MILAN GLASS SYMPOSIUM
CONCEPTS TO GLASS REALITIES
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IAN RITCHIE

Introduction

It has been suggested that my contribution to this symposium should cover recent developments in UK glass architecture.

As a long introduction before addressing some recent examples in the UK, I would like to focus on the importance of conceptual thinking. Although I have a reputation for original thinking, and perhaps audacious glass structures, the essence of my architectural research is finding better ways of synthesizing space with materials, of which light is the most fundamental.
Glass is an extraordinary material whose uses and manipulation by man seems inexhaustible from telling stories to making electricity. However, before I embark on the subject of glass, I would like to précis its place in architecture.

Understanding the context is the first investigation of architecture. The context is both sensual and physical. It is concerned with people, with geology as the fundamental source of materials and the sites upon which we build, and light as the sublime material of architecture. Architectural investigations also take place within the context of an existing economic, political, social and industrial framework, which has to be understood in order to define potential and limits. These investigations have to take place recognizing both the need for a sense of freedom and a sense of discipline.

A blank sheet paralyzes creativity. The context (or parts of it) acts as the conceptual trigger to creative freedom. The context imparts the discipline.
Innovation in architecture works through the investigation of memory and the way buildings are constructed. Innovation occurs because of necessity, not for its own sake.
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.

Let us consider two concepts, gravitas and levitas.
Gravitas recognises the idea of captivity, of being attached to the earth.
Gravitas in architecture reveals a sense of belonging to the earth, of connection and of foundation.

Levitas is about being above the earth (Icarus). 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.
Transparency is about feeling, of openness, or of emptiness.
Both gravitas and levitas have to exist in architecture. The tension between gravitas and levitas is not equal, but a symbol of the degree of connectedness of the one to the other.

Glass in architecture can be used to embody our present ideas about our union with nature, our attitudes towards society, our expression of how we perceive the balance between gravitas and levitas, and between solidity and transparency.

For the last thousand years or so, glass has been the medium through which light has entered buildings. Light reveals the spatial art of architecture, and while glass can complete the building's protective enclosure against wind, rain and noise, its unique physical properties allow visual contact to be maintained with the outside world.

My talk will cover many aspects of the richness of glass in architecture. Specifically, I will refer to my own investigations of transparency, whose meaning is often confused by over-elaborate structural gymnastics.

I will describe how I have used glass as a base to manipulate light and energy, as a metaphor in landscape, and illustrate how glass construction can act didactically to enable the general public to have both an intellectual and sensual contact with the harder materials of architecture, which includes glass and metals.

I will also describe, using a number of my own projects and a selection by other UK architects and engineers, how glass has been used as the key architectural material to create not only the visual and spatial experience, but how the designers have sought to make glass perform in terms of the client's objective and the users of the building.

As I mentioned earlier, the intellectual and practical process of architecture is a synthesis, and although I may highlight the essential characteristic of a project - such as transparency - each project will certainly embody other important characteristics.

Throughout my talk I will make reference to industrial and engineering collaboration in research and application, highlighting the importance of genuine collaboration between industry and the professions.

Finally, I will touch upon about what I imagine to be possible future directions in glass architecture[2].

[1]Dewhurst McFarlane; Richard McCormack; Richard Rogers Partnership; Wilkinson Eyre
Ian Ritchie Architects projects will be <u>selected</u> from the following list.
Extended Text included below.

