ARCHITECTURAL ASSOCIATION
40 DEGREES AND OTHER INVESTIGATIONS
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Alba drawing

INTRODUCTION

Whenever I am asked to give a lecture, the request usually includes…and the title of your talk? If the lecture is for an 'industrial or cross-cultural audience' rather than an academic one, it is usually in the context of a theme, and the talk is specific. For example, at the Kunst- und Ausstellungshalle der Bundesrepublik Deutschland "Tasten" Kongreß 10/95 I was invited to talk about Touch and Architecture. Also speaking was the Australian 'hook-up' (physical as well as electronic) artist Stelarc, as well as surgeons, musicians and writers. When it is for an audience such as the one here tonight, I think that the title is less important.

However, the significance of 40 DEGREES is that it can suggest many things:

- a line or plane that is falling to the earth.
- a line or plane that is still rising from the earth.
- A line that is searching for equilibrium, between levitas and gravitas.

40 degrees may also be considered heat.

Peter Cook made a remark to me a few years ago concerning what he considered a perceived tendency to angular forms in my recent architecture. I am not sure that this is so recent.

The first building I designed, and incidentally built myself, was in France in 1976.

Image Fluy House Chimney

From the point of view of safety and buildability, it was easier to take the chimney through an elliptical hole in a sheet of toughened glass than through the insulated timber roof that was already finished!

But it also served another purpose for me – it symbolised a break with conventional behaviour, and my recent architectural education. But, significantly, it was response to understanding how to make and to construct.

Vilém Flusser, the Czech-born philosopher, made a convincing argument in his short essay The Factory, that it is through 'the factory' by which he means the place of manufacture that we, through prehistorians, can understand the science, politics, art and religion of the society of the time, and identify the human being. His sense of humour suggested that homo faber (maker) was perhaps a better description of the common characteristic of human beings rather than homo sapiens sapiens (a double dose of wisdom).

So, the title of my talk ….and other recent investigations… has led me to explore the role of material and innovation as a condition of an architects existence.

The second half of the 20th century concluded with the fact that we have to fundamentally re-investigate design to enable us, hopefully, to effectively be more intelligent in the way in which we negate the status quo. By this I mean that our very existence, as individuals and as a society dealing with our need to survive changes the balance of nature.

The early reflections of ecology to design as a pragmatic search for a clean, green or eco-design methodology has in fact become an investigation into the problem of design in general. The shift from an industrial reductivist to a post-industrial holistic design requires a complex inquiry. The new design methodology has to embrace social, political and philosophical criticism of design if we are to redefine design with any sense of value and meaning. The problem is vast.

At the moment, I accept that we can only attempt to open up critical discussion of the role of design in a post-industrial ecological society in the hope that in doing so, we can help make it happen.

One action we could take for each and every design decision, independent of its apparent scale of impact, is to question its meaning and impact upon the quality of life on a global level.

Of course we cannot expect to answer this with any scientific certainty, but the simple act of asking the question will help us to begin develop a critical sense along with the new analytical tools and methodologies necessary to change the acts and products of design.

Image Eagle Rock House, the angle!
This house was also largely self-built – but this time with students and staff from the AA.

