# 9 Terminal Architecture

*'The meaning of the message is the change it produces in the image.'*
MARSHALL McLUHAN, 1964

When the staff of a merchant bank in the City of London go home at the end of the day, the firm's computers do not rest. Instead they kick in to a special programme that sets them to work downloading the day's business onto a data recorder in a vault somewhere miles away. This is part of a prearranged plan. Another part of it will come into operation should the firm's City offices be bombed, set on fire, flooded or otherwise disabled before opening for business the following morning. In such a case key staff will be telephoned automatically and advised to rendezvous at a different address, probably in a nondescript, hard-to-let building on the outskirts of London. Wherever it is, this so-called 'hot site' will already be equipped with workstations, personal computers, telephone lines and data terminals. Essential staff will work from this location until the difficulty at the main office has been resolved.

Ever since the first big IRA bomb attacks on the City of London in 1993 and 1994, every major financial institution in London has availed itself of these unobtrusive 'business continuity services'. Initially several accepted downloading vaults in Docklands, but this location lost favour after one or two were damaged by the Canary Wharf bomb of February 1996. Nowadays more remote locations are preferred. There is no requirement for a 'hot site' to be a special kind of building or to be protected from terrorist attack itself. It is a data warehouse, an expendable and interchangeable facility. Virtually everything to do with its usefulness relates to the needs of information processing, for as the complexity and importance of information technology increases, so does the security problem it poses to business.

Defects in buildings, up to and including their destruction by fire or high explosives, are trivial matters by comparison with computer down-time. In 1997 the property agents Savills estimated that for a medium-sized office in the City, the loss

of a single day's business through computer disruption is about £100,000. A single day of disruption across the whole United Kingdom could cost £1.4 billion. Figures of this order explain why, important as they are in computer terms, 'hot site' buildings have no status as architecture. Ideally they are run-down premises without distinguishing features of any kind. Perhaps the worst fate for any of them would be to be declared to be of special architectural or historical interest. To become a Listed building would be a sentence of death. They are information terminals, pure and simple.

Damage caused by the February 1996 terrorist bomb exploded in London's Docklands.

In 1987 there were no companies in Britain offering 'business continuity services'; in 1997 there were more than 40. Today these companies provide automatic data recording facilities, remote office lettings and emergency network planning. Born in the wake of terrorist activities in several countries, the earliest firms in the field called themselves 'disaster recovery organizations'. Nowadays the less inflammatory title is preferred, not only because it too is inconspicuous, but because bombings and fires are relatively rare. Computer system failures, thefts and employee sabotage are much more common. A 1997 report[1] estimated that full business continuity services, covering all risks from bombs to staff sickness, cost companies £5,000 a year for every workstation insured. Sources estimate the total expenditure to be over £50 million a year.

It is a measure of the transformation that has taken place in the relative status of place, space and information that 'business continuity plans', automatic computer records and 'hot site' offices are now considered to be as vital to business as were the same kind of facilities to the command networks of the military forces of the Cold War. At the dawn of the twenty-first century, 'business continuity', following in the footsteps of the identity badge, the access code and the security guard, has completed a migration from the military to the civilian sphere: a migration that confirms the magnified importance of business intelligence in a competitive world with few captive markets, and underlines its new, quasi-military character.

This transformation has already exhibited remarkable side effects. Not least the fact that, in corporate terms, security is now far more important, and far more expensive, than architecture. Indeed architecture, particularly conspicuous, lavish and creative architecture, has become a business liability. The grand corporate headquarters is an inviting target for terrorists and protest groups, or for any individual with a grudge. Along with corporate downsizing and dispersal, this reasoning has played an important part in the evacuation of central London by such major entities as Shell and IBM. Nor is this a national issue. The same thinking operates in the United States where, for example the new Dallas Exxon headquarters, designed by Hellmuth Obata and Kassabaum and completed in 1996, is not only located on an out-of-town site but is subject

to an absolute publication and video embargo. Pursuing the same logic other major corporations not only equip themselves with 'hot sites' but acquire 'remote sites' too, turning these into the centres where their core business is transacted. The German airline Lufthansa, for example, has shopfront offices in major cities all over the world, but its reservations are handled from a 'call centre' in Galway in Ireland – as are those of American Airlines and Korean Air.

Camouflaged by its inconspicuousness, the 'hot site' is a paradigm for Terminal Architecture. Under the impact of information technology and the new media, all buildings, from the private dwelling to the mighty office tower, are beginning to slip away from the art-historical realm of permanent and appreciating value into a limbo where their real value resides in their rock-bottom information utility alone. In his later years Howard Hughes, the reclusive American billionaire, eschewed his corporate limousine in favour of an old Chevrolet in order not to attract attention. He was a precursor. Today experts in the art of fitting organizations into buildings are also beginning to relish the inconspicuous, the remote and the neglected.

To most people the kind of architecture that will dominate the twenty-first century remains a mystery. It is as though we believe, perhaps even hope, that the remaining minutes of the twentieth century will still hold a surprise or two in store. This is a strange idea. Nothing can be built in sufficient quantity between now and the Millennium to transform the imprint of our century and turn it into something else. The average life of our buildings is so long that not only is the identity of the twentieth century ineradicable, but the image of the twenty-first is already clear. Just as the buildings of the Victorian era set the agenda for the Modern Age, so have the buildings of the New Elizabethans set the agenda for the post-Modern. The canonical buildings of England in the twentieth century are few. Only a handful have passed into the public consciousness – the Royal Festival Hall, Coventry Cathedral, the Lloyds building, the Sainsbury Wing of the National Gallery, Stansted Airport terminal, the Canary Wharf Tower, but not many more. What really sets the stage for the twenty-first century is another kind of building altogether, a type so large, so numerous and so anonymous that it does not

appear on ordnance survey maps, is not kept up to date by aerial photographic surveys, and is in all other respects almost completely ignored.

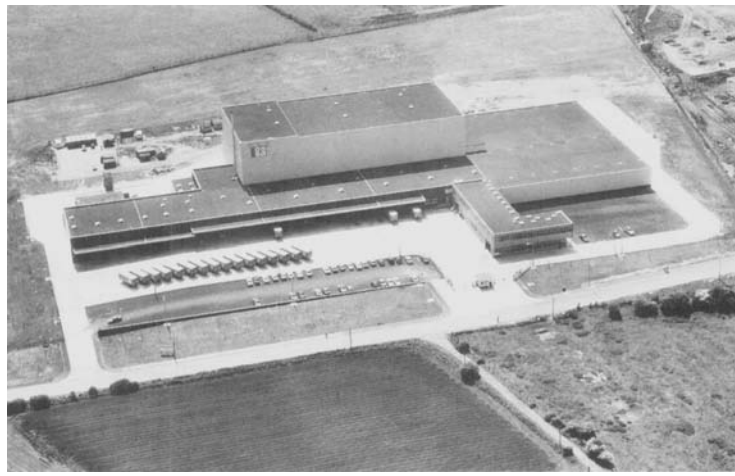
Today Large Single-Storey Buildings or LSSBs, better known as 'Big Sheds', can be found all over the British Isles, everywhere except in the centres of our towns and cities. Exiled from metropolitan sites, they cluster instead on poor-quality land and disused airfields close to the 150 numbered exits and interchanges of 1,800 miles of motorway where they constitute a kind of non-residential urbanism that has no historical precedent. Not only are these 'Big Sheds' of unexampled size and simplicity of appearance but, because no one ever built on the sites they occupy before the second half of the twentieth century, their planning is unconstrained by historic precedent. Indeed, their anonymity goes so far that less than half of the local authority structure plans in England indicate the location of any out-of-town distribution centre, even though up to one third of the new serviced floorspace completed every year consists of new distribution centres.

