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Paper 2: High Tech Architecture. A Critique.
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High Tech Architecture: A Critique

High Tech as an appearance suggested advances in knowledge about building materials, components, assembly procedures and skills, structural and services efficiency. To what extent does such appearance of the advance of knowledge reflect underlying reality?

***A paper written and published by
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About the Author

David Jukes-Hughes was born in Salisbury, England, in 1961. He spent his boyhood at various boarding schools in that country, and in camps of The British Army in parts of Europe. David studied stage design under Anne Brackenbury. He read politics, geography and the visual arts at Lancaster University. He studied the practice of sculpture under Don Potter, Paul Cooper and Faith Winter, and went on to read Architecture at Kingston University under Professors Dennis Berry and Peter Jacob. He completed his professional training under Dr. Paul Nicholson, a consultant to Nottingham University.

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"I have no authority, not even on a building site. I only have advocacy."

Norman Foster. (Quoted by Jack Pringle RIBA President in the RIBAJ December 2006. P. 51)

Preface

This paper was first submitted to The School of Architecture at Kingston Polytechnic, London, United Kingdom, (now Kingston University) in July 1989 as part of the submission requirement for the degree of Master of Art in Architecture: Design and Theory.

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Introduction

The aim of this paper is to investigate the commonly held notion that "High Tech" architecture as an appearance is implicitly representative of significant advances in knowledge about building materials, components, assembly procedures and skills, structural and services efficiency. To what extent we are asked, can we allow ourselves to agree with this notion? And what evidence can be found to support this. Is there, in fact, a point at which the truth of this breaks down, where reality is replaced by deception and the seductive imagery of "style?" Is High Tech merely a new language, one that is based on a catalogue of conventional signs and symbols, which convey only a sense of such notional advances? So that consequently it might well be justifiable to assume that there are, in truth, no "real" advances made at all.

Before we can investigate this problem in any particular detail, it is important for us to define what indeed "High Tech" architecture is, or at least in view of the topic, how we can distinguish its "appearances" from those of other styles of architecture. Colin Davis, who has probably compiled the most comprehensive survey of High Tech architecture, gives us the following definition: "Its characteristic materials are metal and glass, it purports to adhere to a strict code of honesty of expression, it usually embodies ideas about industrial production, it uses industries other than the building industry as sources both for technology and imagery, and it puts a high priority on the flexibility of use." (Davis, 1988, P.6.) In order to lend both a personal and a historical imprint to this definition, Davis identifies the work of four of its leading architects although of course there are others. These are Richard Rogers, Norman Foster, Nicholas Grimshaw and Michael Hopkins. (Davis, 1988, P.6.) Charles Jenks, whose article, "The Battle of High Tech; Great Buildings with Great faults," in the Architectural Design magazine of the same year, also attempts to define High Tech. Jenks highlights its key imagery and its principle concerns. These are "the play between inside and out, the celebration of process, a concern for transparency, layering and movement, bright flat covering, a light height filigree of tensile members and an optimistic confidence in a scientific culture." (Jenks, 1988, P.19.)

Given these learned definitions, I am immediately struck by the nature of their content. They both have a bias towards a description of appearances and they both make only passing reference to any specific polemical standpoint. Both are open-ended. Perhaps, this is not surprising, as both critics tend to take the view that High Tech is more concerned with clever imagery, “style” and aesthetics. Indeed it could be argued that the extent of this concern subverts any serious pretensions it may have about ideology, and about any particular views it may have of architecture as a major social influence in people’s lives. This act of subversion could equally apply to its relationship with technology. For without doubt some technological advances have indeed been made and I have devoted much of this paper to analyzing examples of these.

However, in my own view, it is clear that in many cases these advances were only carried out to enable the architect to “adhere” to a preconceived ideology about aesthetics, and about how a building should “look.” So that ironically when any real technological advances are achieved they are either hidden from view or understated by the architects. The reason for this becomes apparent when one understands the true nature of their attitude to technology, an attitude that is at its best ambivalent and at its worst, frivolous and abusive. Of course there are exceptions and before making any further conclusions about this, a review and analysis of some of the more prominent examples of technological innovations made by High Tech architects is required. I shall deal with each item or “claim” in turn, as covered in the title of the paper.