I would like to suggest that the history of architecture is the history of the way in which architects and engineers have allowed light to penetrate through walls and roofs.
First, through small openings in masonry walls and roofs, then to closing them with small pieces of glass, to total glass enclosures. From this view of architectural history, its development could be described as the desire to master gravitas by levitas, the means to achieving this being the application of continual industrial innovation.
I have been involved in many architectural innovations in glass, stone and metal.
(architectural concepts or intentions in italics)
Lintas In 1984, the first all-glass bridge, hovering above a courtyard in Paris; *(image - advertising)*
La Villette Between 1981 and 1986, the development of the world's first high performance toughened glass structural assembly in collaboration with Peter Rice and Martin Francis - this development, *through an investigation into defining physical transparency*, revolutionised suspended structural glass assemblies and created a new architectural aesthetic; *(It led to an architectural measles !)*
3D visible light forms In 1985, the first ever creation of controlled 3D visible light forms, with J-L Lhermitte and François Bastien at the EDF laboratories in Clamart, France; *(desire)*
Pearl & Terrasson In 1987, the first structural fixing using only one leaf of a laminated glass pane, which we named the Phantom Glass Fixing; *(water and pearl surfaces)*
The Ecology Gallery In 1989, the first ever application of structural glue alone to hold up a glass wall in a public building *(a physical interpretation of the notion of fragility)*
B8 Stockley Park with Pilkington in 1989, the first double glazed structural glass fixing, London; *(technical performance)*
Light Memory Tunnel, also with Pilkington in 1990, the first installation of light memory coated glass, Ingolstadt. *(research, inter-active short life graffiti)*
Reina Sofia, Madrid in 1991, glass used to transfer wind load at the corner of the building through the glass edges *(transparency achieved through emptiness of the corner)*
Bermondsey Station in 1992, we designed the first public glass seat for London Underground at Bermondsey Station. *(lightness in darkness - levitas in gravitas)*
Terrasson,1993, the first cantilevered steel mesh caged stone walls (7m high) in Terrasson, France; *(modernity in visual relationship to history; unprocessed, tactile, ecological walls)*. Interesting to see that Hugh Pearman, architectural critic of the Times, uses the image of Terrasson and has named his new web site - Gabion.
Leipzig Glashalle 1994, the first installation of inclined toughened glass fire escape doors, and first combination of extruded silicone/liquid silicone glass to glass jointing, Leipzig, Germany.
(maintaining architectural form, and by default overcoming Din Standards)
Crystal Palace Concert Platform, 1997, with Paul Gillieron, the first outdoor application in the world of an "active acoustic system. *(non-visual performance)*
London Regatta Centre 1998, the first application of a catenary roof using flat stainless steel sheet, at the Royal Albert Dock Rowing Centre, London;*(more with less)*, and further developments of gabion walling techniques. (also ***ROH and Pharmacy Mesh***)

A significant fact about most of the above innovations is that they all had to meet stringent construction codes for safety.

Then, there are those innovations which have remained ideas, such as:
A proposed **France-Japan** Communications Monument in 1987; a 365m diameter structural ring clad in woven titanium wire. *(Levitas, literally)* (and supermagnets)
and the **fused glass brick** from waste glass (1993).

Then there are those ideas which are coming to reality, I hope. These include:
- **Plymouth Theatre Royal Production Centre** to be clad with woven phosphor bronze wire *(Beached veils)* and other material weaves)
- **The O'Connell Street Monument**, Dublin
- **Alba**, a light monument for Milan

I would like to believe that some of these innovations have been valuable to architecture, and that as an architect, it is still possible to have a direct input into industrial innovation. If we cannot innovate we die.

WHAT IS THE RELATIONSHIP BETWEEN ARCHITECTURE AND INDUSTRIAL INNOVATION?

Alba drawing
Understanding the context is the first investigation of architecture.
The context is both physical, intellectual and sensual.
The architectural process and architecture itself is synthesis, not separation - the synthesis of ideas, of people, of materials and ultimately a sense of man's union with nature.

Creativity and innovation in architecture works through the investigation of memory and the way buildings can be constructed.
These investigations take place with both a sense of freedom and discipline.
A blank sheet paralyzes creativity, it is the context (or parts of it) which acts as the conceptual trigger to creative freedom. The context also imparts the discipline through the architects' response to it.

Historically towns and cities have always conveyed a sense of gravitas through their architectures.
Gravitas in architecture reveals a sense of belonging to the earth, of connection and of foundation. Gravitas recognises the idea of captivity, of being attached to the earth.
Levitas is about being above the earth.
Levitas recognises the idea of freedom.
Levitas suggests an inclination towards lightness, but lightness is fundamentally about the essential. Lightness is an exercise in reductivism - of the problem, of the concept, of the design, of the structure, of the materials.
Superfluousness is an anathema to lightness.
Lightness tends towards minimalism, not necessarily transparency.
Lightness symbolically suggests a victory over gravitas, even gravity.

This search for architectural levitas has been the force behind much of the construction industry's innovations.
Levitas should not be confused with transparency.
Transparency is about a feeling, of openness, or of emptiness.

In individual buildings, the tension between gravitas and levitas is not equal, but can symbolize the degree of connectedness of the one to the other.
This tension has also been at the heart of technological innovation in building.

The improvements in materials have been based upon one single objective - to be able to better predict their performance, thereby improving performance and reducing costs.
Timber, steel and concrete are still the predominant frame materials of structures today.