A good place to contemplate 'Big Shed' town planning is 130 miles west of London, where the M5 motorway crosses the River Avon close to the docks at Avonmouth. There, at Portbury, is one of the most impressive distribution complexes in Britain. Although they do not know it, the thousands who head this way to holiday in the West Country each summer pass the architecture of the twenty-first century, already in place, years ahead of its time.

Portbury is a showplace of Terminal Architecture, with nondescript but dramatic buildings set next to quays as long as airport runways, ships as big as blocks of flats, deep basins, wide roads, narrow tracks, old military huts, new bungalows and, most of all, enormous 'Big Sheds' strewn around like a child's building blocks after a cosmic tantrum.

Generally speaking, LSSBs are steel-framed buildings with laser-flat concrete floors, and walls and roofs formed from sandwich panels with pre-finished inner and outer skins. These steel- and aluminium-skinned rectangles are the wholesale granaries of consumer society, filled to bursting with immense stocks of every kind of merchandise, from toys and games to refrigerated groceries. Served by fleets of articulated trucks, their massive, featureless exteriors defy the terminology of conventional twentieth-century architectural

Building where no one had ever built before. This aerial photograph of Portbury, near Bristol, shows the emergence of a new 'Big Shed' landscape in the Gordano Valley. Centred on the new docks and the M5 motorway, the shape of this development is overlaid upon the patchwork of fields in the same way as the fields were once overlaid upon primeval forest.



A pioneer computerized distribution centre at Birtley, near Newcastle-upon-Tyne, designed by CWS Architects' Department and completed in 1970. One of the first attempts at automated mechanical handling in Britain, it came into operation in 1971 and replaced 50 smaller urban warehouses.

criticism. Like the 'stealth buildings' of the city, 'Big Sheds' leave everything to the imagination. Their names – typically Argos, Asda, Tesco, Waitrose, Makro – are the names of superstores, but they are not public access buildings. Most of them are giant windowless rectangular boxes, 20–50,000 square metres in area. They are in effect superstore feeders, the scale of their operations a mystery even to the people who pass by them every day.

Most imagine that they are warehouses, cheap and artless. In reality they are far more active, day and night. 'Big Sheds' combine perfect formal simplicity with a wonderful sophistication. At one level they are simple because they are 100 per cent recyclable. Because of the way they are put together their sandwich aluminium wall and roof panels can be torn off and melted down, and their steel structural frames can be cut up with oxy-acetylene torches and sold for scrap. Their laser-flat concrete floors can be broken up and sold for hard core. At another level they are sophisticated because, when in operation, their interiors burst with new technology. The cost of the computer-controlled mechanical handling equipment they contain can often exceed their construction cost. 'Big Sheds' are smart buildings, run by computerized building management systems and a small but heavily mechanized work force. Not only can they be operated by remote control from headquarters hundreds of miles away, but some of them have more sinister public functions too. The glistening aluminium walls of one distribution centre at Portbury enclose five acres of concentric cold stores surrounding one another like Russian dolls. At their heart is a deep-freeze chamber kept at minus 25 degrees Celsius. In the event of an air crash or similar disaster it would be requisitioned as a mortuary.

In a way this paradox of household names, frozen groceries and corpses epitomizes the futuristic aspect of Portbury. The same is true of the view that greets a driver cresting the rise that launches the western carriageway of the M5 down to the Avon Bridge. In sunlight it is a seascape whose glistening waves are not made of water but of cars: thousands of imported, unregistered Protons, Mitsubishis and Volvos unloaded from transporter ships at the docks and dense-packed into chainlink-fenced compounds waiting to be sold.

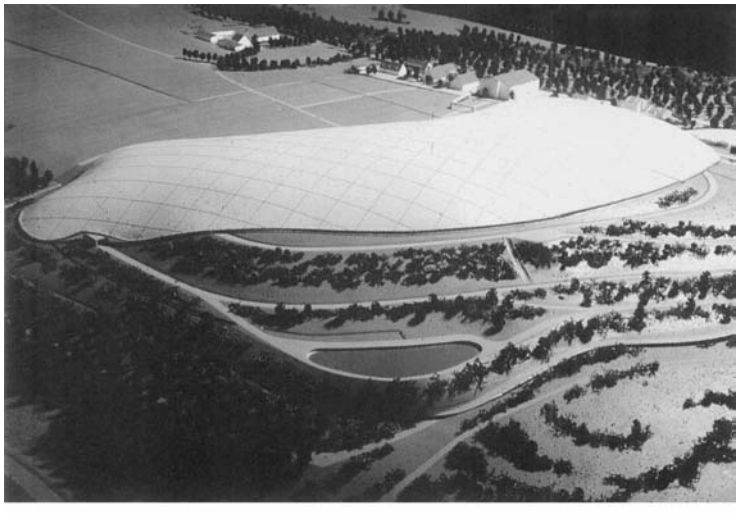
Portbury not only has some of the largest 'Big Shed' buildings in the country, it has three of the most unusual. These are

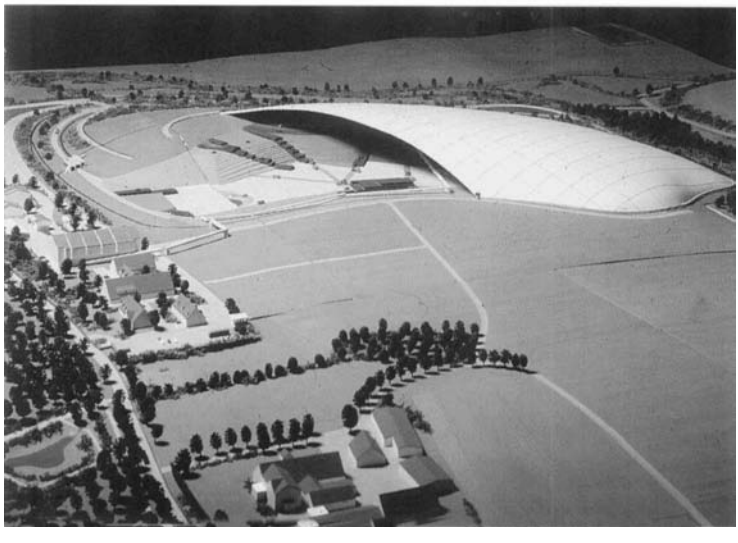
An aerial view of the 60,000-square-metre Lafarge Plasterboard factory at Portbury, a huge advanced-technology production facility that takes in raw gypsum by conveyor from bulk carriers in the docks, and dispatches 50 million square metres of new plasterboard every year.

pitched-roof 'cathedrals', immense and brilliant white triangular structures that are robot buildings of another kind. Two of them are brand new coal-importing and storage buildings. The third is one of the largest and most modern plasterboard factories in Europe. Because of their whiteness, their steep roofs and their prominent overhead conveyors, these three stand out from Portbury's sea of rectangular sheds like icebergs. They are cathedral-shaped because the 38-degree slope of their roofs follows the 'natural angle of repose' of coal and gypsum.

