

The title 'Bridging Art and Science' attempts to represent the philosophy behind the architecture of Wilkinson Eyre. As a practice we like to use the latest technology in our buildings and we draw inspiration from both art and science. We are keen to innovate and try to create something new with each project. Our first decade of work includes projects that range from buildings to bridges, from cultural to commercial projects, and from complex megastructures to small product designs. Each project is different and there isn't a clearly identifiable style but there is a distinctive design approach, which links all the work. It cannot easily be summarized in a few words but there are a series of central themes which underpin our design thinking.

Lightness, for instance, is a term much used in our design discussions and remains a prime objective in our architecture. Geometry is also vitally important to us, even though it is no longer a subject taught in schools of architecture. Through the use of sophisticated computer software, we are able to explore more complex geometries than ever before and with the use of current technology these designs can now be built. We are genuinely concerned with the movement of people through our buildings, and enjoy the dynamic perception of movement in geometry.

At the same time, we find examples in nature and in the parallel technologies of the aircraft, boat and car industries, which inspire us. The design of space is the very essence of architecture – and we are concerned with all aspects of spatial design. The concept of Universal Space is one that holds particular interest as a progression of the ideas proposed in my book *Supersheds*. The concept of a large roof enclosing a single volume of space, which can be used for a variety of purposes, is gaining momentum and our designs for Stratford Market Depot, Stratford Station and the Dyson Headquarters in Malmesbury are all examples of large roof enclosures.

We believe that building structures should be more responsive to the environment and their occupants. We design bridges that can open at the press of a button and we are looking to incorporate these systems in our buildings. Through our work with interactive science exhibits we are aware of the potential for buildings that are more active and responsive to their users. Sustainability is a key issue of our time and buildings should be more efficient and environmentally friendly. We look to incorporate both active and passive systems in our buildings where appropriate.

Quality is also a factor we strive for, which relates to attention to detail in design, and we take Mies van der Rohe's maxim, God is in the details, as an important consideration in our design.

We are known for our bridge designs, many of which involve extensive collaboration with engineers. This leads into another relevant theme, that of Architecture or Engineering, which is about the way in which we explore the boundaries and crossovers of these two interdependent disciplines.

In many ways the scope of Wilkinson Eyre Architects' work is different from other architects in that we design engineering structures as well as buildings. We have, for instance, been part of the team responsible for designing the hundred or so bridges on the new Channel Tunnel Rail Link from Dover to King's Cross in London. There were over 700 engineers involved in this project and our role was to help formulate design principles for a family of bridges and other visual elements for this important piece of infrastructure. This may seem an unusual area of expertise for an architectural practice, since we cannot calculate the stresses involved in bridges any more than we can with buildings. We do, however, have a good understanding of structural principles and a strong sense of aesthetics, which are invaluable to bridge design.



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01 *Bridge 1*, 1997 – Chris Wilkinson / acrylic on board / © Wilkinson Eyre Architects

02 Florence Cathedral, Italy 1296-1462 – Arnolfo di Cambio / Dome added in 1436 by Filippo Brunelleschi
Photographer - Oliver Tyler

03 St Paul's Cathedral, London UK 1675-1710 – Sir Christopher Wren (1632-1723)

04 Chapelle Notre-Dame-du-Haut, Ronchamp France 1950-55 – Le Corbusier (1887-1965)
Photographer - Oliver Tyler

As our work is seen as technology-based, it is often assumed that we are more concerned with science than art, but this is not the case. We see ourselves more as artists than technicians and our primary concerns are with aesthetics not calculations. We like to use the latest technology but we are also passionate about what our buildings look like and how they feel inside. Similarly, while we try to push the technological boundaries of bridge engineering we also want them to look good. Technology is for us only a means to an end.

Our buildings are functional but we strive for something more, something that gives depth and lifts the spirit. All good buildings have a spiritual quality, which affects one's emotions, but there is no simple formula for creating it. The process of architectural design is complex and difficult to define; it involves analytical decision-making combined with the application of technical expertise and creative innovation. It is in these creative aspects that architects look towards art for solutions but this is not an easy link to define because the artistic processes involved in design are quite different from those of fine art. Design involves a rational decision-making process where functions have to be fulfilled, risks eliminated and buildability ensured, whereas art demands high-risk factors and a freer, more intuitive process.

