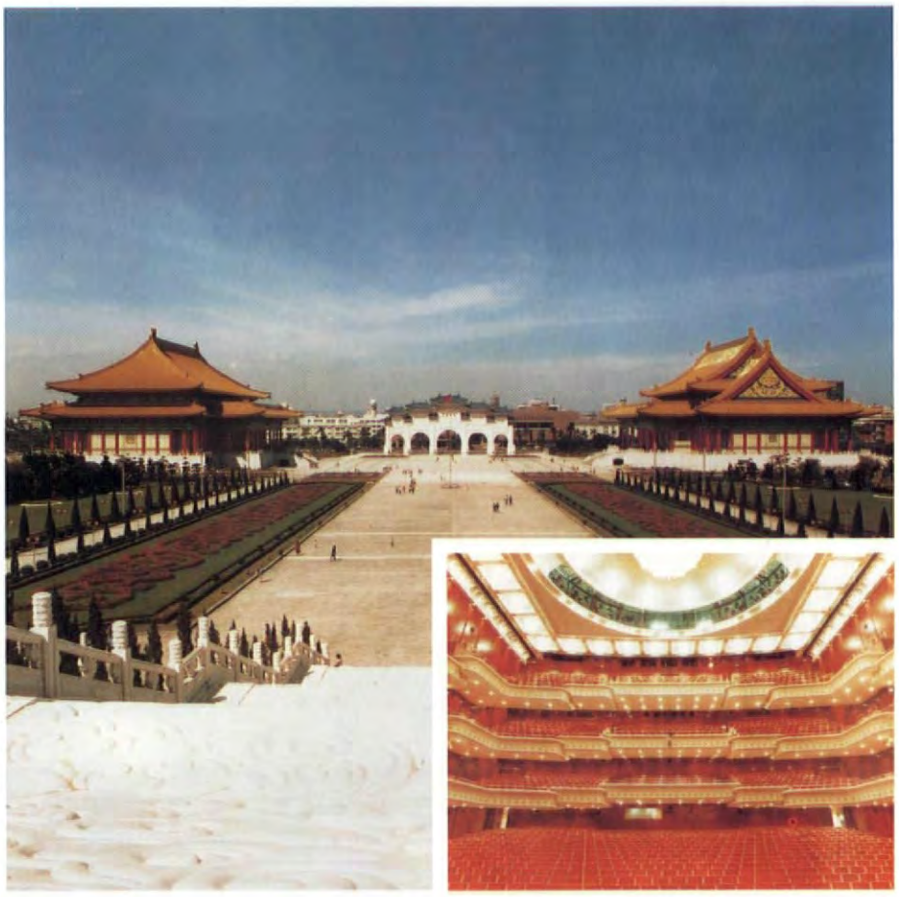

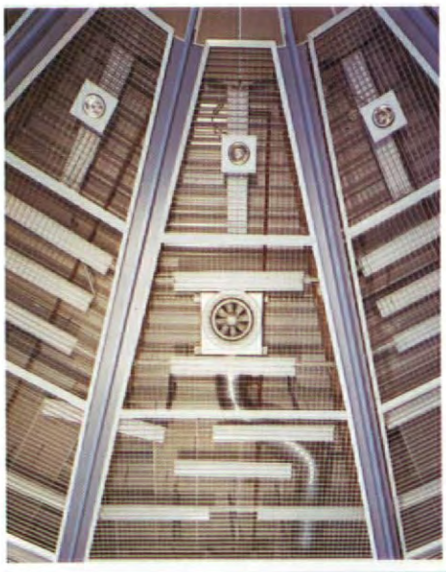

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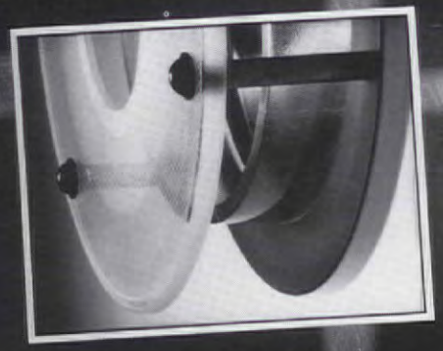

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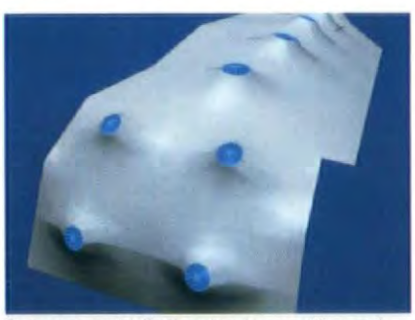

