ARCHITECTURAL THOUGHT:
THE DESIGN PROCESS
AND THE EXPECTANT EYE

MICHAEL BRAWNE

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Introduction

Architectural thought is primarily non-verbal thought; a fact of very considerable significance since so much of our every-day thinking is verbal. We are accustomed, in particular when communicating consciously, to use words; at a less conscious level, body language is ubiquitous. Education reinforces that pattern. What is more, it is virtually impossible to conduct a non-violent argument except verbally; I could not communicate the ideas in this book by non-verbal means, say through drawings.

Yet architects are of necessity involved in drawing by some means or other and continually think non-verbally as part of their normal architectural activity. Visual thinking is particu-larly relevant at the design stage which is also the stage in which an architect makes the most significant impact. To imagine and record spatial organisation would generally be recognised as the activity which distinguishes an architect from others involved in the creation of buildings. This is not to suggest that architects have a monopoly in non-verbal thought. Clearly musicians, painters, sculptors, engineers, product designers, graphic designers, different craftsmen, film makers, some scientists and many others equally and routinely pursue visual thinking. Yet it is possible to modify Descartes dictum and say 'I think non-verbally therefore I am an architect'.

What is surprising, however, is that verbal thinking has been a subject of argument for philosophers and others for centuries yet non-verbal thinking has been greatly neglected. It is as if the use of words to discuss an activity that discards words is in some way an impossibility or at least illogical. It is undeniably difficult but not therefore to be dismissed. Nor must it be assumed that a definitive statement is probable. Linguistic philosophers have, after all, not produced unchallenged answers either.

Charles Eames – architect, furniture designer, film maker, exhibition designer – on being asked 'What is your definition of "design"?' answered 'A plan for arranging

Left
Charles & Ray Eames, unpadded wire mesh side chairs with 'Eiffel Tower' base; the black bird is a piece of early American folk art

elements in such a way as to best accomplish a particular purpose' (Neuhart, Neuhart & Eames, 1989, p.14). The definition places a good deal of emphasis on the eventual outcome and rather less on the process of arriving at a result. It does imply, however, that design is always concerned with some future event; that it is an attempt to forecast that event by whatever means are appropriate and available at a particular time: a drawing, a model, an electronic simulation. In a real sense it is a prophecy. In architecture, preceding that, must invariably come visual thought.

Forecasting a future event occurs, of course, in many other pursuits which involve visual thought as well as those that concentrate on verbal thinking. Several carry out some form of design in the widest sense. What goes on in architecture may thus be of significance to a wide range of activities unrelated to architecture.

The generally interesting and, I believe, relevant question is therefore: how do we proceed from the past and present to a forecast of the future. Moreover, although we know that the outcome is time dependent, we need to ask whether the process, and especially the sequence of design, is also historically variable. If some general pattern were to emerge both over time and between individuals, we might be somewhat nearer to at least a tentative explanation of the process; to a theory.

An interest in theory is neither novel nor idiosyncratic. A standard work – *A History of Architectural Theory from Vitruvius to the Present* by Hanno-Walter Kruft, first published in German in 1985 and in English in 1994 – consists of 609 pages of closely printed text. A great part of the work deals with historical aspects such as analysis of styles while another significant part is devoted to theory that is prescriptive rather than explanatory. Vitruvius is a case in point. In his dedication of the work to the Emperor Augustus from whom he was receiving a pension he wrote:

'Furthermore, with respect to the future, you have such regard to public and private buildings, that they will correspond to the grandeur of our history, and will be a memorial to future ages. I have furnished a detailed treatise so that, by reference to it, you might inform yourself about the works already complete or about to be entered upon. In the following books I have expounded a complete system of architecture.'
(Vitruvius, 1983, p.5)

The so-called system is largely a 'how to do it' manual; a theory, however, is not a set of rules. Despite their apparent usefulness, the '*Ten Books*' were little regarded after their publication at the end of the first century BC. That did not prevent them from becoming, over a thousand years later, one of the most influential works ever written on architecture. The same primary interest in the final product could be ascribed to the manifestos and pronouncements of the Futurists or the Metabolists in the 20th century.

Such a lack of discussion of design is surprising and regrettable. Yet to take a recent publication, very few of the 59 architects, critics and historians whose texts appear in the anthology *Architecture Theory Since 1968* devote much space to this topic (Hays, 2000).

It is only in a few journals that the subject has received much attention (Bamford, 2002, p.245). What distinguishes this book is that it is primarily interested in that part of the theory of architecture which touches the necessary and primary activity of design. And it is design which determines the end result; but always, it should be remembered, design created at a particular period.

Time

Left
Balthasar Neumann,
Pilgrimage Church,
Vierzehnheiligen,
Germany 1743 – 72,
interior looking east

The eleventh edition of Sir Banister Fletcher's *A History of Architecture on the Comparative Method* published in 1943, which was my student copy bought second hand about five years later, does not list Balthasar Neumann's Vierzehnheiligen or the Assam Brothers' S. Johannes Nepomuk Church in Munich, to take two exuberant examples of South German Baroque. Ever since the first edition of 1896, these buildings were clearly not considered sufficiently significant to be included. The twentieth and centenary edition of 1996 describes both churches and moreover devotes space to illustrations. The earlier editions also made a clear distinction between two curiously labelled divisions: the historical styles derived from Egypt and the classical world of the Mediterranean and the non-historical styles which embraced any non-European architecture. The latest edition makes no such distinction and takes a much more global view. Such a change in approach owes as much to politics and an awareness of where the market is to be found as to art history.

All buildings have meanings that are deeply enmeshed with their appearance. That can surely be taken as axiomatic. But that appearance is itself read differently at different times and to some extent depends on what we want to see, what our eye expects to have presented.