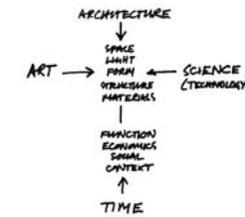
As both painter and architect, I am acutely aware of these differences. When I paint at the weekends I try to be free and lose the discipline of my architectural training but it is not easy. I decide on a starting point and see where it goes from there. Sometimes this leads to an almost complete painting in one session; but when I return to it, it almost invariably changes dramatically and this process continues until I feel comfortable with the result. There are times when a decision has to be made but I try not to worry about the consequences and if it goes wrong, I quite enjoy having to retrieve the situation, for this often leads to something new and different. The implications of 'chance' seem to be important to the creative process in art but are seldom allowed for in design. Having been trained as an architect, I am still in favour of the rigorous design process of fulfilling functions but I now believe there should be more scope for intuitive input and at Wilkinson Eyre we try to accommodate this in our work.

Perhaps architecture can be a natural bridge between art and science. In the past the differences were less pronounced and the quintessential Renaissance man, Leonardo da Vinci, succeeded in being a master artist, scientist and architect.

The distinction between architecture and engineering is relatively new. When Brunelleschi, the architect and goldsmith, designed the great dome of Florence Cathedral in 1436 he also worked out the engineering and had to invent ways of constructing it as well. At the end of the seventeenth century Sir Christopher Wren was an eminent mathematician, Professor of Astronomy and President of the Royal Society at the same time as being the country's leading architect. Even in Victorian times, I.K. Brunel was able to engineer the Great Western Railway and design the station buildings as well.

Later, at the start of the Modern Movement, there was more of a bias towards the arts but the importance of innovation and technology was recognized. Le Corbusier, who painted in the mornings and designed buildings in the afternoons, succeeded in combining some of the fluidity and colour of his paintings with the latest technology in his buildings. More recently, the Spanish architect and engineer Santiago Calatrava has made a powerful impact on bridge design. Being trained in both disciplines perhaps allows him to break the rules with confidence. Certainly his designs are not necessarily the most obvious engineering solutions, but do make strong visual statements.

At Wilkinson Eyre Architects we seek a synergy between architecture and engineering and try to extol the best aspects of both disciplines. We like to take a broad look at each design problem with the design team, sort out the functional aspects first and then allow time for creative ideas to emerge which might shape the basis of a solution. There are always many possible options but soon one approach will stand out as offering the best way forward. This idea is then tested in design development with the production of sketches, working models and drawings of all kinds, including 3-D computer modelling. The structural and environmental concepts are developed at the same time. It is a team effort and through continuous design sessions the



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- 01 Diagram showing relationship between art, science architecture and time – Chris Wilkinson / © Wilkinson Eyre Architects
- 02 Sea Urchin
- 03 Nautilus Shell
- 04 Water spider's enclosure

scheme is rigorously challenged in terms of its intellectual, visual and technical aspects. There is always an opportunity to change direction and we do whatever is necessary to reach the right solution within the deadline. Because much of our work is won in competitions, we have learned to progress from initial ideas to developed concepts in a very short time.

Good design comes from a combination of technical expertise, a high level of visual awareness and creative skills combined with confidence.

Science (technical) and art (creative) inform the five main visual elements of architecture: space, light, form, structure and materials. Other factors, such as context, social aspects, function, cost and programme may have more or less significance, depending on the kind of project. These all relate to time and are likely to change with time. They also relate to nature, which provides a source of inspiration for both art and science. It would seem likely that all known structures, geometries and proportions already exist in nature. They are clearly evident in plants, shells, landscapes and rock and bone structures, and if you look through an electron microscope you will discover a world of molecular structures that can open up an immense range of possibilities.

Space and light are two fundamental elements of architecture, which tend to work together and contribute to the quality of the interior environment. Most people are accustomed to regular rectangular spaces of modest proportions and it is therefore always exciting to experience something different. In nature, spatial enclosures are often curvilinear, organic shapes and if you imagine shell structures large enough to inhabit, they would make dramatic architecture. Our design proposal for the Retail Warehouse in Merry Hill draws inspiration from the sea urchin and our Merry Hill Multiplex follows the spiral geometry of the nautilus shell. The transparent beauty of a water spider's air enclosure creates an interesting space and one can get an idea of what it might be like to inhabit from our Air Pavilion at Magna.

From art, we can admire the experimental installations by the Californian Space Light Artists. James Turrell, in particular, has produced spaces where the enclosing surfaces lose clarity. Solid elements become immaterial due to the way they are lit and the space becomes almost infinite without a picture plane, in much the same way as it might in a painting. The blue space of the Wellcome Wing at the Science Museum in London, designed by MacCormac Jamieson Prichard, explores some of these ideas and in many ways we found that it provides an ideal environment for computerized interactive exhibits and digital displays.