The first of these three distinctive buildings to be completed, and the largest, is a plasterboard factory that was originally built in 1989 and subsequently enlarged from 33,000 square metres to over 50,000 – the size of six World Cup stadiums. At

the time of writing it is capable of producing 50 million square metres of plasterboard a year. Its soaring overhead conveyor can transport 1,500 tonnes of gypsum an hour a quarter of a mile from a docked self-unloading bulk carrier to the cathedral-shaped storage building. From there it is moved to the natural gas-powered plasterboard production facility, an even larger building that is kept at below atmospheric pressure so that it emits no dust, only an innocuous white plume of water vapour, given off by its drying machinery.





Two computer-generated images of the projected waste disposal facility at Bielefeld, Germany, designed by IPL Fabric Structures in 1994. The 120,000-square-metre air-supported membrane was intended to crawl across the landscape over a period of 30 years, shedding membrane panels behind it and refixing them in front. 85 per cent of the membrane panels were expected to be reusable.

The plasterboard factory cost £60 million to build, most of it spent on computer-controlled machinery. Two London firms of architects were involved in its design, Fitzroy Robinson and Partners and Stafford Moor and Farrington. The former firm has built many prestige office buildings in the City of London, including the St Martin's le Grand 'stealth building' described in Chapter 3. The latter firm is hardly known at all outside industrial circles. Such anonymity is part of the culture of 'Big Shed' architecture, with its miracles of functional design, carefully fitted around mechanical processes, vast, computerized, yet ignored. Seen from the air, the plasterboard factory at Portbury speaks for all of them. Like a diagram of the national economy, it reaches out its long conveyor to import raw materials at one end while, at the other, it feeds the adjoining motorway network with a stream of articulated trucks laden with finished products.

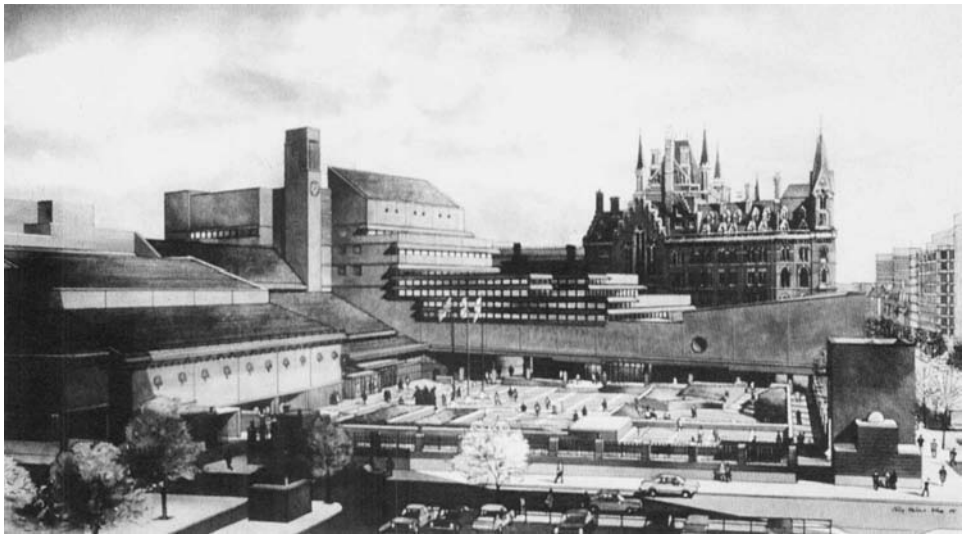
Anonymous, automated giants such as these give us an authentic *frisson* of the twenty-first century in ways that traditional big-name architecture never can, and in the future they are destined to give us more. For if today's 'Big Sheds' are already creating a huge new scale of landscape, then the flexible, air-supported structures that will succeed them are poised to go much further. They already resemble landscape itself rather than any conventional building. In Germany there are projects for huge, hermetically sealed landfill enclosures that literally are moving landscape. This new departure was first developed by the German fabric structure company Ingenieur Plannung Leichtbau – Light Structures Design and Engineering, or IPL – with its design for a 250 x 650-metre low-level 'roof 'covering a toxic waste site near the city of Bielefeld. An enormous envelope composed of hundreds of PVC polyester fabric panels criss-crossed by steel beams supported by air pressure, this £90 million enclosure was intended to crawl over the landscape for a period of 30 years, hermetically sealing toxic waste into lagoons from which no leakage into the surrounding soil was possible. The apparent movement of the envelope was to be achieved by continually dismantling and rebuilding its perimeter, while the sealing-off of fumes was to be maintained by a system of air locks, some big enough to drive trucks through. The performance of the whole membrane was to have been monitored by stress gauges and gas detectors 24 hours a day. It would thus

have become not only the largest air-supported structure in the world, but a kind of architectural organism without precedent.

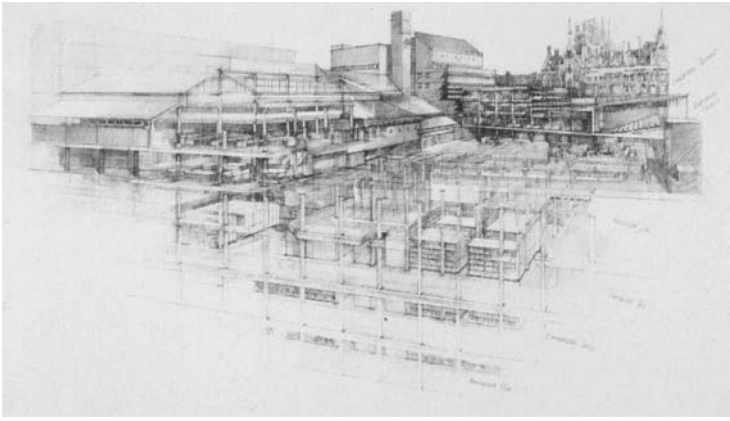
One hundred and fifty years before the first 'Big Shed' was built at Portbury, at a time when the idea of 'moving landscape' did not exist, knowledge was considered to be a matter of the printed word. Storing knowledge was therefore a matter of space to store books, and to this end a great circular reading room was erected for the library of the British Museum. A *tour de force* of Victorian engineering, the roof of this vast chamber, larger than the dome of St Peter's in Rome, rapidly came to enclose the greatest concentration of knowledge in the world. But that was a long time ago. One hundred and fifty years later it is apparent to all of us that the shape of knowledge has changed. In the McLuhan age, collections of books have lost their privileged status. Modern information systems have revealed them for what they are, fragile, limited-capacity pre-industrial cassettes of knowledge. Even the rarest and most valuable old books are no more than compressed rags, sewn together with cotton thread. Their covers are made from the skins of animals, their titles crudely embossed by hand. Even their type was set, letter by letter, in wooden frames. More and more, books are becoming curiosities from a bygone age.

Today we access knowledge by different means. We absorb it from moving pictures, live and recorded sound, signals bounced off satellites, documents duplicated, faxed, e-mailed or displayed on TV screens, from the worldwide web and the Internet. At the end of the twentieth century books have become little more than the 'cassettes' of an old-fashioned information system, containers of a knowledge that must be scanned and digitized in order to be available. Other systems work better. Even as our knowledge sources proliferate we miniaturize their output, recording it invisibly on magnetic tapes, microchips, CDs, hard and floppy disks, and crystals of enormous capacity.

It was in 1962, on the eve of this technological revolution and just over a century after the Reading Room was built, that the project for the construction of a new British Library was begun. The old library was by then thought to be inadequate, not because the farsighted administrators of the day



An artist's impression of the £600 million British Library building in London's Euston Road (architect: Colin St John Wilson). The architectural relationship to St Pancras Chambers is clear and exemplifies the power of the art-historical principle of the pre-eminence of the old.