In 1938 – 39 Sigfried Giedion delivered the Charles Eliot Norton lectures at Harvard which were subsequently published in his highly influential *Space, Time and Architecture: the growth of a new tradition*. The third and enlarged edition of 1954 gives considerable emphasis to the baroque both in architecture and urban planning. Francesco Borromini, Guarino Guarini and Balthasar Neumann are prominent. Vierzehnheiligen, for example, is discussed in terms of the control of clear light on curved surfaces, and in the relation of architecture, sculpture and decoration. The main reason for its inclusion, as of the other examples from the baroque, is, however, that there is a freedom of planning and an exploitation of non-euclidean geometry.

Giedion wants to use these attributes to give historical backing to what he sees as the crucial characteristics of contemporary architecture. On the other hand Charles Eames, photographing Vierzehnheiligen and Ottobeuren in the same year as the third edition of *Space, Time and Architecture* concentrates almost exclusively on architectural and sculptural detail seen in rapid succession. That film – 'Two Baroque Churches in Germany 1955' – was made by transferring 296 slides onto film. The experience of seeing close-up images in quick sequence is thus to some extent suggested by the technique of communication which Eames had chosen. It thus seems very likely that how we communicate also affects, in some measure, the final outcome. Similarly, our expectant eye appears to operate when we draw, whether by hand or computer, and is in turn influenced by the drawings that are produced by us as well as others.

Architecture is never simply a matter of piling materials on top of each other to produce buildings but the thoughtful manipulation of those materials on the basis of ideas which are, however, historically changeable. Powerful among these ideas would be the currently accepted notions of innovation and continuity. These ideas are highly likely to affect the eventual visual outcome, namely that outcome which makes the most direct and quickest, though by no means only important impression on our senses. It also, rightly or wrongly, leads to the most immediate judgements.

It is this relation between ideas, architecture, and what we expect to see which is one of the significant topics of this essay. The reason for choosing the topic is that ideas and selection play a crucial role in how we create architecture; they have indeed done so for centuries and continue to do so today. It thus affects all of us and, as a result, is surely of general relevance.

The focus of this book is on architecture and particularly that conceptual aspect which is totally intertwined with the

design process. Eventually we are, of course, involved with the perception of the outcome of any design. The two are, however, not the same: we conceive of the earth as curved but we see it as flat (unless we are astronauts). In a different but related way, we conceive and then read a plan, but we see spaces. What the eye sees is the eventual test and the memory of that seeing influences subsequent concepts. It is inevitably a cyclical sequence.

Two temples

In the Place de la Comédie in Nîmes and facing the Maison Carrée stands the Carré d'Art designed by Norman Foster and Partners. The temple probably dates from the first century and is among the best preserved Roman temples. It is, to describe it in art historical shorthand, a small hexa-style pseudoperipteral Corinthian temple on a podium. It is built of limestone and has a tiled roof. The Carré d'Art was completed in 1993 and houses art galleries, a library, a roof top restaurant and a very dominant movement space. It is built mainly of concrete, steel and glass. In function, materials and date there is clearly a wide gap between these two buildings. Very similar Roman temples to the Maison Carrée can be found at Vienne, south of Lyon and in Pula on the Dalmatian coast. Only slightly less similar ones are built throughout the Roman Empire over a considerable time span. We do not need very specialised knowledge to recognise a Roman temple when we see one. The Roman temple belongs, it seems, to an architectural tradition which covers a wide time span and which pays little attention to locality. The differences between a temple in Rome and one in Bath in south-west England are very much less than their obvious similarities. The temple of Antonius and Faustina in Rome is, for example, very like the Maison Carrée though a hundred years later. Continuity and only minimal change are the obvious hallmarks.

Norman Foster's much larger building may share certain similarities with his Cranfield University library of 1990 – 95,
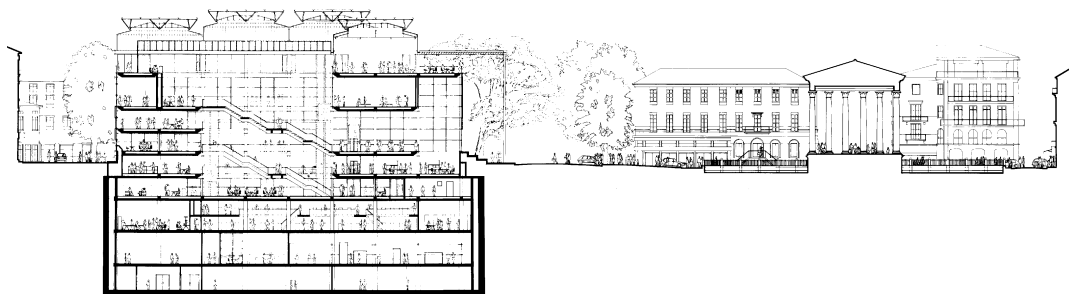
but hardly any with the later Law Faculty Library at the University of Cambridge. Equally there may be some echoes in Nîmes of Foster's much earlier Sainsbury Centre for the Visual Arts at the University of East Anglia (1978) outside Norwich yet few of his later buildings could be said to resemble the Carré d'Art. Innovation is given precedence over continuity. There is arguably a greater difference between successive buildings which come from the office of Norman Foster and Partners than there is between a great many Roman temples in Europe and North Africa built over more than one century. It has, for instance, been argued that 'a dozen fragments, with the dimensions of the foundations, may enable a trained investigator to reconstruct with certainty the main features of a temple of which nothing had remained above the soil' (Robertson, 1943, p.2). Such reconstructions of temples, but not of other building types, are only possible because of the almost invariant repetition of the form.