1. "High Tech" Materials

In the area of materials, perhaps the best known example of an advance made by a High Tech architect is that which was achieved by Norman Foster in his design for the Sainsbury Centre at Norwich, in the United Kingdom. This included the first use ever of external panels of vacuum formed super plastic aluminium. (Davis,1988, P.58.) Jenks noted, however, these had become in such poor state of repair that they would need to be replaced at a cost of 12 million pounds sterling, which is two thirds of the initial cost of the completed building. (Jenks, 1988, P.21.)

Other more successful developments include major advances in concrete technology. I note in particular the S-curved reflecting panels which are used to give an even quality of light and shadow through Renzo Piano's Menil Museum in Huston, Texas. These are composed of "leaves" of Ferro-cement and curved ductile iron which expand and contract in relative unison. This exceptional piece of inventive engineering was achieved by Peter Rice, who along with Anthony Hunt are perhaps the most prominent engineers associated with High Tech.

Significant progress in concrete technology was also made in the Lloyds Building by Richard Rogers. The ultra smooth concrete finish, its light colour, hard surfaces, absence of stairs and blow holes and its sharp edges are a tremendous achievement. However, the reasoning behind this innovation is somewhat paradoxical, if not ironic. Concrete was necessary for the fire protection of the steel structure. However, it was still felt 'necessary' to have the visual and structural logic of a "clipped-together building." With this new technology at least the essence of steel and the machine aesthetic could be maintained. Comments that describe Lloyds as a "steel building in concrete" encapsulate the dichotomy between the aesthetic intention and the reality of the end product. (Jenks, 1988, P.l7.) This is, of course, an old "problem" and one which Mies van der Rohe himself had to face, and like Mies, Richard Rogers 'solved' it in his own unique way. By making concrete look as much like steel as is technically possible, Rogers stays 'true' to the machine aesthetic as laid down by the Masters of the Modern Movement.

2. "High Tech" Components, Assembly Procedures and Skills

The inventiveness of High Tech reaches a high level of sophistication in the design and detailing of components. The Neoprene joint could be described as the innovation that made High Tech possible. Although this was not achieved by a "High Tech" architect, Jean Prouve's invention has been adapted to suit all manner of situations. Perhaps the best example of this is its combined use as a drainage gutter in Norman Foster's Sainsbury Centre at Norwich.

The Neoprene gasket is now of course an essential component in curtain walling, expansion Joints, window and door detailing, and exterior panel systems. Neoprene was first used in the production of aircraft, and we find many examples of High Tech inventiveness that have originated from the aerospace industry. This kind of collaboration resulted in a new form of raised flooring in the shape of honeycombed aluminium panels, designed especially for the Hong Kong & Shanghai Bank in Hong Kong by Norman Foster. This raises further questions about the nature of the relationship between High Tech architects and manufacturers in particular, questions about the methods of production, standardization and quality assurances.

The High Tech architect has in essence three options. The first of these is to design, develop, manufacture and market a standard building. This has the advantage that strict quality control can be maintained at all stages of production. One recent example is the work by Michael Hopkins. However his "Patera" building for small offices and factories have not been successful in the market place, principally because of their expense.

A second option is the more economical method of constructing buildings using components selected entirely from manufacturers catalogues. One house built and designed by Charles Eames for himself in the Pacific Palisades, California in 1949 is perhaps the most famous example. Helmut Schulitz, the German High Tech architect follows this 'tradition' in his recent California houses. In Britain this approach is less favoured. This may be because British architects set higher standards, and this 'produces' a smaller range of components from which to choose. Such components must of course adhere to a strict code of design that in no way compromises the machine aesthetic. Standardized Victorian sash windows produced, as they are in vast quantities, would not count as High Tech.

As a result the third option is usually preferred, some form of direct collaboration with product manufacturers. This is done on either on informal basis, where existing products are modified to suit particular needs or more formally, where products are designed, developed, and tested by the architect and manufacturer working together to meet very specific requirements. This method was extensively used by Norman Foster in his Hong long Bank. Here the curtain walling, the computer cut structural cladding, the service modules, the floors, the ceilings, the partitions and the furniture were all created in such a manner. Foster calls this "Design development." (Davis, P.7.) Money is allocated in the budget specifically for this, just as in car manufacturing. There is one important difference, in architecture it is the client not the manufacturer that pays, and therefore its occurrence is extremely rare.