A cutaway drawing of the British Library that offers an indication of the enormous complexity and cost incurred by the decision to locate the book stacks underground, and in an area laced with existing railway tunnels.

had anticipated the obsolescence of the book, but because it lacked sufficient storage space and the millions of books it already owned were disintegrating as a consequence of wear and tear and poor storage conditions. Build the right library building, it was thought, and devise a better book handling and storage system, and all these problems would dissappear for another hundred years.

Thirty-five years later this has not happened. Ever since the project to build what is now called the British Library began, the world of knowledge has been living through a volcanic eruption of new technology whose effect has been, if not to render the book entirely obsolete, at least to make its place in

the future doubtful. Certainly from fifteenth-century Gutenberg to twentieth-century Marshall McLuhan the overwhelming bulk of the world's knowledge has been contained in books. But no such certainty exists now. We have discovered that, just as a refrigerator is no more than access to a volume of cold air, so is a library no more than a place where there is access to information: information that may be stored remotely, in books thousands of miles away, on silicon chips, compact discs or rolls of microfilm.

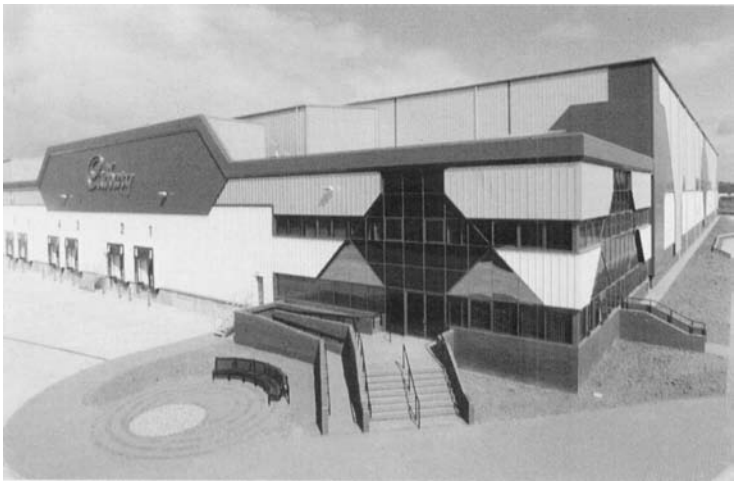
This of course is a deculturalized 'Terminal 2' view of the function of a library, according to which access to its store of information – kept perhaps in a 'Big Shed' out on the motorway network – might as well be made by fax, modem or telephone from the enquirer's home or place of work, as by a journey to a grand bombastic cultural edifice in the centre of a city. Few would dare to say that the British Library next to St Pancras Station – 'One of the great pillars of civilization', as its chief executive officer has modestly described it – could have simply been a 'Big Shed', but why not?

The 'Terminal 1' library on the Euston Road that was finally opened in the autumn of 1997 had undergone a process of design, redesign and agonizingly slow construction and fitting out for as long as most people could remember. It had been allocated four different sites, been made the responsibility of five successive government departments, had five chairmen, three chief executives and two client

The British Library's own 'Big Shed' complex, the 60-acre book depository at Boston Spa in Yorkshire, from where 90 per cent of the British Library's business is transacted.

bodies. All this had involved the expenditure of a line of credit exceeding £600 million. Vast amounts of money were thrown at it, only to be clawed back in savage cuts, and savage cuts in turn were succeeded by grudging gifts of more money. As political attitudes, national fortunes, library technology, information science, conservation and utopianism waxed and waned, so did the building mutate over 35 years from an architectural masterpiece into a treasure house of rare books, from a treasure house of books to a magnificent setting for great Modern works of art, and from a magnificent setting for great works of art into a world centre for information technology and distance learning. And all this took place largely in the mind! For not one of these grand identities was to be seen in action on the ground. True, there is now a building on the Euston Road called the British Library. True, it will house 12 million monographs, 280,000 manuscripts, 8 million stamps, 1 million maps, 1 million music scores, 32 million patent specifications and so on. But it has long since been admitted that it is not really capable of replacing its Bloomsbury predecessor. Already there has been trouble with its automated book handling system, with its shelving, and with delays and arguments with the publishing industry over copyright. Already we know that, far from providing extra space, it could have been full to capacity the day of its long-delayed opening. Most important of all, we know that without its vast but undistinguished 'Big Shed' satellite at Boston Spa, in Yorkshire – the 60-acre book depository that handles 93 per cent of all requests to the library by means of a mass photocopying and electronic data transmission service supplying 22,000 customers a day – the British Library would not be a British Library at all.

At the opposite extreme to the lavish, generation-long, 'Terminal 1' saga of the British Library is the Cadbury's Easter egg depository at Minworth, near Birmingham. This is very definitely a 'Terminal 2' structure. Designed and built in only 18 months at a total cost of £24 million – half of which was spent on the computer-controlled mechanical handling equipment inside it – the Minford depository is a very large, pressurized, condensation-free chilled store that was opened in September 1993. At 40,000 square metres, its floor area is less than half that of the British Library. Yet, although the



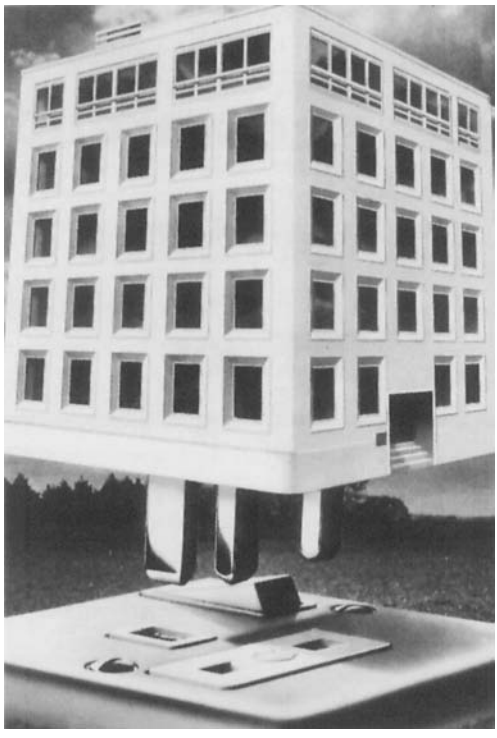
The Cadbury Easter Egg store and distribution centre at Minworth, Birmingham. It cost £24 million instead of £600 million and took 18 months instead of 35 years to build.

comparison might seem outlandish, the job it does is not very different to that carried out by Boston Spa, where the real business of the British Library is transacted. Under carefully controlled conditions Minworth receives, stores and dispatches huge numbers of Easter eggs, vulnerable items that require handling at least as carefully as books. Easter eggs have only one selling season a year yet, unlike the British Library, with its elaborate art-historical 'Terminal 1' superstructure and its impossible-to-waterproof maze of underground book stacks, Minworth is a bland, even crass above-ground building all on one floor. The arrival and departure of the eggs that are its 'books' is completely mechanized. They pass through twenty conventional loading bays, or one of two Hydra-Roll automatic unloaders that can empty a full-sized articulated lorry of all its pallets in just two minutes. Six robot electric trains following buried guide cables carry the eggs to and from an array of manned mobile cranes that serve the miles of high-density racking that occupy the bulk of the building. Stored in that racking, up to 30 million chocolate eggs can be kept at controlled humidity and a constant temperature of 6 degrees Celsius, winter and summer alike – a climatic tolerance better than that achieved in the Reading Room at the British Museum and comparable to that of the new British Library. So efficient is Minworth's operation that it has replaced thirteen smaller warehouses and requires a staff of only sixteen, working shifts, to keep it in operation 24 hours a day.