Many of the design determinants of the Carré d'Art stem from the existence of its classical neighbour across the square. Principal among these was the decision to keep the roof of the new building as low as possible. This resulted in very considerable excavation; there is more construction below than above ground. The placing of the library and other accommodation below street level in turn influenced the design of the open central core with its glass staircase which allowed daylight to filter down the lower floors. This luminous central space is now one of the memorable characteristics of the building.

Externally, the Carré d'Art has, like the Maison Carrée, a columnar screen and portico. It is also raised on a podium. It might be said that the two buildings rhyme though very different in appearance and meaning. The acknowledgement of the predecessor and of an existing skyline is not accidental but a very deliberate design act fully confirmed by the architect (Foster, 1996, p.22).

We believe that Greek temples were sited in relation to certain features in the landscape, and in particular, to the profile of hills (Scully, 1962). There was a kind of dialogue between the exterior environment and the building, between nature and the physical embodiment of the gods. Neither Greek temples nor Roman ones, however, altered their primary architectural form because of locality. The idea that we should do so – currently an accepted norm – was, it would seem, not relevant. Yet no-one at the time or, for that matter, now would suggest that Roman temples are less visually appealing because of their general similarity.

If we accept that architecture is the deliberate manipulation of space and materials on the basis of ideas, then a number of conclusions follow. One of these might be that it may be possible to discover some explanatory ideas in so far as they affect design and that, moreover, we might attempt to categorise these in order to clarify our understanding of the design process. Such an understanding might then have an impact on both the practice and the teaching of architecture.

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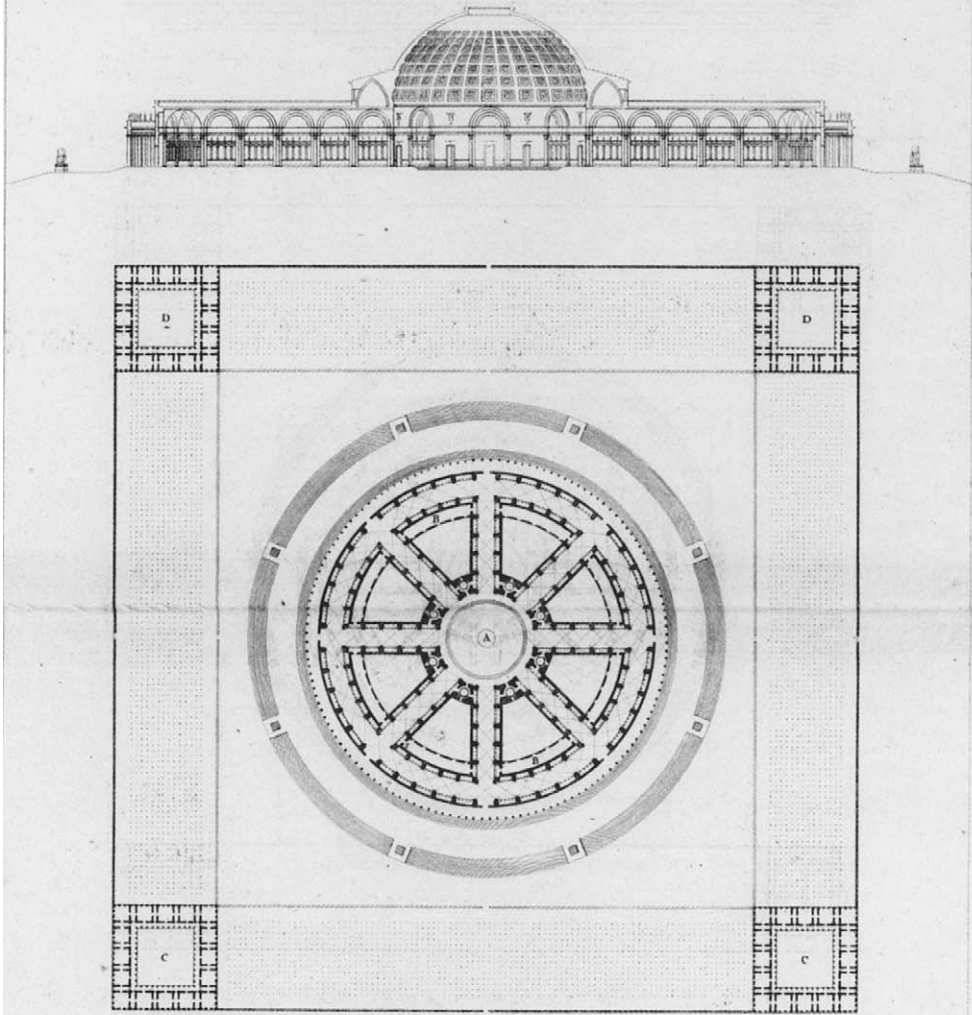
A . Bibliothèque.

B . Manuscrits, Médailles, &c.

C . Logemens des Bibliothecaires.

D . Imprimerie, Dépots &c.
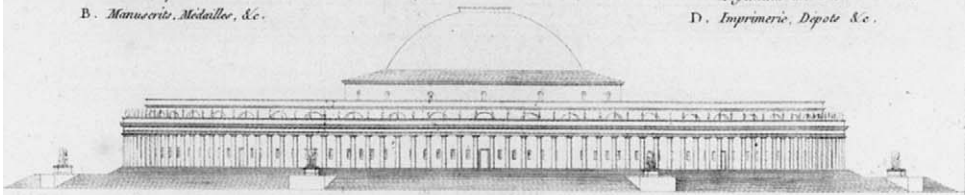
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Can we describe how we design?

The first and impulsive answer to the question is 'no'. We believe that design is a mysterious and individual activity which is beyond description; it happens but is not amenable to analysis. The same could be said of a great number of human activities but we do not immediately conclude that they are beyond description. A large segment of the population is, for example, engaged in some economic activity. The underlying description of that activity, of its basic organisation, may not be agreed but both free-market proponents and Marxists would hold that a theory – an explanation – can, perhaps must, exist. What is more, the way economic activity is conducted will depend a great deal on which theory is held to be operative. Theory and practice are not unrelated matters.