With the domination of the frame came the innovation of the infill. During the twentieth century, and in particular during the past two decades, glass has become the dominant material of building facades, replacing the "punched holes" in masonry. Glass in architectural facades can be used to embody and convey our present ideas about our union with nature, our attitudes towards society, our notions of both gravitas and levitas, and transparency.

WHO INSTIGATES INDUSTRIAL INNOVATION?

It is rarely an architect. Architects are generally too far removed from industry, and as such the latter simply does not have sufficient confidence in architects. Architects are rarely industrialists. In fact, since the creation of professional apartheid of architects and civil/structural engineers during the 19th century, architects have ceased to be at the forefront of constructional innovation. Innovation has been largely led by industrial entrepreneurs with an engineering background, such as Eiffel, and engineers, such as Freysinnet (pre-stressed concrete). Even some of the more spectacular spatial explorations and innovations can be seen to have come from engineers who also practised as "architects" - Owen Williams, Candela, Nervi, Otto, and Calatrava today.
For architects to have an influence on constructional developments, their ability to collaborate is a precondition. The fact that architects, engineers and the construction industry are using the same, or compatible computer programmes suggests that this collaboration could be easier than it has been.

Pylon images

In 1994, when I read about nano-composite research work being undertaken on "ormocers" (organically modified ceramics) in Saarbrücken, I was reminded of previous articles I had read in New Scientist about nanotechnology and I wondered if it could be possible to dope glass at the molecular level to overcome the inherent inability of glass to resist crack propogation, while retaining the optical properties and essential surface qualities which we associate with glass. This seemed to me a far more interesting line of research than one based upon further exploration of laminating transparent plastics with glass.

images of glass molecule simulation…

To develop such a new material would inevitable require research either directly with industry, or at a research institution, or collaboratively between both. In 1983, I had been successful in bringing together three industries, (two French & one Belgian) to produce a 50% light transmitting permanent structural fabric; **Brochier *image of prototype***; and again, in 1986, bringing together academia (a physicist) with industry (Electricité de France) to successfully realise a vision of controlling 3-D light forms. Exploratory discussions with different glass industries of the dream of a new glass material, and the need to develop it, have so far yielded nothing. Yet one is sure that this industry should be interested, and maybe some are secretly researching it as I talk. As an architect it is too often the case that one's credentials and ideas are not those that industry will accept. The alternative is academia, and the specialist research institutes. Here, there are several involved in new materials, but collaborating with them is constrained either by budgets and existing programme commitments, or by secrecy, a quite reasonable precondition of the research contract when they are being financed by a particular industry. Convincing people to finance new scientific/industrial ideas, is a very difficult one to crack for an architect – but it can happen.

WHAT ARE THE CHARACTERISTIC CONDITIONS FOR INDUSTRIAL INNOVATION?

Leipzig Concept Drawing

One presumes that the most significant agents of change are the individuals on the boards of the industrial companies. It is they who confirm R&D policy, not just in product research, but also with regard to the education and development of those people who work within the company, and those who supply the company with products and services.

I would also suggest that an innovation culture exists within the company, and that it does not reside solely in the boardroom.

However, in my experience of the construction industry, there are not too many companies that have this culture.

WHAT ARE THE KEY INGREDIENTS OF AN INNOVATION CULTURE?

Confidence, skill, judgement, understanding, and notably foresight - a sort of early warning system for the next 10 to 20 years.

A company structure that incorporates foresight thinking as an integral and shared part of its operations builds in the recognition and potential to innovate, and to survive.

The most difficult commodity to introduce into companies is the recognition of the importance of thinking ahead. This means making available both time and money to think ahead. Everyone everywhere seems to be fully occupied with the pragmatic issues of the present.

The most difficult attitude to get rid of within companies is the belief that holding onto information is to the benefit of the company. It is a notion which should be consigned to history.

Sharing information is not dangerous nor detrimental to companies. Sharing information is essential if we are to help create a better world.

It is what we do with the information that will differentiate companies more and more.

It will reveal those companies which are better able to manage change, to innovate and to be successful.

Innovation is not only evidenced through products, but also in the way information is applied throughout the process.

Innovation is a characteristic behind the reality of adding more value to a client's business.