The difference between these two buildings might seem at first too obvious and trivial to make a serious point, but it is not. There are sound technical reasons for arguing that an above-ground 'Big Shed', automated in the manner of the Minworth depository, would have made a much better British Library than the one we have now, even if it had to be built on the same site in the Euston Road. A 'Big Shed' British Library would not only have been in service in *one twenty-third of the time* it took the present building to come on stream: if necessary it could have been built and rebuilt *twenty-four times* in response to rapidly evolving information technologies, all for less money than was spent on the sculpture-bedecked British Library.

In the information age there is no market for a computer system delivered three years too late, an airliner with insufficient range to reach its destination, or a non-industry standard recording device. When a building is commissioned into a knowledge environment, yet fails as spectacularly as the British Library has failed – by being so late that its anticipated functions have been overtaken by events – it is clearly obsolete. To counter that such a building is a 'Terminal 1' architectural masterpiece and a treasure house of priceless historical artefacts is to miss the point. As Charles Darwin insisted, it is futile to take pity on an ill-adapted species just because its environment is hostile. All species must conform to the demands of their environment or die.

'Big Shed' architecture is a post-Modern phenomenon. It began in earnest in the early 1970s when all over Europe, in a great dorsal belt running from the English Midlands to the Mezzo Giorno, the new distribution landscape of the European Community first began to come together. In place of traditional town and city locations, giant mechanized distribution-centre floorspace began to be constructed at break-neck speed at thousands of exits and intersections on nearly 50,000 kilometres of autoroute. During the 1980s a million out-of-town commercial and retail centres sprang up to join them, with no reference to the fate of the ancient town and city centre sites left behind. In England alone 100 out-of-town shopping centres were projected between 1985 and 1989, nearly half of them planned to include more than 100,000 square metres of covered floorspace, and no fewer than nine



The concept of a plug-in building, used as an electricity advertisement in the 1970s, is now a key principle for all non-art-historical architecture.

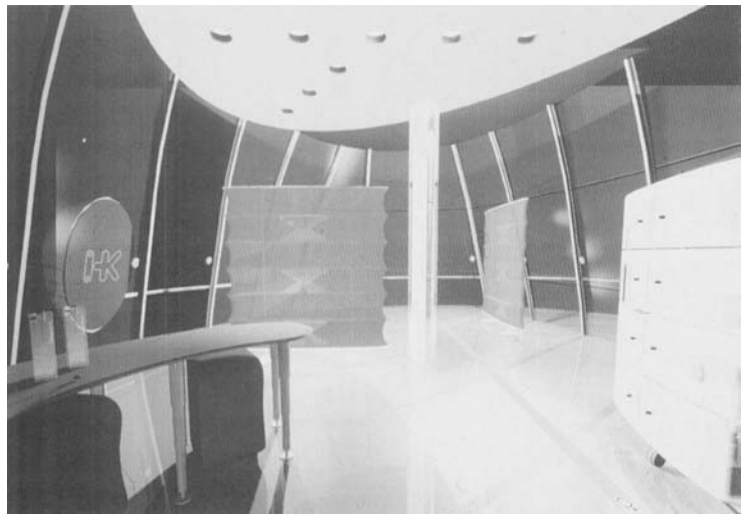
of them projected for sites on the M25 London orbital motorway then nearing completion.

All the 'Big Shed' buildings completed during this period are part of the unsentimental, computer-generated face of Terminal Architecture. Planners and architects played only a minor role in the production and operation of these vast 'zero-defect' enclosures, devoid as they were of any art-historical identity. These blank-walled buildings were visible manifestations of the abstract, invisible, digital network that now links all the EC countries and their neighbours in a seamless web of production, distribution and consumption. They are part of a network of terminals linked by schedules and journeys that work a 24-hour day through container ports, airports and railway stations, automated freezer stores, sealed warehouses, vast truck parks and transient dormitories of mobile homes.

At present this 'digital urbanism' (its 'towns' are often only designated by numbered autoroute exits) is culturally ignored. Yet in economic terms it is already of far greater

importance than anything built inside the old towns and cities it has bypassed. Unlike heritage architecture, which has the vast literature of tourism to support it, this is, in the terminology of the immigration officer, 'undocumented' construction. There is no cultural literature to document it. No novelist or film maker explores beneath its surface. Who in the arts knows anything about the culture of truck drivers who sleep in tiny capsules above the cabs of their trucks, their positions plotted and checked by satellite? Which gallery curator comprehends the space occupied by those who sit, day after day, in front of video monitors? Who chronicles the doings of fork-lift truck drivers, checkout persons, air traffic controllers, control room operators, computer troubleshooters, ambulance men, mechanics, linemen, canteen operatives, cash card loaders, vending machine loaders, photocopier repairers, stacking crane drivers or security guards? These are the prototype non-communal persons of the future, denizens of the 'Big Shed' universe, linked to one another only by the global heartbeat of FM radio and satellite TV.

The Australian architect and industrial designer Michael Trudgeon has seen very clearly what Terminal Architecture means in terms of a revolution in architectural design. In a 1993 magazine interview he was quoted as follows on the enormous disparity between the number of design hours



A computer-generated image of part of Michael Trudgeon's 'Hyper House'. The glass walls are supported by aluminium mullions with integrated drainage channels. With the compound curvature facility of a car body, the hypocycloid corners of the floor metamorphose into an elliptical roof plan. The single supporting column in the centre contains thermal batteries.

invested in the development of a complex industrial product like a new motor car, and the number of design hours invested in new buildings:

> A totally new Japanese car requires 1.7 million hours of research and development time from a blank sheet of paper to the first customer delivery. With an average production run of one million cars, the design cost amortized across the production run comes in at only $425 per car, but each car has the benefit of 1.7 million hours of design thought. By comparison a new office building, costing $50 million with design consultancy fees running at 5 per cent of cost, has the benefit of only 10,000 hours of design thought. The worst case of all is a three-bedroom architect-designed family home, with fees running at 11 per cent of cost. This will have only 1,750 hours of design thought. Under these conditions it is ridiculous to talk about 'smart buildings'.[2]

Trudgeon's own response to the want of design time for conventional architecture has been to issue a specification for a prototype industrial dwelling, approaching the problem as he believed a car manufacturer might approach it. First conceived in 1992 and still under development, his 'Hyper House' project treated the dwelling as a multifunctional living space enclosed by an intelligent skin, in the form of a chemically-treated glass membrane capable of generating variable privacy, views out, and high or low insulation values. In his own words this skin 'acts as a chameleon-like canvas wrapped around a TV screen', generating sampled images, textures, graphics and text.

The living space enclosed within this skin is to be serviced using systems manufactured to car industry product standards, leased and serviceable, like computers, video recorders or aircraft sub-assemblies – for example a roll-in, roll-out bathroom modelled on passenger aircraft toilet modules, equipped with a mechanical vapour recompression water recycling unit, and a single arterial service loop from which sewage, clean water, optical, data and telephone links can be accessed at any point required. The external envelope of the dwelling itself will be cleaned and maintained by a crawling 'service limpet' as though it were the hull of a supertanker.