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Top detail, Diplomatic Club, Riyadh

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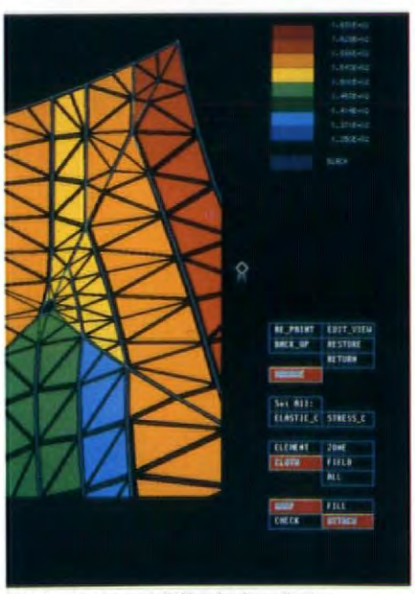

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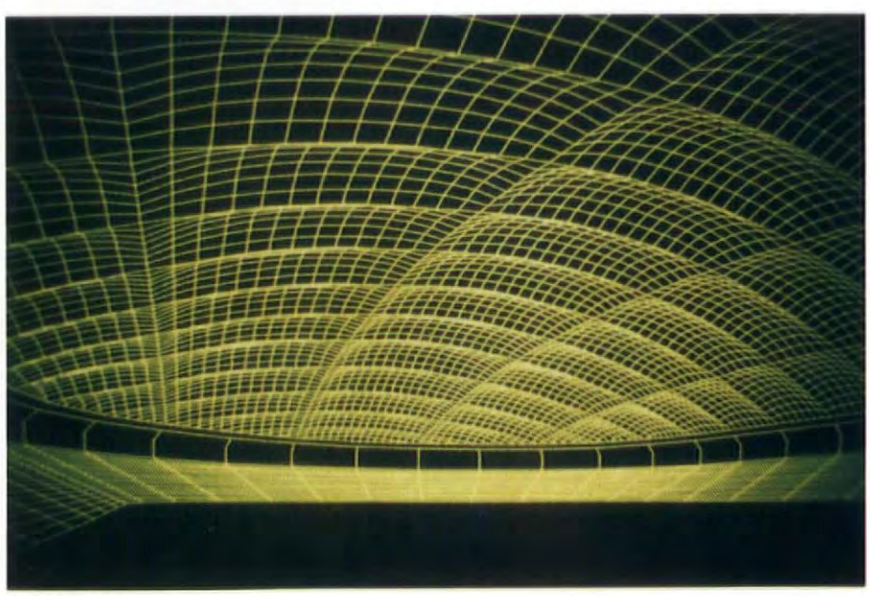

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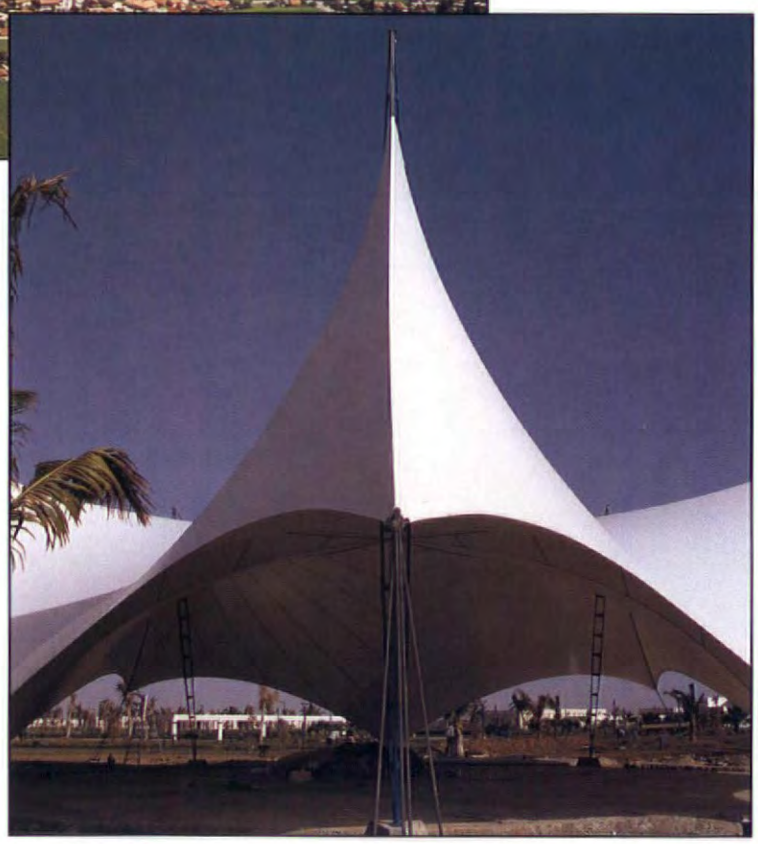