The minute attention to detail which this kind of activity generates raises questions about the attitude High Tech architects have towards mass production and standardization. This would not be important if High Tech had appearance of seeking to establish itself as the mainstream or vanguard of the Modern Movement. By making such a claim it presumably accepts its ideals and social intentions as realized through mass production and standardization. Yet clearly this is not quite the case. Jenks identifies an inherent absurdity in this ideal which seeks to unite the "desires of the body and the impersonality of the machine." So that there is a "culture of industrialization with modern technology as responsive, subservient and humanized the same way that traditional handicraft was in the past." This, he says, has resulted in the oxymoron of "'handcrafted High Tech," something which is more akin to prototyping a Rolls Royce, "a luxurious affair and one that can only be justified as a form of art." Hence, he says the argument that ultimately defends the Lloyds Bank and the Hong Kong Bank from the many 'attacks' they have sustained is a cultural, not utilitarian one. (Jenks, 1988, P.25.) Nevertheless in the context of this discussion I would argue that without this kind of "craft" approach to design, the advances in building technology which these two buildings have made would not have been possible. Real quality and sophistication have been realized in component design. Every pipe, stair tread and joint in the Lloyds Bank was purpose made for the building. The entrance canopy, the exposed steel atrium, the glass exterior lifts, the perforated metal balconies and the ingenuity and complexity of the floor section show real achievement in the skills of design and craftsmanship. Perhaps the central question we should attempt to answer ourselves is, whether or not such achievements can be applied to the more commercial side of the building industry. My own view is that this is unlikely to happen to any great extent, precisely because one can only buy such quality craftsmanship at a price.

3. "High Tech" Structural and Services Efficiency

One area where improvements in quality have been possible outside of the realm of High Tech architecture is in the fabrication of service pods. It is now common practice to design, fabricate and test completely fitted washrooms as single units, made entirely off the site. This not only improves the product itself, but also enables the work on site to be carried out that much quicker. There is also the argument that because factory production is at ground level, this allows for all round access and thus a more compact pipe layout can be achieved with its inherent cost savings. (Davis, 1988, P.12.) Other advantages such as standardization and the notion of "a plug-in pod" allowing for flexibility and renewal are perhaps a little overstated. In High Tech these ideas are important concepts, and are in part responsible for the popularity of the "service pod" throughout the construction industry.

The initial idea of a service pod is an old one, and one that is not therefore "High Tech" in origin. Since it was introduced by Buckminster Fuller in his bathroom pod of 1937, High Tech architects have made considerable improvements on it, as both an isolated building component and one that relates to ideas about the building as a complete organism. In 1967 Farrell and Grimshaw used the pod in a clustered arrangement, taking on board Louis Kahn's ideas about dividing, and expressing that division between the "served" and the "servant" areas of a building. Their "service tower" for the International Students Club in London competes with Team 4's Reliance Controls factory as Britain's first "High Tech" building. A more recent adoption of the service pod by Norman Foster in the Hong Kong Bank is the production of a pod that contains both localized air handling units along with washroom facilities. In view of the argument for the renewal of pods, this makes a little more sense. It is, after all, unlikely that washrooms will ever need to be replaced, whereas air handling units tend to wear out more quickly. Despite this, and like the Lloyds Building, the service pods are not in fact un-pluggable and may not even look as if they are, although at Lloyds Building they do. Davis also cites the Hong Kong Bank as built evidence that undermines any ideas about the mass production of pods. Apparently, of all 139 pods, no two pods are the same. In simpler systems, mass production is more feasible. The prototype washroom modules designed by Nicholas Grimshaw are just one example. (Davis, 1988, P.11.)

Advances in the technology of services have of course been made in other areas. Mass production has been applied to the fabrication of staircases, floors, ceilings and so on. Notable innovations by High Tech architects include those for the environmental control of natural light penetration into the building. In Jean Nouvel's design for *l' Institute du Monde Arabs*, in Paris, mechanisms which, like a camera have many little shutters that control the flow of natural light into the building by adjusting the aperture of the shutters. Applied to the south facing wall, each "Mandela" like piece has 56 tiny lenses, 16 medium-size openings and a central giant "camera." (Jenks, 1988, P.24.)