Richard Serra's planar steel sculptures explore and control space in a different yet new and exciting way, which relates to architecture. The space, defined by planes of thick steel plate, is reminiscent of Mies van der Rohe's houses. These are modern spaces that allow free movement through from inside to out, which is something we have worked to achieve on a number of our projects, in particular the Four Seasons House, the Goldschmied House and more recently the Istanbul Science Centre, where the walls act as planes that define the space.

The control of light is also an important factor in the appreciation of space. Light from above, for instance from rooflights, is more powerful than from vertical planes and north-light glazing is more neutral than south-light glazing. Spaces that allow sunlight to penetrate the space feel more human and friendly, due to the warm colour of the light and movement of shadows, which animate the space and help with orientation. The rooflight at Park Hall Road, London, for example, draws inspiration from James Turrell's Meeting House installation and helps to create an expansive space in which the interior opens out to the sky. Clouds passing overhead seem to invade the space and when it rains, you are very much aware of the external elements.



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- 01 Wellcome Wing Galleries, Science Museum, London 2000 – Wilkinson Eyre Architects (Building Design: MacCormac Jamieson Prichard) / Photographer - James Morris
- 02 Goldschmied House, London, UK 1989 – Wilkinson Eyre Architects
- 03 *Let's not be stupid*, 1991 - Richard Deacon / stainless and painted mild steel / 545 x 1,380 x 450cm / Photographer & © Richard Deacon
- 04 Park Hall Road Skylight, London, UK, 1996 – Wilkinson Eyre Architects

At Explore at-Bristol the huge plane of glazing at the front of the building faces north. This not only prevents solar gain but also allows clearer views through the building and ensures that the light within the space is neutral and of even intensity. Where less light is required on the first floor, the glazing is restricted to a narrow band of clerestory glazing at each end, overlaid with a blue gel which greatly reduces light levels within the space. The use of clerestory glazing here (and at the Dyson Headquarters in Malmesbury) also serves to separate the wall and ceiling planes, giving clarity to the construction.

Form is particularly important to sculptors concerned with the shaping of materials and how light falls on surfaces. Michelangelo took an idealized form of the body for his statue of David whilst modern sculptors often distort and simplify the body to great effect. Both are equally valid approaches and ultimately influence the space in which they are set.

Richard Deacon's work is more architectural, in that the forms enclose and engage with the surrounding space. His Lets not be stupid piece at Warwick University allows a twisted form of steel construction partially to escape from a pen-like enclosure, which seems to provide form and metaphor at the same time. The Spanish artist Eduardo Chillida also explores space and form in a way that relates to his training as an architect.

In architecture, form not only strongly influences the external visual appearance of a building but also affects the interior space; the two cannot be separated.

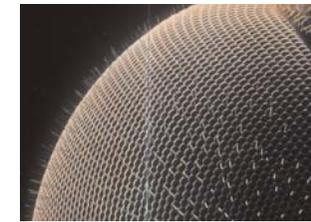
We are fortunate to be living in an age of advanced technology which allows us to design and construct much more sophisticated forms than ever before but we cannot compete with nature which still provides the ultimate source of inspiration.

We are only now beginning to learn about the remarkable geometry and proportions that exist in our natural surroundings. It is fascinating to read in Ian Stewart's book Nature's Numbers how often spiral forms and the Fibonacci series (an infinite series of numbers in which each number is the sum of the previous two) occur. The magnified view of the fly's eye, for example, shows how a dome can be constructed of smaller elements in much the same way as a geodesic structure. The fluid form of sand dunes and wave patterns offers a rhythmic beauty, which surpasses most human constructions.

Similarly, there is much to learn about structural systems and how they work in nature. For in nature economy of means is invariably a priority: the shape of bone structures, for example, clearly follows the patterns of stresses applied to them, just as the skeleton works in conjunction with the tension members of muscles and tendons.

The remarkable structure of the beehive sets a precedent for lightweight honeycomb structures and parabolic curves occur consistently in plant forms, but even more basic is the geometric code of life itself in the wonderful form of the double helix. Crick and Watson's splendid first model of DNA resides in our Making the Modern World Gallery at London's Science Museum. Embodied in our bridge and building designs is our extensive research into structures. For example, our 'tree structure' proposal for the Willis Faber Headquarters courtyard enclosure, which was worked out with the engineer Tony Hunt in 1984, would have been one of the first of its kind had it been built. It was unusual in the way it branched out like a tree, to cover a large area of support for the glazed roof above.