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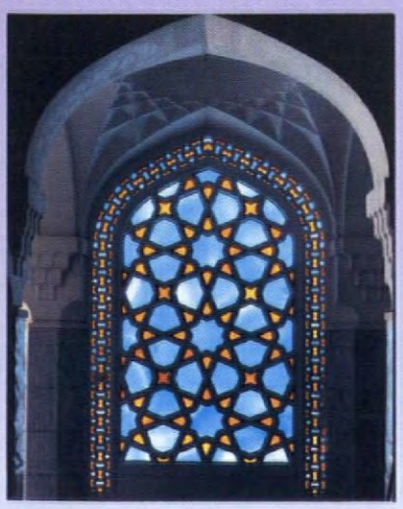

TURATH has extensive experience in the complete range of traditional materials, techniques and art forms particularly calligraphy, floral arabesque, and geometric patterns. This combined with innovative high technology solutions and methods makes it possible to achieve excellence and economy.

Whether architectural decoration and finishes, custom designed building components or specially commissioned works of art, TURATH offers a unique service to clients, architects and contractors for design and supply where quality is paramount.

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109 Uxbridge Road, Ealing, London W5 5TL, England. Telephone 081-840 5050. Telex 892988. Facsimile 081-840 5060

The FSB door-handle programme already encompasses over 50 designs. Enough's enough, surely? After all, you can't go on thinking up new styles forever. And the 50 or so versions that FSB has so far come up with are not the only fish in the sea. But the plethora of existing styles notwithstanding, FSB has never contemplated resting on its laurels. Convinced that every epoch has the right to contemplate new forms, FSB invited Dieter Rams, at present probably the German designer, to try his hand at designing some door handles.

Dieter Rams prevaricated briefly, then accepted on condition that he be permitted to design not just one-offs but entire series. 27 handle variants emerged. As well as the two door handles, there are 2 window grips, two door handles for narrow frames, rosettes, narrow backplates, broad backplates, furniture for lavatory doors, a furniture grip and two doorstoppers.

FSB is proud to present, in conjunction with Dieter Rams, two product lines – rgs 1, rgs 2 and the variation rgs 3 – whose impact is all the more crisply distinctive given the stylistic bedlam elsewhere. Strikingly styled and technologically innovative, these handles are adaptable to doors and windows of every description. Their plainness is startlingly novel and yet somehow familiar.

rgs quite consciously bucks the widely prevalent trend towards loud colours and brassy Baroque ornamentation and signal a counter trend. rgs will still be looking good next century.

This advertisement is just a taster. For professionals (architects, interior designers, carpenters, door and window furniture specialists, etc.), there is a comprehensive catalogue covering Dieter Rams' rgs programme. In addition to this programme FSB has published a large-size poster. The front carries a portrait of Dieter Rams, the reverse offers a brief synopsis of the programme. The catalogue and poster are available from FSB on request.