In his Sainsbury Centre, Foster uses photo-sensitized cells and motorized louvres to control light throughout the gallery interior. Unfortunately they hum continuously. Foster is also responsible for the novel idea of the "sun scoop," so devised to provide natural light within the atrium space of his Hong Kong Bank. This is made up of a set of computer operated motorized mirrors on the south side of the building, which follow the path of the sun and bounce its light onto a further set of reflective surfaces at the top of the atrium. These are aluminium panels and are intended to reduce glare. The result is perhaps less than perfect. Instead of a warm sunny glow, Jenks states that the effect is one which is "dull and metallic." (Jenks, 1988, P.21.)

The integration of services with building structure has been more thorough in the Lloyds Building. Here there is yet again an emphasis placed upon flexibility and renewal. This explains the motivation behind the exposure of ducts and services on the exterior of the building structure, an idea which was first realized in the *Centre Pompidou* of 1977. It not only allows for easy access to services and their potential expansion, but it also frees the internal 'served' spaces of the 'clutter' of services, and so enables these to be more functionally flexible as well.

In the *Centre Pompidou* the perceived need for flexibility was so initially important that it was felt advantageous to provide for the movement of entire floor areas. Originally six were to be movable, although only one was eventually realized.

At Lloyds, Rogers has given equal attention to the design of floors. Less ambitious but equally complex, the fixed flooring combines structure and services in a manner that mirrors the more apparent principle in operation on the external walls. The deep cross section reveals a complex layering of parts that aims to allow for at least fifty years of changing electronic technology, the expected life of the building. In essence, the floor consists of a modular pedestal floor resting on a thin concrete slab and permanent steel decking. This in turn is supported by slab columns on a structural grid, which are connected to the main structure by inverted universal beams fixed to the column brackets.

Building services are fully integrated with the structural system. In each bay of the main structural grid, the indirect artificial lighting, the sprinkler heads, smoke/heat sensors, acoustic treatment and air conditioning terminals are combined into one single element, which Richard Rogers calls "the rose." (Davis, P.24). The zone between the slab columns (in plan and cross-section) provides enough space for the many air ducts, pipes and conduits. These are then connected to the vertical service towers, which are found on the exterior of the building. This kind of integration between services and structure has a certain unique style about it. However, on closer examination it is not far different from more typical high-rise commercial architecture, which contains equally integrated systems, but without necessarily expressing them in visual way.

Advances in the technology of structure have been slower. Although it's expression is perhaps the key element that distinguishes High Tech's unique form from other kinds of architecture. No doubt some progress has been made in the area of tensile structures. The Inmos microprocessor factory in Newport, South Wales by Richard Rogers is particularly noteworthy, as is the warehouse and distribution centre for Renault by Norman Foster. However, it must be said that the principles of tensile structures are not exactly new. Cross bracing, suspension bridges, the catenary or "rope" bridges and even tents have all had longer histories. It is only their application to architecture that is relatively new, and even in this High Tech has followed rather than led. The Schlumberger Research Centre by Michael Hopkins owes as much to Frei Otto, as it owes to the Bedouin Arabs.

What then can we say about claims related to structural efficiency? It is certainly true that structures in tension are more efficient than those in compression. But when this is applied to buildings rather than bridges, so many problems become immediately apparent that beyond aesthetics one could almost negate its use on mere utilitarian grounds. Perhaps the best or rather the worst example of its application is that of the Hong Kong Bank. The cost of the structure came to 58.4% of its total construction cost. This is twice that of a normal office building of a similar size. The need to express the structure loses approximately 20% of its carrying load. If one measures the weight of steel against the number of floors, at 55Ib/ft2 and 50 stories, this building is well above that of the medium. In engineering terms it is "upside-down" and clearly irrational. The weight of the floors has to travel up the hangers and down the "masts" doubling the distance that the load has to travel, and thereby offsetting any gains in the use of tension as a structural component. (Jenks, 1988, P.31.)