By analogy, can there be theories of design? 'Theories' is advisedly used in the plural on the assumption that there is unlikely to be a single all-embracing theory which is able to explain the process of design at all adequately. Theory is here meant not as the antithesis of practice but in the sense of explanation, that is in the sense that it is normally used in science to describe a series of related phenomena.

It is important at this stage to make a very clear distinction between a design theory and design methodology. A theory is, at least initially, a non-prescriptive explanation which does not have an architectural end in view. Design methodology, on the other hand, describes specific operations which are believed to be helpful in the design sequence. Such operations might include matrixes, flow charts or brainstorming. These are, however, tools which one may employ but which are neither essential nor in any way an analysis of the design process itself. Design theory is also totally unrelated to design appreciation, a horrendous topic prone to a host of pitfalls and in any case unlikely to be discussed in a meaningful way.

The test for a design theory in architecture – or for that matter in any other design discipline – would be that it offers a descriptive explanation of the way the design process operates.

The explanation also needs to be sufficiently general to embrace a significant number of examples and to be seen to correspond reasonably well to the way in which we actually design or, at least, to the way we think we design.

The test may, what is more, be influenced by our views on innovation and continuity. We may, if we are traditionalists for instance, favour one explanatory theory because it strongly supports continuity at the expense of innovation. Our test is therefore unlikely to be value free.

The architects of the temples erected throughout the Roman Empire over several centuries worked, it would seem, on the basis of accepting a form as a *type* which is only to be varied within narrow limits. The idea was very much later given some formal underpinning when in 1800 J.N.L. Durand published a volume called a *Compendium & Parallel of Ancient & Modern Buildings*, the *Recueil,* and between 1802 and 1805 his '*Précis des leçons d'architecture données à l'École Polytechnique*'. Both are predicated on the idea that there are building types and that these have a discoverable morphology. The volumes illustrate these types under various headings – towns halls, abattoirs, theatres – and the designs are now most notable for their uniform symmetrical neo-classical appearance. The architectural categorisation is seen as a rational parallel to the classification of plants and animals which had taken place in the 18th century and which had proved so scientifically fruitful.

In Sweden, for example, Linaeus (Carl Linné 1707–78) devised a botanical taxonomy which was the first major attempt to bring some systematic order to a part of the natural world. Such a system of classification proved extremely useful and is still applied today. If such an immense and varied area of study as that of plants can be ordered according to a comprehensible system, cannot a similar system be achieved for architecture? Linaeus based his classification on the form of the plant's flower; Durand's published volumes categorise buildings by their function. However, this biological analogy – like many

other analogies applied to architecture – has its dangers. The
existence of species and their acceptance as distinct recognis-
able entities depends on the fact that they copy themselves; that
there is a process of 'invariant reproduction'. We know swans
from geese because each species reproduces its particular
characteristics sufficiently faithfully. Arguably Roman temples
are equally recognisable as such and can be distinguished from
other building types. Buildings for the performing arts may also
display morphological similarities in plan and section that make
them readily recognisable. It is unlikely, however, that the theory
of types, of typology, can be applied to most buildings. The the-
ory is, it would seem, of limited utility, although in the last fifty
years typology has found serious support in the writings of
Aldo Rossi and Rob Krier. Both base their views on their under-
standing of the traditional (i.e. pre-20th century) European city
centre and the kind of spaces and buildings which it created
rather than on function. Its limited application does not, it
must be emphasised, make it invalid; it only means that we are
justified in looking for other theories that might have greater
application.

The fact that Durand used the function of a building as
the significant characteristic is probably not fortuitous. We
recognise that buildings vary according to their purpose and
daily see the difference between them. It is the most obvious
categorisation. What is, however, also assumed is that such
systematic ordering will enable us to design future solutions
on the basis of the discovered type; that success depends on
the repetition of the significant characteristics.

The idea that form arises from the functions to be
performed in a building and that these can be specified is,
ultimately, underpinned by the notion of determinism. In its
functionalist guise, however, determinism has a number of
logical problems. The first is that any set of functional criteria –
verbal or numerical – have to be expressed without simply being
a description of the solution. If the solution is already present,

the criteria need not be enumerated. The second difficulty is that it is extremely difficult, if not impossible, to establish a direct correspondence between a set of verbal and numerical statements and a set of forms. It is only possible if the form exists and we simply describe the known form in verbal and numerical terms; we are thus back to the first problem.

The third difficulty, which is certainly equally crucial, is that we can never be sure that we have enumerated all the criteria on which a solution is to be based. To say that we have selected the most important ones immediately introduces a set of value judgements and questions as to who is to decide which are the most significant and how do we determine what is important. The theory is not as neutral as it might at first appear.

There is also a general problem as far as all aspects of determinism are concerned: is there free will? In the case of functionalism, one manifestation would be: do we have any visual choices? If we accept that the building design emerges from a series of points established in a programme by the client and by society, and also from another series which exists within a culture, it would follow that if these points are thoroughly analysed and understood, one and only one solution should result. The moment we allow personal choices, the theory is undermined. We know from the most cursory observation and from personal experience that we are continually making visual choices which are in no way related to the programme. They stem from quite different roots. To deny such roots and to label all visual choices 'formalism' is to negate experience and to attempt to establish some form of rationality which is spurious and certainly suspect.

Both typology and functionalism have their roots in the use aspects of the building. Both say nothing about appearance even though style may eventually become a distinguishing aspect of each theory. Despite their common root, the two design theories lead to opposite results: typology favours continuity, functionalism is more likely to lead to innovation, it may

even denigrate continuity. What becomes obvious is that theo-
ries are not only explanations of the design process but can –
and often do – also embody specific values.