Ian Ritchie Projects (*= for further details see website: www.ianritchiearchitects.co.uk)

TRANSPARENCY
***La Villette** Bioclimatic Facades,Paris (1981-86);
The seminal work on transparency, developed by Rice Francis Ritchie.
The search for a meaning of transparency - both political and physical and
***Lintas Bridge** Paris (1984)
An opportunity to explore total transparency to create the world's first all-glass bridge
***Louvre Pyramids** (1984-93)
An ambiguous transparency
***Glass Hall, Leipzig** (1994-96),
Landscape and transparency
Wurzburg Station Canopy (1996-)
A design exercise with industry to "float" a glass canopy
Museum of London Rotunda History Centre (1997)
A transparent container

LEVITAS - GRAVITAS
***Reina Sofia Museum of Modern Art**, Madrid (1990-91);
A dialogue between old and new and the aspiration to produce a didactic construction
***Terrasson Cultural Greenhouse**, France (1992-93)
A virtual lake and a wall
*__Crystal Palace Concert Platform__ (1996-7)
A real lake and a deceptive object - a sense of emptiness achieved without glass

LANDSCAPE AND GEOLOGICAL METAPHORS
***Pearl of the Gulf**, Dubai (1987),
A symbol recalling the past, present and future
***Ecology Gallery**, Natural History Museum, London (1991)
Energy and ice, and etched images of the old and the new
***London Regatta Centre** (1994 and 1997-2000)

GLASS AND LIGHT - REFLECTIONS ON SOCIETY
***Bermondsey Underground Station**, London, (1990-98)
Transparency and daylight for security and comfort
***The Meridian Cosmosphere**, London (1984 and 1989)
Glass architecture as a surface for images and emptiness
***Alba di Milano**,
A Light Monument for Milan - a metaphor for connexity.

MANIPULATING LIGHT AND ENERGY - PASSIVE & ROBOTIC
***La Villette** Roof, Paris (1981-86);
Light transmitting insulated glass fibre roof, playing with sunlight
***Louvre Inverted Pyramid** (1990-93)
Playing with sunlight
***Louvre Sculpture Courts** (1983-93),
Art and the question of shadows
***Eagle Rock** House, Sussex (1981).
Passive solar energy collection through the roof
***Fluy** House, France (1976-77),
Passive solar energy collection through the roof

***B8** Offices, Stockley Park, London (1990)
Glass coatings and surface treatment to improve energy performance

FUTURES
Structural fixings (1970-1985)
Have we reached a cul-de-sac?
Light Memory - Exhibition, Ingolstadt & Frankfurt (1992)
Experimental Interactive light sensitive coating on glass
New Glass Materials –
Nanotechnology - The Atomic Structure of Glass

FUTURE DIRECTIONS IN GLASS ARCHITECTURE

There is a vast range of glass materials. There are those that have been in existence for thousands of years, and there are those that are very recent such as glass fibres and metallic glasses.

I am concerned about how, as architects and engineers, we can contribute positively to the future, and in the context of glass this leads inexorably to thinking about new glass products and how to obtain a higher technical performance from this material, and to imagine these improved technical performances with new aesthetics.

What we can predict and control in glass are certain static performances, e.g. its transparency, refractive index, and colour; and we can also predict and control glass dynamically e.g. photochromic glasses.

The first level of understanding must be at the atomic level.
The reason for mentioning the atomic structure of glass is concerned with an ambition about improving the performance and predictability of glass. I cannot stress too much the importance in all forms of construction of understanding as much as possible about the material itself. In construction, as in other disciplines, the fundamental need is to predict behaviour with more and more certainty, to achieve better performance, and to do both with more economy.

Constructing with glass still has a degree of unpredictability. At the moment we can overcome the brittleness of glass to some extent by suitable surface treatment to produce glass of great strength and toughness. Macroscopically we understand that flaws in the glass surface and edges can precipitate failure. At the microscopic level we are still somewhat in the dark, and interesting research based upon microscopic cracking theory utilising “simulated cracking” software is being undertaken through computer modelling.

Recent investigation techniques using synchroton and neutron radiation sources to probe the glass structures, together with the geometry of disorder, has not only given us direct results of glass molecular structures but has also enabled the development of computer modelling of solids and liquids and spatial theories for electronic structure. Computer modelling uses simulated “melt” and “quench”, and “cracking theory” to achieve an understanding of the dynamic nature of glass. Some of these are models have “built” up to 10,000 atoms, and incorporate tensile stresses into the 3D model.

