Summary

Designing Energy
Thomas Herzog in conversation with Nikolaus Kuhnert and Angelika Schnell
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ARCH+: Looking biographically at your work, beginning with your 1972 dissertation about "Pneus" (pneumatic structures) up to the Linz design centre, parallels can be found. Pneus was about air-supported structures, where the shape of the skin was determined by the relationship between the outer and inner pressure. The exchange of energy makes it variable. In Linz, a highly technological product which is integrated in the roof controls the solar radiation. As with other projects, the envelope with its energy exchanging function is the central element of your architecture. Is it true to say that you are concentrating on the energetic concept of architecture?

Thomas Herzog: First of all I would like to point out that my attitude towards energy has changed. Questions concerning energy didn't use to be a problem. After my diploma in 1965, I worked in Peter von Seidlein's office for four years. He was influenced by Mies van der Rohe and Eiermann. He'd brought very progressive ideas from Chicago. In our work, we studied the technological possibilities and were indeed fascinated by the thought of replacing matter with energy and we accepted a loss of energy in favour of attractive, unenclosed structures. At that time no one thought that resources were limited and that they had to be used sparingly. As an assistant at the Institut für Baukonstruktion (Institute for Building Construction) in Stuttgart, I saw Frei Otto's lightweight structures. I got to know him personally and often took the opportunity of visiting the special field of research for lightweight structural members. Under this influence I then began to collect material about pneumatic structures. This is where my involvement in the energy exchange function of the skin began. And through this involvement I realised that the natural sources of energy can and must be used and that they determine the appearance of the skin. For it is really quite obvious that the buildings of this world are essentially influenced by two things: firstly by the local climatic conditions, secondly by the materials and technology available. These are the central conditions from which the fact that the skin takes on the primary function and not the frame, which is confusingly known as the "primary structure", can clearly be derived. The skin has to create a balance between the differences between inside and outside, in terms of; temperature, air movement, purity and humidity of the air together with the type of radiation, all of which are dependent on the time of year and day. It must provide the conditions of permeability and non-permeability. Apart from its purely protective function, the regulation of this balance is therefore the main task of the building's external skin.

New Regionalism
If the envelope regulates the energetic and metabolic exchange, the building can be defined as an organism which is characterised in three ways. Firstly by the local conditions (climatic, topographic). Secondly by the skin as the interface, the transition line between inside and outside, it is made up of either opaque, transluscent or transparent elements, which absorb, reflect or allow the radiation to pass through. You describe these elements as "regulators" or "kinetic manipulators". Thirdly by the interior which has its own specific requirements and, in turn, affects the whole system.

It is sensible to proceed gradually along the stages you have outlined. First of all we need to consider the structural elements of the envelope, these depend to a large extent on the locality, i.e. the prevailing radiation and wind conditions. If for example one is building an office block near the coast, where strong winds and intensive solar radiation are certain factors to be reckoned with, it is usual to look for ways of providing shade to avoid blinding. Internal shading is, however, known to cause the interior of the building to heat up, outdoor shade becomes a structural and possibly financial problem because of the prevailing winds. In this situation some translucent glass can be used, which whilst allowing light in, prevents blinding by direct sunlight. In addition to this, it spreads the light much further into the depth of the space and possibly has better insulation properties than transparent glass. This means that the workspaces can be taken much closer to the outside wall.

However, the skin is not just determined by the choice of materials, but also by the selection of proportions and dimensions, the structure and the composition of materials. We refer to the use of these measures as "active" or "passive" measures. The building reacts to the external influences and itself contributes to the process of change for the desired comfort level inside. Through the technological methods used, i.e. "active" or "passive", measures are then employed to complete, alter or provide the comfort required. The same applies to the natural ventilation, which influences the arrangement, size and the mechanics of the openings in the skin. The importance of the climatic conditions outside therefore soon becomes clear, they have a substantial say in the structure and look of the skin. Intensity, timing and frequency of the sun's radiation together with the topographical and urban developmental features are all part of the survey.

The different aspects can surely lead to contradictory measures.