Typology and functionalism stem ultimately from the
sciences; from outside architecture. The view that there is a lan-
guage of architecture which operates on the basis of a discov-
erable *grammar* through an understanding of past architectures
is a more recent development which we owe to Christopher
Alexander at the University of California, Berkeley. Christopher
Alexander and others produced *A Pattern Language . . .* in 1977,
the second in a series of books in which *The Timeless Way of
Building* is the first. It contains 253 patterns, each defining some
'atom of the environment' and ranging in scale from indepen-
dent regions and the distribution of towns, to ornament and
furniture. Each pattern carries a specific recommendation, an
architectural answer, which is seen as the correct outcome
of the analysis of the problem. The eventual combination of
answers is hinted at but not specified. The illustrations in both
volumes suggest very strongly that the timeless way is to be
found in traditional vernacular architecture. The strong impres-
sion is thus that continuity rather than change will produce the
most relevant architecture for society.

One of the inevitable doubts which arises is that gram-
mar in language is something that exists and is in fact extracted
from the language as used to provide rules for sentence struc-
ture. The other immediate unease arises because grammar
provides generating principles but says nothing about content.
Even nonsensical sentences can be grammatical. The claim
that is, however, made by Alexander and his collaborators is
that it is they who have devised a grammar. Judging by the
illustrations which accompany the patterns, it would seem that
the grammar is most evident in buildings of the past and that
innovation is unlikely to conform.

Clearly any single building would not emerge from fol-
lowing every one of the 253 patterns. It therefore becomes

necessary to select and apply judgement as to which patterns are relevant. This is to some extent helped by a Michelin type star system – devised by Alexander – and by the fact that each pattern begins and ends with a list of other patterns to which it relates within the network.

The assumption implicit in the theory is that a design can be created by assembling the 'atoms of the environment' rather than by starting from a view of the whole, as in typology, for instance. Such design by accretion puts a low premium on intuitive leaps.

There are, it would appear, a number of architectural difficulties in these theories in the sense that they make propositions which go counter to the way we believe we design or which, if actually carried out, would produce buildings which are unlikely to solve the problems of creating architecture as we know it. There are additionally very serious logical issues which, for example, Janet Daley – a philosopher – addressed at a symposium in Portsmouth in 1967 (Daley, 1969, pp. 71–76). She aimed her 'most vituperative abuse' (her phrase) at behaviourism and Alexander's *Pattern Language* for their internal contradictions and misuse of language. She particularly castigates behaviourism for its assumption that it is value free, and *Pattern Language* for its belief that it can establish the criterion of rightness. Neither seems a safe theory to follow or to use as an adequate explanation.

The three theories which have been outlined stem initially from outside architecture. Perhaps we should look for theories from within architecture since these might turn out to be more applicable. Arguably there are two theories which need to be considered: that of universal space and that of served and servant space. We associate the first with the work of Mies van der Rohe and the second with Louis Kahn. Both theories, however, suffer from the weakness that they are as much prescriptive as descriptive; they tell us rather more about what we should do than explain what we actually do when we design.

Typology, functionalism and the Pattern Language all
have embedded within them as fundamental the idea that preci-
sion in knowing what the uses of a building are to be is likely to
be highly beneficial in determining a design; may, in fact, be
essential before even a start can be made. The theory of univer-
sal or anonymous space starts with the opposite assumption,
namely that we are unlikely to know all aspects of the uses and
that in any case these are going to change over time. What is,
therefore, required is undifferentiated space within which a
great number of activities can take place with only minimal
adjustment. We devise a whole rather than analyse the atoms.

But is there such a thing as undifferentiated space? If we
take the open floor of Mies's Crown Hall of 1950 – 56, the build-
ing for the departments of architecture and city and regional
planning as well as the Institute of Design on the Illinois
Institute of Technology campus in Chicago, it is at once
obvious that we are dealing with a very large space. The column
free plan measures 220 ft by 120 ft (67 m × 36.5 m) and is only
interrupted by two service cores. Free standing partitions can
be placed anywhere. Mies said of Crown Hall. 'I think this is the
clearest structure we have done, the best to express our philos-
ophy'. Yet it is hardly undifferentiated space, to be near the
glass perimeter is very different to being in the middle.

To overcome this, many buildings and particularly
factories, substituted opaque walls for glazing and excluded
daylight or only allowed highly controlled light to come through
the roof. This may have solved one problem but simply created a
host of others: view out, a sense of daylight and sunlight, contact
with the outside, were all ruled out. Aldo van Eyck coined the
phrase 'the glove that fits every hand, fits no hand' as a way of
describing the dilemma, but by no means offering a solution.

The fact that Mies did not fully achieve his aims – in any
case a whole array of small and specific rooms is placed in the
semi-basement – does not detract from his greatness as an
architect or the significance of Crown Hall. It only demonstrates

that even a great architect is unable to apply the theoretical assumptions in practice.

Kahn's categories are probably not surprising in view of the increased importance and cost which services occupied in a great many buildings, and not just laboratories, in the second half of the 20th century. One suspects that the characteristic emphasis on these two categories was abetted by the ability to create greater expressiveness than was then current in architecture. It was a rationale for form making. Although it is generally seen that way, Kahn vehemently contradicted that conclusion in an interview and also emphasised the difference between the architect's gesture and the engineers' use of the given space.

'I have made statements about the Richards Laboratories towers. I have said, *These shafts are independent exhaust.* Now they are being taken as showpieces. I wouldn't think of that. They are not worthy. These ducts are generalised units for certain services, without knowing what they are. I wasn't making jewelry out of exhaust ducts. They are simple, but they are not ordinary. I sense the differences in instruments in the broadest way, but I don't know every mechanical detail. First of all, I don't know the instruments that well. I cannot distinguish one thing from another. So I put them all in one great big wastebasket, and that's the exhaust duct. But to pull it out and make a submarine out of it, that's ridiculous!