Business maxims at the end of the 20th century include:-

"we must add value"

"we must reduce costs"

"we must accelerate the rate of environmental improvement".

I have not attempted to identify differences between incremental innovation or quantum leap innovations. In architecture and construction, few companies will pioneer, (the risk of arrows in your back) because it is often felt that the financial risks are too high, or the source of the financing of the development dictates that the risk shall not be taken.

The principle that it is better to be second to apply a new concept or even to be the hundredth. is the one adopted by most people in architecture and construction. The British often like to talk about their strength in individual ability to innovate, and to complain that these British ideas are rarely exploited at home, but by others abroad. Nevertheless, the British return as the first to insure the developed idea; and it is this attitude of "insurance" which is so often prejudicial to innovation. But, as we have seen with the evolution and final arrival of the Euro, the British will, it seems, only join in when it is seen to work.

Perhaps this explains why my own innovative work has rarely occurred in Britain.

Architecture can be read as a record of technological change and innovation.

Technologies do get supplanted: timber - cast iron - steel - reinforced concrete - fibre structures - polymers ... etc.

2001 Image

Architecture - or rather the construction of buildings has nearly always been produced from man handleable components. However, for more than a hundred years, new construction components have got bigger and bigger to such an extent that the "hand" has lost its primary role to the machine, and the machine in due course will lose its role to the robot.
Also the component - whether it is the humble brick or the most sophisticated 3D knitted titanium fabric is becoming more and more standardised.
In the future, the art of architectural composition will probably be measured by the designer's ability to innovate using standardised components or standardised processes.
Optic fly Image
I would like to quote from my erstwhile friend, Peter Rice, an engineer.
"To build quickly we must standardise. We must use industrial techniques. Components become industrial elements which are used and re-used to create giant facades. Similar buildings multiply over the landscape and the building components dominate the architecture and the growth and power of technology is given the blame. To counteract this architects and designers have returned to the forms and images of old. But to do this is to miss the point and the problem. What is needed is something which returns the human scale and human involvement to buildings. It is the feeling that people are unimportant when compared to the industrial processes which is so damaging. The Victorians succeeded where we do not. "
Innovation is recognisable as individuality, and the means available to us through computers to be innovative have never been stronger. It is a question of attitude. One can use computers creatively to design, to analyse, to fabricate. If we do not innovate, we stagnate.

CONCLUSION

Recycling and Chamelion images

I know that the only way forward to develop better results is to work closely with industry at all stages of manufacture, and to understand the fundamental nature of the material.
Most architects are not interested in the fundamental process by which this can be achieved. Architects are concerned primarily with what products are available on the market (and accept the manufacturer's data about their performance), how much they cost per square metre, and how best they can serve both the aesthetic and environmental standards, including safety, for their designs.
One aspect which is less well documented is how architects can work better with those companies which produce the glass, timber, masonry and metal products for buildings; those companies which process these materials into the components; those companies who undertake the installation, and those companies who produce or use the maintenance systems necessary for keeping the design looking as it did on the first day it was completed.
I am concerned about how, as architects and engineers, we can contribute positively to the future, and in the context of materials, this leads inexorably to thinking about new products and how to obtain a higher technical and environmentally intelligent performance from these materials, and to imagine synthesising these improved technical performances with new aesthetics.

We are not at the dawn of another renaissance, but in the stream of a continuous technical evolution where we have the opportunity through the intelligent synthesis of art, nature and technology to make decoration performance and performance decoration; and where dynamic behaviour is understood as a fundamental characteristic of materials and constructions.

What is the colour of the wind?

If only buildings could embody the intelligence of a tree!
They capture light, make energy, grow by processing CO2 and water, support and are a home to other life forms; they do not appear to waste heat or energy, nor waste anything else for that matter; they are natural pollutant processors, they provide shade and they look great; they change colour and their leaves - alive and dead - make pleasant sounds in the wind. If there are appropriate architectural forms, they are to be found in nature.
But, as I mentioned earlier with regard to glass, we need to understand their composition and physical processes at the molecular level, not simply appropriate their forms for visual delight.
As history has shown us, it is through our imagination, unhindered but informed, that we will improve architecture.
It is also through cooperation and collaboration that we can become better informed, and our imaginations better nurtured.
Innovation, which has lasting value, can come from the dreams of architects.

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