That is correct, and it would be too easy to expect simple solutions. We often observe that one-sided energy saving can be counterproductive. For example an administrative building will generally be a minimalised structure, in order to keep the thermal losses to a minimum in the winter. This happens because the proportion of usable foor space is high compared to the external surface area, which as a rule has a favourable effect on the building costs. As a direct consequence of this a large number of the work spaces will not have natural light. Even by diverting daylight, one would nevertheless be at pains to make the façade as pervious to light as possible. This in turn results in more solar radiation energy entering the building between the seasons and in the summer, shading is used to prevent this, consequently despite tremendous brightness outside and large transparent areas in the façade, the interior is darkened. Similarly in the winter, the low sun can lead to blinding and does not create any heat. Which means that electric lighting gets turned on in the brightest daylight thus contradicting the initial concern which was of course to save energy. These conflicts and contradictions are often fundamental but also depend on the local environment. Trees, surrounding buildings and the type of terrain can aggravate or alleviate such conflicts, for example by providing shelter from wind or radiation. An exact survey of the local conditions is therefore absolutely essential. These days that can no longer be taken for granted. An important requirement for a new architecture which saves resources, is that the environment be defined not in general but in particular locally and specifically. This architecture can lead to a kind of new regionalism which has nothing to do with a formal canon. My idea is that the buildings become real features. The more importance that is attached to the skin as the part of the building that, amongst other things defines and regulates the interior climate as far as temperature, humidity, air circulation, purity of air, radiation and light distribution is concerned, the more structural possibilities there are. That involves making use of knowledge about today's technological possibilities, which on the one hand enables us to work on a general level and on the other hand make it easier to consider the local conditions. This in fact represents the biggest challenge to our profession, it means that during planning the initial formulation of the question has to be continually understood and examined. This is more important than ever because the amount of prefabrication in the sense of "engineering" i.e. prefabrication of the ideas, particularly in the field of structural subsystems, notably the outside wall, is constantly increasing. Hardly any architects consciously produce a detailed design of a façade any more, they buy one instead. The architect says where the

mullions should go, how he would like the space to be divided up and possibly specifies a few performance data. The rest is then done by specialised engineers. However, what we need are environmental engineers who can co-ordinate all of the functions, so that the building can be developed and seen as a whole, balanced organism; the environmental engineer qualification should be part our professional field and not seperate.

So it's about more than a rational comprehension of the task and its "scientific" execution?

My objective is not solely rational. Many new things are arising, such as new floor plan layouts, new qualities for the skin, new forms of perception etc. Whereby simply being new is not for us an end in itself. I am interested in elements and systems in structures which are plausible and efficient. Not because I would rather be a scientist or have purely technical ambitions, but because I am firmly convinced that an architect for whom the artistic considerations are of some importance must have an exact knowledge of his object and that the prerequisite, even for virtuosity, is being in full command of the technology. That does not only apply to the use of natural energy sources - in particular solar energy - but also to the repertory of planning instruments and products which clearly needs expanding. What we are striving for is design, in the sense of the word that HfG Ulm and Otl Aicher have developed, i.e. as an artistically convincing, efficient form. The opposite is styling, the sales form, which in the generally sloppy word and term used by today's "promoted" society continually gets confused with design.

The performance of the shape: Linz for example

The English refer to it as performance. Give us a concrete example, the design centre in Linz for example. How was the roof built?

For the great hall in Linz, we had to design a construction for the glass roof to stop the direct sunlight from shining in all year round. By means of a particular geometry which is possible to ascertain today, we were able to use a production system with a depth of only 16mm which permits us to build a very low room (in comparison to its width and length) and to completely glaze it over without overheating. At the same time a lot of sunlight can get into the room, saving electricity and brilliantly illuminating the objects on display. Through the years of excellent co-operation of a few engineers, especially Christian Bartenbach, we've succeeded in developing a construction which can be universally used to construct large glass roofed rooms like this, with skins which are only a few centimetres thick and have a direct visual link with the outside, without the disadvantage of blinding but with very good insulating properties, namely k-values of 1.2. In addition to this the volume to be heated is limited by the low roof. That means we produced a type of building which had not existed before and which has a different role to play in municipal areas. To exaggerate a little, the effect of the breakthrough concerning 16mm (even by fractions of a millimetre, for we were for example concerned with the question of whether an even reduction could be achieved and whether it was possible to spray the parts with the necessary accuracy) has an affect to the extent of urban development. I am convinced that we are just at the start as far as such developments are concerned. My experience here always makes me sceptical, if town planning decisions affect the dimensions of buildings. Firstly this is no longer town planning, but rather urban development, which in this day and age usually has its roots to a large extent in the tradition of the trade and therefore has certain historical criteria, be it the traffic or the area proportions of the city, although shading patterns, wind stream directions and density should also be part of urban development. In fact there are hardly any competitions these days where the people holding it do not stress the ecological aspects, but the judges all naturally tend to use other criteria for their decisions. I am not categorically questioning this, just saying that I think it is necessary to check whether the criteria by which competitions are drawn up and judged are still correct, when fundamentally a qualitative change has taken place. Secondly in order to develop good decision making criteria when building, it is in my opinion necessary to have a much closer look into new technologies, products and their origins.

How would you describe the special qualities of space in Linz? It is naturally lit but it has something artificial about it because of the refraction.