Franz Schneider
Brakel GmbH + Co

FSB

Greifen und Griffe

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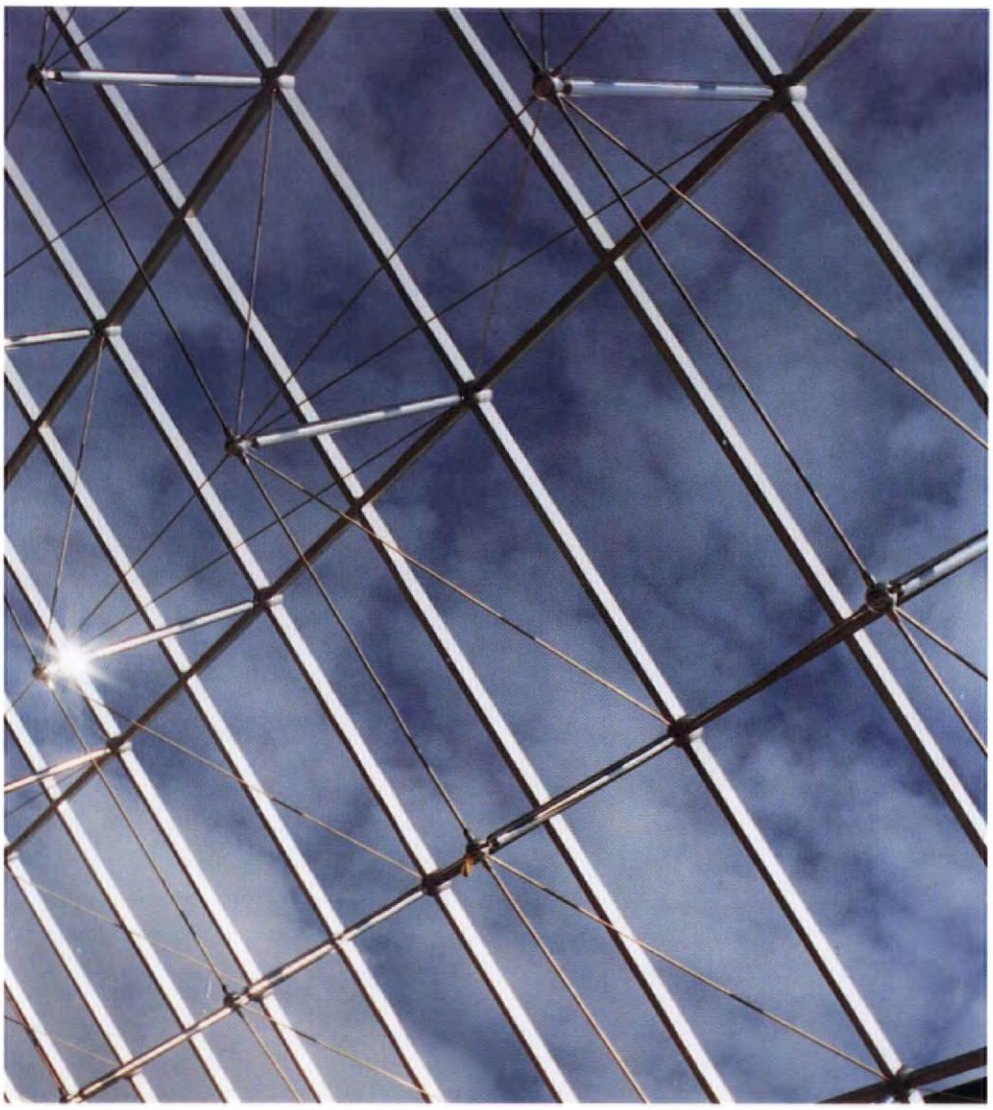

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System Built Concept Wins

Hosbyg A/S, DK-7130 Juelsminde, Denmark
Telephone +45 75 69 44. Telefax +45 75 69 52 97

Facing the declining housing market in the mid 80'es **Hosbyg A/S** was forced to look for new products to manufacture in its 38.000 m^2 plant in Juelsminde (Denmark).

As so often, the solution was a step-wise process: the factory-built bathrooms used for years in the housing programme was knocked down into elements to be transported as flat-packs and easily manoeuvred into old multi-storey buildings with out-dated or – more often – no private bathrooms in the flats.

Thanks to the factory production the elements arrived tiled and finished only to be assembled and connected to existing services, a job lasting only 2 working days and with no re-housing required by the tenants.

But development did not stop here.

The manufacture of the original system-built bathrooms was refined and optimized and a new market was attacked based on a *prefabrication concept:* the customized bathroom for larger projects such as hotels, commercial buildings or apartments blocks.

Under the registered trading name of HOSBY production expertise and facilities are offered to the clients who specify the design and quality level required for their given projects.

The advantages of using system-built bathrooms or lavatories are considerable:

★ the number of different trades and sub-contractors on site is lowered considerably
★ the risk of damage and vandalism is almost eliminated
★ the high interest rate require fast-track building programmes
★ quality assurance is optimal under factory conditions
★ client inspection during the fabrication progress is easily arranged
★ the connecting to mechanical and electrical services on site involve only a few operatives.

The pods are usually based on a steel frame with drywall superstructure and the fully fitted and finished pod is sealed and transported to site being then craned into its final position and only unsealed just before opening day.

The price comparison and prefabricated toilet pods and conventinally constructed lavatories as conductred by London-based Quantity Surveyor Company Hanscomb Associates and published in Chartered Quantity Surveyor in the July 90 issue; the choice to be made is evidently showing an average cost saving of approx. 17% when chosing pods.

hosby®

World Architecture

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