'Let me put it a different way. The space you live in can be beautiful, especially if it is unfettered by all these other things. I don't believe in pipes in living rooms. I hate them. I believe they should be in their place like children. I want to remain ignorant of how the mechanics really work. I'm impatient with the restrictions of mechanical and construction engineers and with details about how every little thing works. But its *place* I think I know. I want

Right
Louis I. Kahn, Richards
Medical Research
Laboratories, University
of Pennsylvania,
Philadelphia, Pa. 1957 – 60,
south façade ca. 1959

to express that which is worth expressing, that which has grown to be a distinct characteristic. When one is characteristically different from another, I don't want to make a homogenous mixture of the two. I want to bring out the difference. But I care very little if one pipe goes east and the other goes west. I don't want to make a special characteristic out of pipes, because I know that mechanical things are the first things that are going to be changed or altered; but the space you live in must be alive for a very long time. The space is a new landscape, which is to last as long as the material lasts. But the spaces which are serving it are made to change. Their position must be very general and they must be big enough for change and addition to take place. This is truly the nature of architecture. It is not giving service an individual shape.'
(Wurman, 1986, p.205)

This division into served and servant spaces was seen **29**
by Kahn as the present-day and relevant order of architecture:

> 'The space order concept must extend beyond the har-
> boring of the mechanical services to include the
> "servant spaces" adjoining the spaces served. This will
> give meaningful form to the hierarchy of spaces. Long
> ago they built with solid stones. Today we must build
> with "hollow stones" '
> (Latour, 1991, p.80)

There is, though, another and different reading of the Richards
Medical towers. Kahn travelled widely in Europe and the Middle
East at different times. His travel sketches record his impres-
sions (Johnson and Lewis, 1996). Many of these depict massive
vertical forms; the solidity of the form and its relation to light
are the most recurrent theme. It is evident in the watercolour of
the towers in San Gimignano of 1928, in the drawing of the
hypostyle hall at the Temple of Amon in Karnak of 1951, the pen
and ink drawing of Carcassonne of 1959, or of the cathedral in
Albi from the same year. This preoccupation with columnar
forms in light and shade is already evident in one of his earliest
illustrations, that of the main portico of the Palace of Liberal
Arts at the Sesquicentennial International Exhibition held in
Philadelphia in 1926.

The influence of these buildings, Kahn claimed, was
indirect. In a conversation in 1971 he put it like this:

> 'How do you integrate sites in Italy such as Siena or
> Carcassonne into your architecture?
> 'I have not integrated.
> 'That's the point that is missed in the statements that
> I've made. People don't understand what I've said.
> I respect Carcassonne – not because it's the only exam-
> ple. I haven't scurried around the world and picked on one
> thing and said: *Carcassonne!* I come upon things all the
> time which are new to me, which were there all the time.

Right
Louis I. Kahn, pen and ink
sketch on paper of the
apse, Cathedral of Sainte
Clare, Albi, France 1959
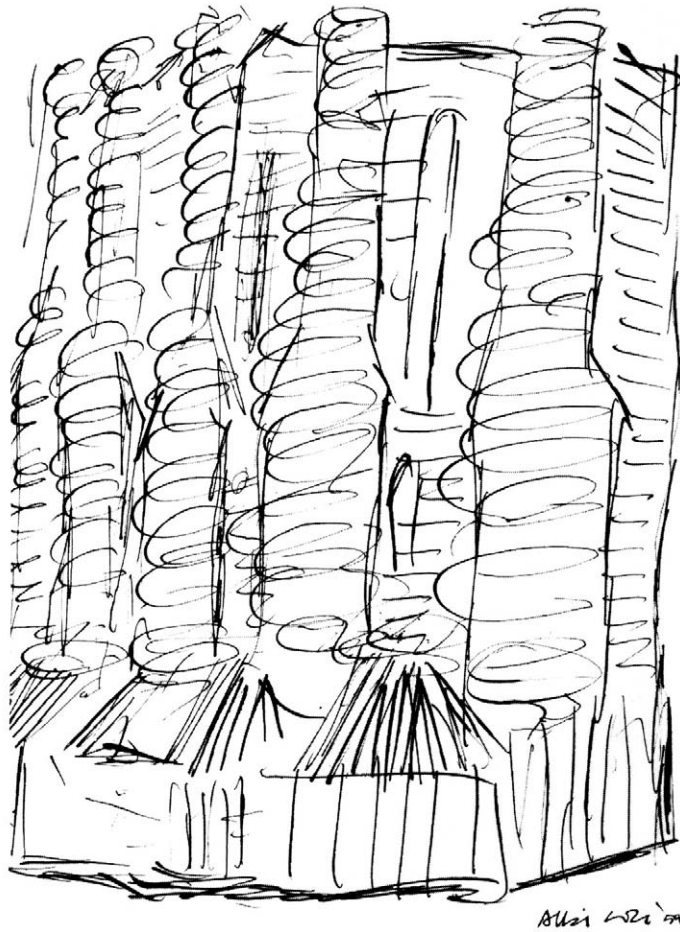
'I happened to be in Carcassonne, therefore I like
Carcassonne, that's all. People imagine I took that and
put it in my notebook, and the next job that came around
was Carcassonne.

'Carcassonne impresses me because it's Carcassonne. Not because it's a military thing, just because it's a clear picture or a purpose well expressed.