Yes, it is strange, it seems like light shade. It is very unusual. It is important though not to raise one's expectations too high. It is not sensational in the way that the Pompidou Centre is. Body Building is not our aim, we are concerned with a different kind of aesthetics. After we'd won the competition, we started by talking to the people of Linz. Linz has a social democratic local government which openly confronted a modern subject. Added to that, Linz is the industrial city in Austria, so it was important to show off industry's potential. Also there is a very strong feeling of social responsibility. Which is why, upon our instructions several dates were fixed in the town hall when firstly the town could explain the plans and then I could explain the project so that the people living in this district had an idea of what would happen. At first people were frightened by the size of the project. This impression was created by the elongation of the plans. The power posturing effect, however, generally comes much more from the vertical development. I told the people of Linz that our ridge is only 13 m high and with this information, we were able to dispel any fears. The main hall is not at all threatening or imposing, although it is a high-performance piece of equipment, the impression of being one, however, is only given by the way it is made. The arches span nearly 80 m and have a tension bar to the ceiling through which the horizontal thrust is absorbed. The large area is of course somewhat impressive particularly when it is completely empty because of the unsupported expanse together with the brightness. Actually it is the kind of light which is amazing and the strange effect of a room with a symmetrical structure but where the visual connections, the transparency vary so much. If you look to the north, you can see the clouds and birds through a very fine web. Looking south, you discover a virtual space due to the reflective ceiling. It appears twice as high as it is, not like a perfect mirror, but in Pointillist breakdown. I simply trust that something like that will work, even if it goes beyond my experience so far. For me, a preoccupation with physics does not replace sensuousness.

The question of transparency or not has in the meantime become highly idealised, probably partly because it has become a purely aesthetic concept, used to directly characterise modern architecture. You understand transparency principally to be about transmission. Is that a development of the modern age and a development of the aesthetic concept of transparency?

I am very conservative on one point. In our understanding, architecture still stands on the three pillars: technology, use and beauty. These three aspects are inextricably linked with one another. The word aesthetic originally means perception by the senses (aisthesis). Naturally we also consider questions of proportion, with the connection between the height and the purity of the shape and symbolic language and imagery. I insist upon describing architecture as an artistic dimension. If it is ugly, it was a waste of time. But I do not have any fixed concept. Architecturial form results from the correlation of the three "Vitruvian pillars". What interests me is not the banal but the complex form, which comes into being by refinement, by overlapping things that make sense and which are not applied. If transparent elements appear plausible, then they are part of the whole. I would never say, the more transparent the better. You can make something banal or beautiful out of all materials. It is important to me for example, that the transparent parts of our structures are aesthetically convincing. Mind you transparency is not used figuratively without reason. The contemporary questions about the use of solar energy and also the requirements of an open society suggest transparency as an architectural concept. Wonderful things can be achieved using today's technological means. Incidentally the dream of transparency is not from this century. Brunelleschi darkened the pillasters and clerestorey inside the Church of Santo Spirito, while the curved walls between formed conchae and were painted white, in order to give the impression of transparency, weightlessness and permeability of the opening to the exterior. Which means, this subject, this hope and this vision were already part of the intellectual repertory during the renaissance, without mentioning the first-class Gothic architecture, or the marvellous baroque ceiling frescos, which were supposed to dissolve matter and create the illusion of a clear view of the sky. Perhaps it should be said that transparency is characteristic for the Enlightenment, or an enlightened mind. I am not questioning the concept of the modern age. I have not dispensed with that at all. Incidentally for a purely egoistical reason I was not just annoyed by the "postmodern era", despite all of this nonsense. It gave us a little time in the 80s. We were able to try out and put into practice a whole series of new ideas, to a certain extent of course in the shadow of the fashion of the day. We knew that as with a merry-go-round its just a matter of waiting until the phase comes round again.

Variety and Changeability

Can we see the first signs of a symbolic language for solar architecture? There are of course already some examples: computerised simulation of natural ventilation gives rise to parts of structures which are reminiscent of wings, a new light redirection system creates a new type of structure, new kinds of glass refract light in a way which changes our perception of it.

We must not forget that a strong emphasis on this subject is fairly new. I think it is too early to speak about a symbolic language. At the beginning of the 80s, solar architecture meant conservatories, a lot of glass facing south and that would make the world a better place. That has indeed been quite successful. How little architecture, in terms of a highly artistic way of building with a high standard of form, resulted from this can be seen all over the country, if you look at the hideous tumors, the over-sized, glass lumps, with vulgar, wide mullions which are pushed on to the outside of otherwise quite good houses (they are also often pointless in terms of energy because they have to be heated in the winter). That is not solar architecture, in the same way that putting a few square metres of solar panelling on traditional roofs, or integrating miniature photo-electric cells into individual roofing tiles is not solar architecture. Perhaps there are two common characteristics, which should not so much be seen as symbols, rather as descriptions of a field. First it has to be variability, otherwise what I have said about the regional situation would be nonsense. This holds the prospect of diversity and of what I referred to as a new regionalism. The buildings will be identified as distinctive individuals in particular local situations, not by using stylistic features. That takes us directly to the second characteristic: the fact that the buildings' skins change their conditions. In actual fact more so than up until now.