As a result, scientists have been able to achieve a better understanding of the complexity and variety of molecular structures at the atomic level of silicate glasses.

However, because glass does not have long-range atomic order, it poses special challenges to scientists using these analysis techniques in describing the physical and chemical properties of this remarkable and fascinating material.

Increasing knowledge and predictability at the atomic level opens up the possibility of developing new and more improved glasses, some of which will no doubt be appropriate for architectural application.

The latest developments in glass products has stemmed from an understanding of the structural chemistry responsible for the versatile properties of the glassy state - states which extend from the familiar insulating behaviour which we are exploiting more and more in architecture, to the metallic.

The classic example of a new glass is the optical glass fibre. It represents a peak in our scientific and industrial capacity to create some of the most perfect solids ever manufactured - on a par with device-grade silicon. The revolution in telecommunications is a direct result of this invention. Yet this development, which required several technological breakthroughs, including the fabrication processes to produce ultra-pure glasses and the ability to graduate the refractive index of glass fibres is only twenty-five years old. Its potential is far from being exhausted, and the glass scientists are trying to develop a glass which allows the refractive index to be changed as a function of modest optical power such that all parts of the telecommunications system can function using light and no direct electrical energy.

CONCLUSION

It is still true that glass in architecture is more appreciated for its aesthetic value, particularly its transparency than as a dielectric material or as an information highway.

Only in the past two decades or so has demand and consequently industry responded to produce new glasses which can be exploited in architecture as a truly dielectric material.

By far the most important glasses for construction are the range of oxide glasses based on silica and prepared by cooling. Silica forms the network and metal oxides modify it.

It is the viscous properties of glass which permits such a very wide range of compositions and hence different properties to be manufactured.

Underlying glass construction is the inescapable fact that glass construction is always dependent upon another structure - either foundations or a superstructure - which means that we must understand the scale of these structures' short and long term dynamic behaviour. It is not a question of statics, but of dynamics, and once the scale is known and understood, it is a relatively straightforward task to design the movement interface between glass and structure, and to resolve the other issues, such as material compatability, within a desired aesthetic objective.

It is at this point that our architectural practice departs from most others. We know that the only way forward to develop better results is to work closely with industry at all stages of manufacture.

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.

Apart from art applied to or etched into the surface of glass, the history of architecture reveals that architects have exploited it in very few ways, yet the aesthetic use of glass is virtually limitless.

Before the 16th century glass was essentially the preserve of ecclesiastical buildings - a luxury. As economic flat glass was developed it started to be used in secular buildings - to keep the rain out and let light in - but early on it was not of sufficient quality to ensure undistorted views. During the mid-late nineteenth and early twentieth century glass manufacture heralded a new dream for architects - the transparent envelope. It was the development of float glass in the mid-twentieth century which brought this dream to reality.

In the past thirty years it has been the toughening of this float glass, and more recently the introduction of quality controls - heat soaking - that has permitted architects to fully realise this dream.

Twenty years ago, architects began dreaming of the "chameleon" wall - glass wall that is dynamic. A wall which can respond at the flick of a switch to become opaque, colourful, transparent; a wall which can change its thermal performance; a wall which can capture energy and transfer this energy to other parts of the building.

Ten years ago architects, besotted with the media age, began dreaming of information walls.

Decoration has for much of the twentieth century been discarded in a purge of architectural self-cleansing, best represented by the puritanical Adolf Loos in Ornament und Verbrechen.

Light symbolises goodness, illumination, rationality, order, and hygiene.

So, early in this century, glass became an aesthetic in its own right; its crystal transparency symbolising rational and economic thought. As twentieth century architectural aesthetes we have fastidiously abjured decoration on the grounds of virtue. To decorate glass and other materials of architecture was to be decadent and immoral, to be less than pure. The search for minimalism - as if it were the same as a monastic existence - is to fly in the face of human nature.

Glass is a great survivor, and has excelled as the first choice material of architectural minimalism. Why?