'I would admire a safety pin for the same reason. If I happened to be impressed by that, I would have said the towers at the University of Pennsylvania were inspired by a safety pin. Then you would really be surprised! But it has nothing to do with Carcassone or San Giminiano and those places. They record themselves as being marvelousness that they are phenomena of man's nature, and if they are well-said they become the example for all things you do.
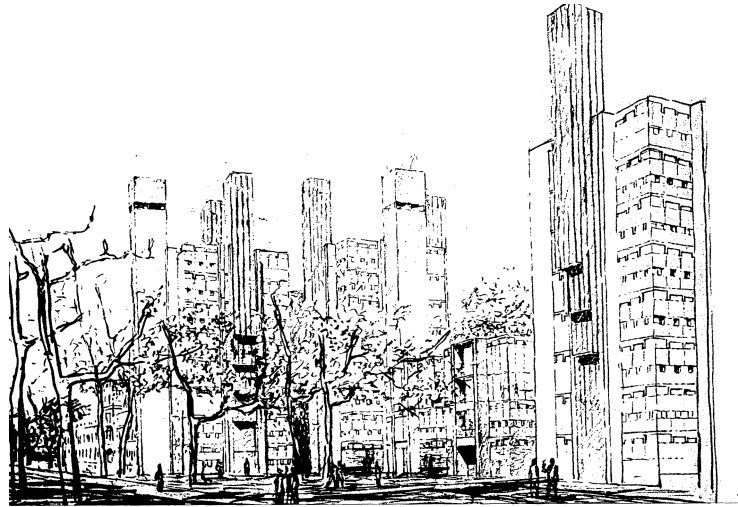
'The Mellon Center is as much inspired by Carcassonne as is the Medical Towers.'

(Wurman, 1986, p.116)

On the visual evidence it would, however, be difficult to dismiss a connection between Kahn's sketches and his frequent preoccupation with solid tower-like forms and the built Richards Medical Research Building. The relation between the past buildings and the present one already exists in the early sketches for the laboratories. Kahn denies the existence of a direct model but acknowledges the importance of the past. His disclaimer is no doubt to some extent influenced by the very considerable premium given to originality in his formative years and also by the clear distinction he always wanted to make between form and design; between the intangible and timeless and the tangible and specific.

It is thus difficult to dismiss the importance of models in the design process in view of the evidence we continually have around us. It also needs to be remembered that Kahn's own buildings have become models for others. Richard Rogers & Partners' Lloyds Building in the City of London (1979 – 84) has a plan that dramatically distinguishes between served and servant spaces which are placed around the perimeter.

The sixth theory and, as far as I am concerned, the most
satisfactory, gives very considerable emphasis to the role of
models, to the critical choice of some precedent. The theory
owes its roots to the work of Sir Karl Popper in the philosophy
of science and especially to that part dealing with the nature of
scientific procedure. It had a subsequent extension to the philo-
sophical foundations of social reform in such books as *The
Open Society & Its Enemies* (1945). I have tried (Brawne, 1992) to
discuss at some length the relevance of these wide ranging
theories to architecture in *From Idea to Building*.

Crucial to Sir Karl's work is the supposition that what
distinguishes scientific theories is that they are always poten-
tially falsifiable. Our inability to falsify a theory at any particular
time only means that it is the best corroborated theory at that
time; it does not mean that it is true. Equally significant is the
notion of conjecture and refutation which is the title of one of
his books; namely that we put forward hypotheses and that
these have to be tested and criticised as rigorously as possible.
The sequence which Popper proposes as explaining the way
in which scientific theories come into being is that we start with

the recognition of a problem, then put forward a hypothesis,
a kind of tentative theory which needs to be tested in order to eliminate errors and end with a corroborated theory which is, however, the start of a new sequence in which it becomes the initial problem.

Although clearly architecture is not a scientific pursuit since a building as a totality cannot be falsified. I nevertheless believe that the problem, tentative solution, error elimination, problem sequence is the most accurate description of the design process. I believe it has both a short and long term validity. When we design a building we tend to sketch and iterate our probing for a solution until we are satisfied (or time has run out). The built outcome, however, enters the stock of existing buildings and influences our perception of the next problem. That stock consists, of course, not only of recent architecture but equally of the architecture of the past of which we are aware.

It needs also to be remembered that we are not innocent problem-solvers; we come to the recognition that there is a problem influenced by a host of forces: architectural, social, economic. Powerful among these is the question of style, of what is visually desirable and acceptable at a particular period. It tends to limit the range of possible models. Our expectant eye is in operation.

My preference for the explanation offered by the $P_1 \Rightarrow TS \Rightarrow EE \Rightarrow P_2$ sequence (Problem recognition, Tentative Solution, Error Elimination, best corroborated solution which becomes the problem to the next sequence) is not meant to suggest that other theories are invalid or unhelpful. It is only to state that the Popperian sequence represents, in my view, the closest approximation to the way I know a great many architects design and have in fact stated that they do so. Different theories may also apply under different circumstances.

When Le Corbusier, for example, designed the monastery at La Tourette built near Lyon in 1960 he created a

very considerable model shift by going back to the monasteries on Mount Athos. He had visited these in 1911 and recorded them in sketches. The shift was from recognised but rejected central European monasteries to remote Greek Orthodox examples. It is very likely, on the other hand, that the Athonite monasteries were over the centuries designed on the basis of an accepted and largely inevitable typology.