A metamorphosis?

A metamorphosis is when one shape changes into another and it is an irreversible process. I would sooner think of the example of a tulip which opens and closes every day, or the way in which living organisms react, they change their behaviour according to the weather around them. For example by matching the clothes they wear to the weather conditions. The changing appearence of the skin is accounted for by changeable controls, which do not only react to the environmental conditions, but also cater for the required comfort level of the interior. (Which rooms are used, how often, what lighting is required, etc.) The correlation of these internal requirements and the external conditions has to be managed by the skin. The principle of this phenomenon has always been familiar to us, but it must be seen as a more complex issue now, and as a possibility to create opportunities for new products which will facilitate change. The future for example lies in the development of new kinds of glass (eg thermotropic glass) and new moving parts. Glass which becomes opaque at a certain radiation intensity already exists, it does so as a translucent material lets light in, but prevents blinding and transparency. Windows and shutters have of course always been known to us. Their modifications just need to be made on a larger scale than before. An important characteristic of solar architecture is the controlled ability to change permeability. This kind of architecture behaves like an intelligent organism. This should obviously not be taken literally, but as a statement it comes closer to expressing its complexity.

You have said that there is not yet any codification, but a tendency towards variety in dealing with the regional conditions and depending on them there is the question of transformation. At a time when new directions are developing in Germany, working with simplifications and rules (the new self-confident architecture), it has to be stone again, it has to be heavy, the windows once again have to be upright etc. That way, in complete contrast to your ideas, spaces near the windows end up being well lit and the further away the spaces are, the darker they get. A dark ceiling makes us feel the weight, the heaviness of the room. The other possible but opposed standpoint accentuates the variety and individuality, a situation which cannot be described in terms of a fight between factions. This position is on the one hand innovative and on the other hand individualistic.

Well, simplification is always characteristic of times of disaster. Complex and varied ideas are more difficult to put across. The success of fascism was based on popularised strategies, no more need to tolerate, instead the enforcement of drastic remedies - even aesthetically speaking. I believe that the desire for thick walls and small windows is a reflection of peoples' fear, at a time when there are more useful and exciting architectural alternatives and at a time when we are aware of the necessity of using the natural energy sources and have the technology to do so.

Alternatives of which no-one was aware at the beginning of this century...

Perhaps this undulating movement did exist, but in longer time cycles. We have the choice of two possible perspectives. Either we want an open society, offering the individual a lot of opportunities to develop, against the background of a feeling of trust in the individual, mutual trust, or we regard the environment as essentially hostile. That is why we isolate ourselves and our habitats. This can have various causes. On the one hand the increasing number of lonely people in society, the collapse of value systems and the helplessness of many people to adapt to the situation and to establish their own personal structures that really support them, that are stable and have the quality of a religion. A retreat to privacy is a possible compensation. On the other hand the reason can be connected to certain professional colleagues, who are no longer prepared, simply for the sake of over-individualisation, to go along with the novelty trends which were designed and even built mainly in the 80s and which they would like to see the back of sooner rather than later. I'm not saying that this is all bad. Towns do just happen to be long-term projects and the buildings don't have to be one more showy than the other. Giving up conventions does not automatically lead to freedom. It is a pity though that this countermovement leads to rigorism even to the extent of laying down the materials to be used and window sizes, and that is not just for one building but for a whole block or a whole town. That is not the tradition for European towns. It is important that we regain the richness and even discipline which can be percieved when gradually approaching a renaissance, baroque or classical façade right down to a few centimetres' dimension, depending on perspective and distance. It is very short-sighted to propagate the schematically simplified "block" system as the overriding basic principle for European cities. The stress put on the relationship between wall and opening is anachronistic and cannot be deduced from contemporary themes. For the question about the use of ecological energy is definitely not a trend, but a necessity and as architects, we should be looking for solutions instead of just giving up because we can't cope with it. We are at the point of departure to a new time and no one should at the moment pretend to know exactly where the solutions lie. If for example, we bear in mind that the use of solar energy is not restricted to heating buildings in winter. But that we can put it to use in an area that uses up three times as much energy as heating, and that is, cooling. Then it becomes clear to us that with solar cooling a new technology is budding, and no one can say what the solar cooled buildings look like, because none have been built yet. In actual fact architects as a profession have vast scope for designing, as the generalists it is incumbent upon them to do the integrated planning. Just as the architecture of the last century began to change when industrial production technology took over from the craft trades, so too will the incorporation of the local climatic situation for a sun orientated architecture, be a great opportunity for all those to whom quality design is a matter of concern.

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