Described in this way it is clear that Trudgeon's 'Hyper

House' is an appropriate subject for 500,000 hours of design work. He wants it to respond to climatic changes and the demands of its occupants through an array of sensors connected to a network of small control computers. It will be able to store energy with its own structure acting as a thermal battery. He likens it to a kind of mechanical mammal, sharing the same ability to conserve internal 'body heat' by controlling the permeability of its skin. Structurally the dwelling will be a kit of parts snap-locked together from an ever-expanding array of components adding up to an infinitely upgradable product. The house will thus become a static customized car, with a different equipment package available for every owner. In this it leaves the realm of architectural design and joins the realm of industrial design instead, becoming a model for Terminal Architecture in the process.

As a mechanism to speed the arrival of advanced industrial shelter products like the 'Hyper House', conventional architectural design has little to offer. Too little design time and minimal performance targets make it a methodology that actually stands in the way of industrialization, holding much of the construction industry back even from the standards of sophistication associated with the production and assembly of 'Big Sheds'. In Trudgeon's view architecture has become 'an anti-technological virus', an antibody that prevents the machine culture of design from spreading out from high-tech manufacturing industry to engulf the construction process. Kill off that virus and the machine culture of design will soon determine the shape of the terminal world, for in all fields save architecture it has already displaced ideology as the connecting link between human needs and available resources.

One terminal building type that has in the past benefited from relatively high levels of design input is the petrol station. Like 'Big Sheds' all modern petrol stations are deceptively simple in appearance but are in fact sophisticated three-dimensional structures. For years they have evaded the anti-technological virus of architecture by drawing on the design resources of the motor industry and the huge materials base of plastics, derived from petroleum, their parent fuel.

Like icebergs, most of the bulk of a petrol station is invisible, typically taking the form of 60,000 litres of petrol and oil in tanks under the ground. Above these tanks is a paved

Rear view of the Shell RVI petrol station at Littleover, Derby. Apart from the brick and slate shop called for by planners, the rest is minimalist sophistication, with its complexity sublimated in its function.

forecourt dotted with pumps, canopies, car washes, monoliths (the totem poles with the petrol prices on them) and small shops. It is this upstairs-downstairs configuration that makes it relatively easy to update the topsides of a petrol station with a new look, like a car body on a chassis. The difference is that not only most of the forecourt pieces in a petrol station but the underground tank linings and pipework too are made entirely of plastic, which in turn is made from petroleum, which is the product the oil company sells. In this sense the petrol station is a perfect example of Saint Exupéry's observation that 'Every machine will lose its identity in function'.[3] Structure and merchandise both come from the same source. It is as though a home with gas central heating were actually made out of gas. A petrol station is a piece of chemical magic made of space, energy and information, and nothing else.

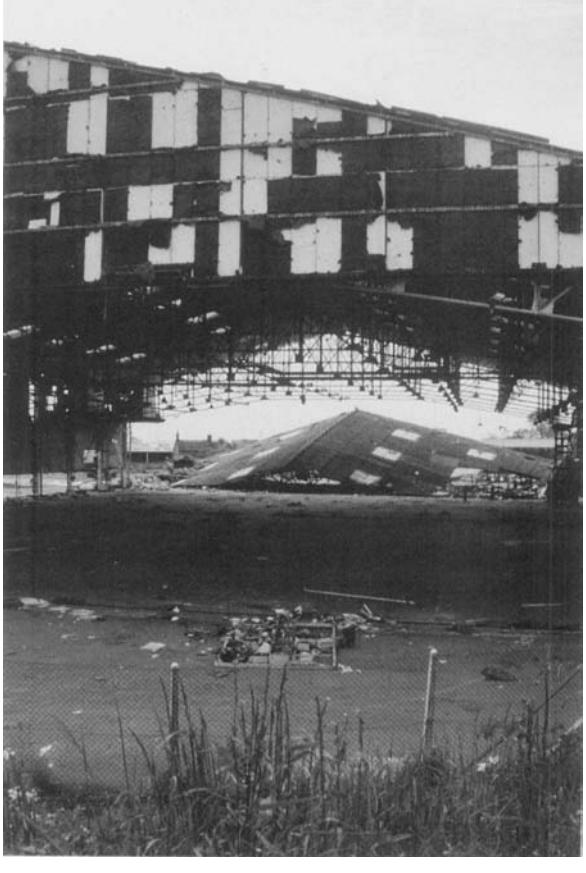
This strange chemistry is the reason why, to understand petrol station design, it is necessary to think about it in a different way to more conventional buildings. Its shape and purpose have entered popular mythology as a different kind of symbol altogether, one of enthusiasm for the rootless mobility of the automobile age. Over the years successive artists and film makers have captured the strange mixture of emotions generated by the enigmatic architecture and sociology of the filling station as a structure alien to its immediate

surroundings, but indissolubly tied to the endless ribbon of road that links all places in the modern world.

Petrol stations are not architecture incidentally attached to a massive processing and distribution system that starts from an oil platform in the North Sea. They are the product of their own product. The typical petrol station is not a 'Terminal 1' art-historical object, but a 'Terminal 2' product of industrial design, something more akin to an enormous vending machine, one of the largest pieces of non-mobile, freestanding product design in the world. It is because petrol station designers have been free of art-historical criticism that even their most mundane product is so refined, so attenuated, so minimalist and so instantly recognizable. Like 'Big Sheds', all the operations of petrol stations, from routine maintenance to tanker visits, can be controlled by computer from operations centres hundreds of miles away. Petrol prices, the only prices denominated in fractions of a penny, can be simultaneously changed at pump, monolith and cash register in the same way. Nor is this the ultimate level of automation. Unmanned petrol stations, where payment is made using a credit card, are increasingly common, while completely robotized forecourts where the driver need not even leave his or her car are already in use experimentally.

Because of their complex and evolving design background, and the global reach of all the major oil companies, the redesign and harmonization of an international chain of petrol stations is a momentous event. The recently introduced Shell RVI design is a good example. The first step was taken in November 1989 when a group of senior executives of the Shell Group of Companies met at the Awana Golf and Country Club, near Kuala Lumpur in Malaysia. The details of their conference are secret, but what came out of it was one of the most ambitious industrial design projects of the twentieth century. Shell had decided to redesign their petrol stations all over the world at a cost outside observers estimated would be at least £4 billion. Because Shell was at that time the world's largest retailer, with three times as many outlets as the McDonalds hamburger chain, the world to them meant 40,000 petrol stations in 100 countries.

Shell's chosen design, called 'RVI', standing for Retail Visual Identity, like Michael Trudgeon's new Japanese car, was allocated thousands of hours of design time, including market



Large temperature-controlled agricultural storage buildings on a site in Essex.

Second World War aircraft hangars being demolished at Magna Park in Warwickshire in 1989. Magna Park, a former airbase known as RAF Bitteswell, lies at the centre of the M1/M6/M69 triangle and was for a time the largest distribution complex in Europe.

research in twelve countries and the design work of Addison Associates, later part of Wolf Olins. All the components of an RVI filling station, from its subtly curved, light-reflecting acrylic fascia to its flat – not corrugated – canopy underside, are fitted together as neatly as the body panels of a car. Here Shell's global reach helps, for economies of scale have enabled RVI to be based on precision 'production line' plastics, like satin acrylic, instead of locally hand laid-up glass fibre. Nor does the terminality of the petrol station stop with its construction. By the mid-1990s full RVI conversions in the United Kingdom were taking place at the rate of seven per week.