Then, more recently, the Challenge of Materials Bridge at the Science Museum drew inspiration from several different sources. In the initial dialogue with the engineer Bryn Bird, four images were produced which influenced the concept for the structure. These were a spider's web, a sculpture by the Australian artist Ken Unsworth called Stone Circles II, the first man-powered flight machine Gossamer Albatross and a glass sculpture by the artist Danny Lane. The completed structure utilized a deck of glass plates standing on edge, supported by an array of high-tensile steel cables so fine as to be almost invisible – like the spider's web.



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- 01 Magnified view of a fly's eye
- 02 Drawing: Ten Trinity square Courtyard Enclosure, City of London, UK, 1986 – Wilkinson Eyre Architects
- 03 DNA Model – Crick and Watson / © Science Museum London UK
- 04 Glass balustrade detail by Danny Lane for V&A Museum Glass Gallery, London UK – Pringle Richards Sharratt Architects
- 05 Suspended stone circle II, 1984 – Ken Unsworth / 103 river stones and wire / 1,100cm diameter / © Art Gallery of New South Wales, Sydney Australia

Finally, the study of materials and the possibilities for their innovative use plays an important part in the development of our architecture. Understanding the qualities and performance of materials is essential to achieving the right design and specification. This is relatively easy with traditional building materials because there are so many precedents, but new materials provide more of a challenge and with it the opportunity for innovation.

New products are developed to fulfil a need and although this may not be specifically for the building industry, there may be applications in our work so we keep an interest in parallel technologies. There are many opportunities for this transfer technology – the teflon coatings developed by NASA for the space industry, for example, are now widely used with fabric membranes to provide a long-life durable finish. Similarly, the ‘shot-peening’ process developed in the aircraft industry for creating smooth curves on metal sheeting, is now used for other applications. Following our own research, we specified its use for stainless-steel cladding at Stratford Station, where it has proved to be extremely durable and London Underground have adopted its use throughout the network.

Composite materials such as carbon fibre are also widely used in other industries, such as boat building and Formula 1 motor racing, but have been slow to take off in the building industry. With their great advantage of high strength to weight ratio, we see their obvious relevance to bridge building and we have been working on an experimental bridge project with DERA at Farnborough to progress these ideas. We have also used the material successfully on our Lockmeadow Footbridge at Maidstone – for the balustrade supports. This was originally instigated by a subcontractor working on our South Quay Footbridge, who suggested that he could match the price of stainless steel for balustrading in carbon fibre and give us any shape we wanted. He showed us a sample of the Lotus bicycle frame used by Chris Boardman to win the gold medal at the Olympic Games and we were hooked. It was then only a matter of time before a situation arose in which we could put the material into practice and the result is the spectacularly shaped balusters that support the stainless-steel wedge wire infill. We now have experience of this

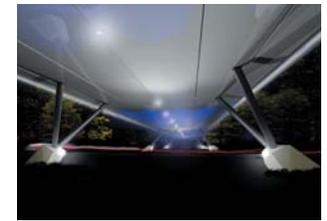
material and look forward to developing new uses for it in the future.

Materials science continues to advance and the new area of development is in the field of nanotechnology, where the molecular structure of materials is changed to suit the requirements. We know, for instance, that the molecular structure of carbon, when changed to a spherical geodesic form, becomes more fluid. This new carbon molecule C60 has been named a ‘fullerine’ or ‘bucky ball’ after Buckminster Fuller. With the progress of this kind of technology, it will not be long before we are able to specify the performance of the materials we want to use in construction instead of being restricted to the use of known materials.

Adriaan Beukers, in his book *Lightness*, says ‘The most important thing to do when choosing a material for a certain function is to keep an open mind’, but then this could be said to apply to most things in architecture and it is certainly true in our office. At Wilkinson Eyre Architects we see ourselves as a creative design force, keen to take on new challenges and find exciting new solutions to old problems. Since the practice formed we have moved into many new areas of design work and have been able to make a valuable contribution in these sectors. It wasn’t until 1991 that we started to work on railway projects but now, several projects later, we are recognized specialists in that field. Similarly, it wasn’t until 1994 that we designed our first bridge but we are now working on bridge design throughout the world. We very much enjoy designing museums, educational buildings and leisure facilities as well as industrial and commercial projects. We have successfully completed several commissions for product design, exhibition design, landscaping and masterplanning, all of which have been both challenging and enjoyable. There are no areas of design that we would not attempt, as long as the problem is interesting and the opportunity exists for a good design solution.



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- 01 Gossamer Albatross
- 02 DERA Advanced Technology Bridge
Project, Farnborough UK
1999 – Wilkinson Eyre Architects
- 03 Lotus Bicycle Frame