This ubiquitous material's uniqueness lies in its ability to refract and reflect light - the essential material of all architecture. Glass is phenomenal. Its lickable and durable surface can take a multitude of textured surface treatments which no other material can approach - yet continue to refract light. It can be graduated from transparency through degrees of translucency to opacity, pattern and profile rolled, macro and micro etched by machine, sand and acid etched, drilled, micro-perforated by acids, body coloured, stained, enamelled, painted, fired, and printed.

Today, the stained glass window may be thought of as an anachronism - being the product of basic glass technology when only small pieces, uneven and of irregular thickness, could be manufactured. But this misses the point. Its essential perceived qualities are the same as those of today - luminosity, translucidity and composition. The fact that we have so many more techniques does not camouflage these qualities. Now, we can compose beyond the refracted light paintings of historical narratives, stories and symbolism, with the new composite techniques to achieve higher levels of environmental performance as artistic compositions: coloured and interference laminates, processed holographic film sandwiched between glass, pixellated electroluminescence, photochromism, holograms, dichroism and switchable crystals, photovoltaics, information technology, metal deposits coatings, and in the not too distant future, biogenetic coatings and perhaps “stitched in” miniaturised lasers. The application of these techniques seeks to create responsive thermal and more intelligent glass sheaths for buildings. But, at the same time these applications can also go beyond the technical and harmonious integration of glass in buildings to seek to inspire, excite and be didactic as stained glass windows did so long ago.

If we consider the dream of the information media wall, glass becomes the essential support. So far, liquid crystal technology has not been able to overcome its characteristic low-brightness and limited angle of view. Apart from miniaturised lasers, other likely developments may include miniaturised diode arrays and thin film deposits. For example, low-cost thin carbon film, combining the electrical conductance of crystalline graphite with the electron release characteristic of diamond, may enable high brightness, sharpness and wide angle view imaging to be created by the controlled illumination of phosphor coatings (cf. TV screen) with thin wall glass construction

We can be thankful to Theophilus’ De Diversis Artibus written in the twelfth century in Germany, to Braque, Chagall and Miro who inspired Meistermann & Schaffrath, but also to Loos, Taut and Mies van der Rohe. We are at the dawn of another glass renaissance through the intelligent synthesis of art, nature and technology where decoration is performance and performance is decoration and is dynamic rather than static.

During the last 30 years there has been a slow, but growing awareness amongst the general public, and the construction industry in particular, of the need for ”earth intelligence" and the important role of building design in physically demonstrating this new direction.

There can be no revolution in the industrialised regions of the world with regard to the way we extract, process & manufacture, distribute and consume materials - i.e. an energy revolution. Only a long campaign will eventually change our habits, of which this seminar has a role. We are beginning to use and develop new materials which are both less processed by industry (saving energy), and of higher performance using less material.

Imagination - creativity - intuition, material understanding - analysis - design - economics, and an understanding of the political and social role of the process through which we realise projects are all ingredients in the making of architecture, and the urgent need to dissolve the intellectual boundaries between professionals is a fundamental necessity if we are to realise more intelligent and responsive architectural and engineering concepts and built realities.

Real progress for mankind and a real sustainable future for the earth are becoming essentially the same.

Architectural and engineering design and construction must deal with its own progress by drawing upon the strong metaphorical stem of the human spirit and earthly values and make evident metaphorical intelligence and humanity in what we design should be indisputable.

During my entire professional career, I have been very aware of the need for new methodologies to achieve a better synergy between aesthetics and engineering, particularly as all of our activities have become increasingly more complex and accountable. I believe we are beginning to define some of these new methodologies.

We are still a long way from producing energy intelligent buildings in the widest meaning of the word, but it is certain that future developments of glass molecular structures and coatings will play an invaluable le in achieving more sophisticated and economic enclosures with glass.

As history has shown us, it is through our imagination, unhindered but informed, that we will improve glass constructions in architecture.

"Progress is nothing but the victory of laughter over dogma" [Benjamin De Casseres].