Characteristically, just as the architectural profession has only a tangential relationship with 'Big Sheds',[4] so does it tend to ignore the design quality of petrol stations. When in 1990 *Country Life* magazine published a diatribe against modern petrol stations accompanied by a number of architect designs for Palladian, Gothic, rustic and even camouflaged alternatives, some feared a concerted backlash against the RVI programme, but it did not materialize. Commenting in 1994, a Shell representative said, 'We don't have difficulties with planning officers, but the architects on the planning preview committees are a different matter. They look at our applications and recommend refusal to the planners. But even they don't want petrol stations that look like Georgian houses. They want real Georgian houses. They don't want petrol stations at all, even though they all drive cars.'[5]

The twentieth century has seen so many technical innovations emanating from the electronics industry that the day-to-day life of a citizen of 100 years ago seems almost unimaginably primitive. Even dwelling houses, which have hardly changed at all in appearance, show innumerable changes beneath the skin. Yet there is one area where all buildings seem reluctant to adopt a truly terminal stance and step into the twenty-first century, and that is in the matter of optical illusion. Despite the advent of virtual reality, permanent, unvarying external appearance and negligible internal exploitation of the possibilities of virtual space have been an architectural constant, from the beginning of our century to its end.

From the pioneering Modern architecture of the 1927 Weissenhof exhibition in Stuttgart to the Milton Keynes 'Futureworld' competition of 1994, all architectural 'homes of

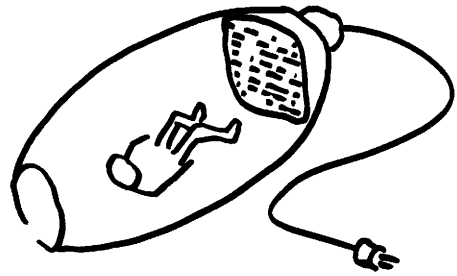
the future' have been futuristic only to the extent that they have used non-traditional materials and displayed different arrangements of walls, windows and floor plans. Roof gardens, free-form and open plans, unorthodox sections, air-conditioning, double glazing, domestic robots: none of these has ever changed the dwelling's commitment to real time and unchanging space. In this sense it is true to say that the perceived spatial limitations of all buildings, except cinemas, drive-in cinemas, exhibition pavilions and multiscreen, 3-D or IMAX theatres, remain limited by the acceptance of structural space definition in an era when structure need only serve as a framework for the illusory reality of virtual worlds.

Apart from the commercial building types identified above, which are deliberately designed to exploit spatial distortion for the purpose of entertainment, there is very little evidence of any deliberate architectural attempt to explore the impact of spatially distorting electronic imagery. In fact any such investigation is discouraged whenever architects hold, as many do, that virtual reality spells the end of all architecture.[6] The best-known architect to have penetrated beyond this point is the Japanese Toyo Ito, who is intensely interested in the impact of electronic media upon architecture and has been quoted in Chapter 8 on the subject.

In his 1989 Tower of the Winds, a temporary urban structure erected in Tokyo and since removed, Ito produced a cylindrical tower whose apparent configuration continuously

A mobile home with satellite antenna in Arizona, 1989. Prototype for the kind of 21st-century terminal dwelling submerged into the landscape that is represented in the illustration on page 167.

The initial concept of the VAP 'Futureworld' competition entry: a pod, like a small space capsule, with an internal video environment like the artificial horizon of an aircraft.

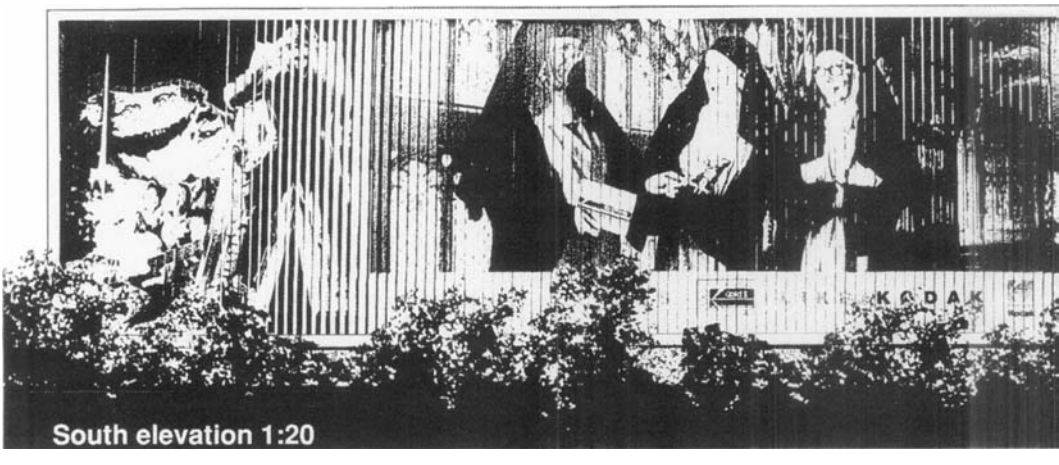


changed through the agency of computer-controlled lighting effects driven by changes in wind force and direction. Since then he has tried different approaches. In 1992 he based the design of his competition entry for the University of Paris Jussieu Library on the much magnified circuitry of a microchip. Most recently he won a competition to design a mediatheque for the city of Sendai, north of Tokyo, with a glass-clad project whose stacked floors emulated the shape of floppy disks, which he called 'media plates'. These plates were penetrated and supported by hollow geodesic columns providing communication between the different levels. The resultant building, highly transparent and structurally attenuated, Ito describes as 'a new image of space'.

At the time of writing Toyo Ito's view of the correct line to be followed by architecture in the information age follows this last precedent. He is quoted as having said, 'I do not think that architecture should be replaced with video images, or that temporary buildings should be used. We should rather build fictional and ephemeral architecture as a permanent entity.' To this end his present tendency is to 'dematerialize' his buildings by reducing the mass of their construction to a minimum. Perhaps with less fanatical attention to detail, but also at much lower cost, this has been the direction taken by the designers of 'Big Sheds' and petrol stations for many years. However, Ito clearly sees further ahead for he has also stated that 'the invasion of new media into architecture will not permit the survival of fixed, static form'.[7]

The next move beyond this position adopted by Ito requires, first of all, a reversal of his veto on video images for the internal definition of space, ideally coupled with a non-structural means of changing the apparent identity of an elementary 'Big Shed' envelope. To the author's knowledge

little or nothing has been done along these lines. However, in their unplaced entry for the *Futureworld* 1993 'Home of the Future' competition, the Virtual Architecture Partnership (VAP) did design a variable-identity dwelling, capable of transforming its external appearance through the alignment of different images on three-sided rotating louvres, and transforming its apparent interior volume by means of video walls. In this way the identity of the outside of the house and the perceived shape of the interior were both freed from static formal constraints and opened up to the realm of interactive, immersive experience. Despite the rudimentary means employed, this project was truly terminal in so far as control over its inner and outer appearance depended entirely on a continuous flow of continuous electric current. In this project the concept of the house reached out to join the virtual reality of arcade video games and the IMAX cinema, demonstrating that exciting sensory experiences involving loss of orientation, time distortion and spatial anomaly need not be confined to screens or helmets, but could actually be lived as a domestic environment. Two subsequent VAP projects, one for a virtual reality 'House of the Future' to be part of a theme park in Barcelona, and the second proposed as an engineering study for a black-box office building with an artificial internal environment, were to have employed 3-D stereo projection in addition to video walls.[8]



For different reasons the Terminal Architecture of the 'Big Shed', the petrol station and the virtual reality building are all out of the mainstream of architecture. All of them are conceived in a different way and according to 'Terminal 2' scales of value. Yet because of this they illuminate the forgotten essence of architectural design, which is not art-historical nor cultural but functional, in the end simply a life-servicing technology expressed as covered floorspace. Culturally excommunicated architecture of this kind can be beautiful, just as a ship, a truck or an aircraft can be beautiful, but once it is no longer required to adhere to a permanent form or a permanent space, there is no need for it to be individually 'creative' or 'intellectual'. Nor is it required of designers that they should drive themselves mad, like painters putting up a fight against photography, by trying to design 'abstract buildings', like paintings by Picasso, Braque, or Nonja, the artist chimpanzee...