Yet the Hong Kong Bank is not untypical. In the *Centre Pompidou* the need for fireproofing of the exposed steel structure again provided the motivation needed for real technological advances. As I have already discussed the steel would normally be encased in concrete. In this building the combination of water cooling for the columns, dry insulation for the trusses and spray-on fireproofing for the Joints are exemplary. However, water cooling in particular proved both technologically difficult and difficult to maintain. So when Rogers designed the Lloyds Building, the initial intention for a water cooled steel structure was dropped in favour of a concrete system. (Davis, 1988, P.9.)

Conclusion

Clearly there is a wealth of evidence which supports the view that High Tech has made significant advances in knowledge. Examples can be found in virtually all areas of building technology. However, it could not have gone un-noticed that nearly all of these have come from the work of just three buildings, the Hong Kong Bank, Lloyds of London and the *Centre Pompidou*. There were, of course, other examples but clearly these were the most prominent. This is no coincidence. For without doubt, what has enabled the architects to make these advances here and not elsewhere is the fact that all three had clients with almost unlimited funds at their disposal. This, of course, enabled significant expenditure on “Design development,” with a corresponding number of new innovations. Nevertheless, these are not the only buildings that can be described as “High Tech.” The IBM Sports Hall by Nicholas Grimshaw and the supermarket for J. Sainsbury at Canterbury by ABK are also “High Tech.” Yet neither one has pushed the boundaries of technology more than a few inches. What these five buildings share in common is clearly one of “style.” At the heart of this is the so-called “Machine aesthetic.” High Tech subscribes to the Modern Movement idea of the “*Zeitgeist*.” That is, the belief in the existence of a “spirit of the age,” and like the pioneers, High Tech demands that architecture should express this “spirit.” “The spirit of our age” according to High Tech architects is found in high technology. Architects should therefore make use of this technology. And that which is regarded as the most appropriate is the technology of industry, communication, flight and space travel. (Davis, 1988, P.6.)

Combined with this view is the notion of the “*Zeitgeist*” is that like all industrial objects, architecture should be judged on its utilitarian performance and not for its artistic or symbolic value. Such a view is probably naive and ignores the existence of our immediate emotional response, as human beings, to all objects within our environment.

Exponents of High Tech know exactly what effect they are trying to achieve. It would be foolish to believe otherwise. Indeed, as the title of the paper implies, the symbolism is almost inherent and certainly deliberate, even when real advances in technology have not occurred. Nevertheless, in a different sense it should also be said that nothing in High Tech is purely representational. A strict code of honesty of expression prevents this. “Expressed structure” means exactly what it is, although it may not be the right kind of structure, particularly with regard to matters of efficiency. No-one can deny that the use of tensile structures to support a simple factory shed does not create a more exciting image than one constructed of standard portal frames. Pure functionalism is just not an issue. Both will provide large interior open spaces, and portal frames are usually a cheaper and certainly an easier option.

If we return to the central question raised in the introduction, we must conclude that there is a point at which High Tech ceases to make real advances in technology. Smaller budgets just simply prevent this from occurring, only in the larger projects where basic economics no longer appears to exist, or only partially applies, are any real advances being made in constructed buildings.

However, it is also clear that given unlimited resources, architects tend to be less concerned with fundamental issues regarding efficiency and value for money. This may also affect their judgment with regard to the usefulness of the new technology developed, which in some cases has not even been rigorously worked through. Norman Foster's “Sun scoop” is a classic example. A further criticism is its use as a tool to solve basic design problems, which could be managed in easier ways, either more appropriate or more economical. Finally, there is the more ironic tendency among High Tech architects to use the very advances they make simply to solve problems related to the implementation of the Machine Aesthetic. This in itself is proof of a real disconnection between the expression of real technological advances and the obsessive pre-occupation with appearances for their own sake. As we have seen, when confronted with the problem of fire proofing steel structures, this is taken to new levels of absurdity in all three of what might be called ‘The Masterpieces of High Tech.’

Perhaps, as Jan Kaplicky would argue, there can be no real advances made in building technology without the full support of the building industry. It is almost too much to expect individual architects and their clients to do anything other than point the way.

Norman Foster recently put the problem faced by all architects in these terms: "I have no authority, not even on a building site. I only have advocacy." (RIBAJ, December 2006. P. 51) Industry, of course, may or may not choose to follow. Until it does, much of Jan Kaplicky's work is probably destined to remain on the drawing board.

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