The issue of originality is an interesting issue in this context, and indeed an old one, having been the turning point of legal actions brought by and against artists in the nineteenth century.[9] A more recent case, which has already been mentioned, is exemplary because it involved undeclared originality. This came to light in 1935 when the celebrated violinist Fritz Kreisler admitted to a journalist that for 30 years he had been inserting pieces of his own composition into recitals of


An elevation of the VAP 'Futureworld' competition entry, showing the variable external identity achieved by means of commercial rotating advertising signs.

A distribution centre at Magna Park seen from a distance. 'Another kind of building altogether, a type so large, so numerous and so anonymous that it does not appear on ordnance survey maps, is not kept up to date by aerial photographic surveys, and is in all other respects almost completely ignored.'

the works of seventeenth- and eighteenth-century composers. Kreisler came under savage attack but he was unrepentant. If his listeners could not distinguish between the pieces he played and genuine baroque music, he argued, why should it matter whether they were forged or not?

The Kreisler episode has its analogues in architecture today. Architecture, like music, is inextricably bound up with the exalted myth of individual creativity that Kreisler exposed. Why this should be is not clear. All architects know, notwithstanding recent legislation permitting the registration of their designs, that their buildings are not really intellectual property in the same way as paintings, patents or musical compositions. Building a building is more like winning an election than writing a book. It is a process involving a cast of hundreds, if not thousands, of whom the architect is the only actor who may be trying to produce something original. The more architecture becomes a matter of combining finished assemblies, the more design time will be applied to it and the

more consultants will become involved. Logically, therefore, the more certain it will become that architects will have to share, or move away from meretricious claims of creativity and 'meaning'. Sooner or later they will follow the advice of the perspicacious Adolf Loos, who wrote a century ago, 'We have enough original geniuses, why don't we repeat ourselves endlessly instead?'[10]

Why not indeed? Because of the loss of 'individual creativity' in the built environment? Lasers, electronics, holography and video graphics are already beginning to relieve architects of this burden. What will remain for Terminal Architecture will be the sort of pure 'zero-defect' design that produces those modern paradigms of technological perfection: the motor car, the airliner, the racing yacht and the precision metal cladding system. Why this should not be a source of pride is a psychological matter connected with the self-image of the architectural profession. Few celebrity architects today are prepared to jettison their art-historical pretensions and admit that the design of buildings in the future is destined to be a process founded on the pursuit of technology transfers, every one of them passed beneath the Occam's razor of Richard Buckminster Fuller's first law of technological evolution, which says that the only valid measure of success is the capacity to achieve better results with fewer resources. To do this would be to admit that architectural design is no longer 'creative' in the old 'Terminal 1' sense, but 'mechanical', in the 'Terminal 2' sense that it depends upon a process of multi-sourced element combination that can better be systematized than created anew for every job.

Established on a proper financial footing, a research organization devoted to the task of creating the first architects' technology transfer data base could open up the key process of finished element combination so that it brings together the anonymity of the 'hot site', the efficiency of the 'Big Shed', the ephemeralization of the petrol station, and the limitless horizons of virtual reality, and exposes all of them to the methodology of automated industrial production. Such a project may sound more difficult than opening yet another architecture centre, or continuing to invent new tunes for old composers, but it is an enterprise that is admirably suited to the skills of the practitioners of Terminal Architecture.

Ultra fast, dirt cheap and error-free, depopulated instead

of overpopulated, the architectural profession that survives into the twenty-first century has the opportunity to become a producer of instruments, not a creator of monuments. It need no longer be enslaved by ideas of value drawn from the 'treasure houses' and museums of antiquity. Instead it will be free to exploit the products of research and development in every developing field of technology, living like a parasite upon the body of all productive industry, from aerospace to biotechnology – a paperless profession that will travel light, relying on electronic brainwork instead of voodoo symbolism and the tribal taboo of the past.

Southwood is a leading proponent of intelligent buildings. He has also shrewdly observed that ideas of place and space can be heavily influenced by information: 'The office buildings at Stockley Park near Heathrow airport have a central London telephone prefix so that potential tenants can believe they are in London.'

9 TERMINAL ARCHITECTURE

1 'You can be the master of potential disaster', Business Continuity Supplement, *The Times*, 6 February 1997.
2 'Architecture as an anti-technological virus: the work of Michael Trudgeon', *World Architecture*, No. 23, May 1993. See also 'World Hyper Kitchen', dealing with roll-in, roll-out kitchens for the conversion of redundant office buildings into apartments, *World Architecture*, No. 35, March 1995.
3 Antoine de Saint Exupéry, *Wind, Sand and Stars* (1942). Saint Exupéry's comments on technology are extremely insightful. The complete passage, referring to the evolution of the aeroplane, reads, 'Startling as it is that all visible evidence of invention should have been refined out of this instrument and that there should be delivered to us an object as natural as a pebble polished by the waves, it is equally wonderful that he who uses this instrument should be able to forget that it is a machine. Every machine will lose its identity in function.'
4 The role of the architects involved in the design of the Minworth distribution centre was typically negative. They saw their task as 'scaling down' the 20-metre-high by 240-metre-long building. This they did by adding huge purple panels, big gold Cadbury signs and Trabant-style styling strips to the 55,000-square-metre surface of its sandwich panel walls.
5 'And they all look just the same. . .', *The Observer*, 8 May 1994.
6 A notable example being Peter Buchanan of the magazine *Architectural Review*, who closed many lectures in the early 1990s with remarks to this effect.
7 Sources for Toyo Ito's quotes are *El Croquis*, No. 71, Madrid, 1995; *World Architecture*, No. 43, February 1996; and *World Architecture*, No. 53, February 1997.
8 The Virtual Architecture Partnership was formed in 1993 to explore the field of spatially disruptive design. The partners were Peter Wislocki and the author. The only fully designed project was the Milton Keynes 'Futureworld' competition entry (with Tony Keller), which was unplaced. The theme park proposal formed the subject of discussions with Peter Gabriel's Real World Studios group and with AVE Realization Ltd. The 'black-box' office building study was proposed informally to Ove Arup & Partners in 1995 as a suitable subject for funding by the Arup Foundation. The outline specification called for a very high-efficiency air-conditioned sealed urban commercial building, capable of operating in very poor air conditions with the capacity to reprocess its air if necessary. This building would have operated with lights out for video monitor work and would in effect have been 'glassless architecture', with the loss of direct visual contact with the outside world made good by high-definition moving images of 'natural scenery' projected inside.
9 Notably the famous Ruskin versus Whistler trial of 1877. See Gaunt, *The Aesthetic Adventure* (*op. cit.*).
10 Quoted in Kurt Lustenberger, *Adolf Loos* (1994).