It is essential to acknowledge that the recognition of what becomes the starting problem can occur both within and

Right
**Monastery of Stavronokita**, Mount Athos, Greece, 16th century
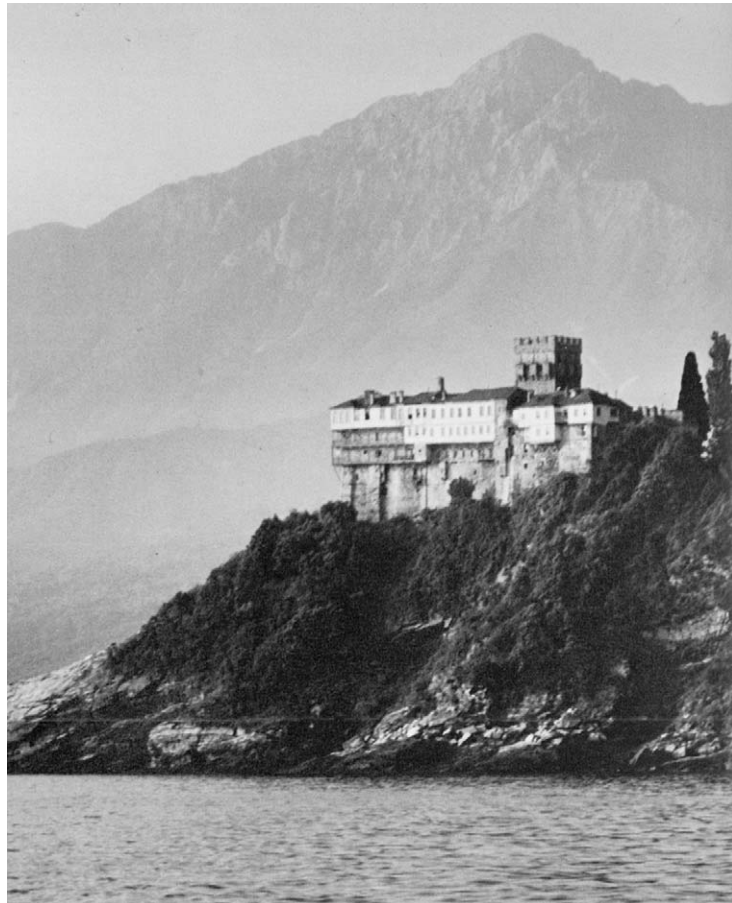
outside architecture but more often than not manifests itself as
a problem in architecture irrespective of its origin. Thus social
housing may stem from political initiatives but its design soon
evolves as an architectural issue and in fact, through associa-
tion, style may become coupled with political views. We start
with a verbally stated problem but very soon have to shift into
non-verbal thinking.

In a very different way Buckminster Fuller's harnessing
of technology to produce lightweight – frequently air-deliver-
able – buildings arises from a criticism of existing building
methods and a general belief in the economy of materials.
The model that he adopts from his earlier naval experience is
the ship as a self-contained structure. A lecture by Buckminster
Fuller was also like a mariner's tale of wondrous worlds. He
also adopts great circle navigation as the basis of his geodesic
geometry. In other words, the P_1 to P_2 sequence is a description
of a sequence, of a process, and in no way either the prescrip-
tion of a particular solution or the enforcement of a starting
point. It simply states that there *is* a necessary starting point and
that a sequence develops from that recognition of a problem.

The Popperian sequence has, moreover, the virtue of
allowing both verbal and non-verbal thinking to play their part
with different emphasis at different stages. The TS stage, the
stage of design, is likely to be dominated by non-verbal
thinking. In functionalism, on the other hand, verbal thinking is
given priority during the defining problem recognition
stage.

One of the further important strong points of the theory
is that there is an internal consistency since the various steps of
the sequence can be carried out in architectural terms, namely
through drawings. We are not dependent on any correspon-
dence between verbal or numerical prescriptions and architec-
tural results. This consistency tells us nothing, however, about
content; there is no inevitability of a successful outcome or that
architectural poetry will flower. What the theory does suggest
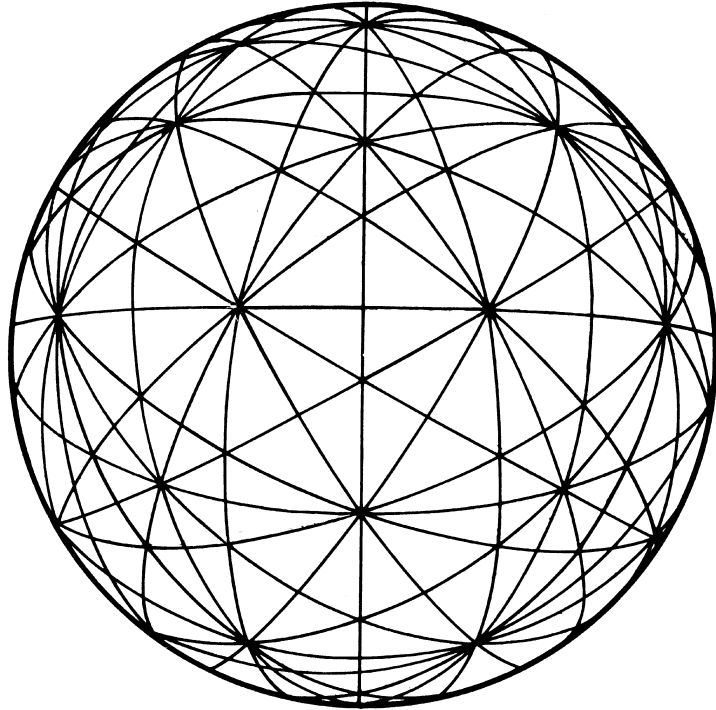
is that since it is based on both earlier precedents, on an awareness of the past, and equally on the severest possible criticism of those examples before any acceptance, there may be a reasonable balance between continuity and innovation. It may be likely that we have not discarded all the lessons since Adam and Eve built in paradise but that, at the same time, we are equally conscious of the existence of new problems and the necessity for new solutions; that we work in a radical but on-going tradition.

Any theory needs to survive a number of tests. In this instance crucial among these would be to what extent it adequately explains the way design takes place. We can apply this

test by analysing a number of buildings and by finding out about their design. I first intend to discuss three significant buildings completed in 1997 which have made an impact on both architects and the general public.
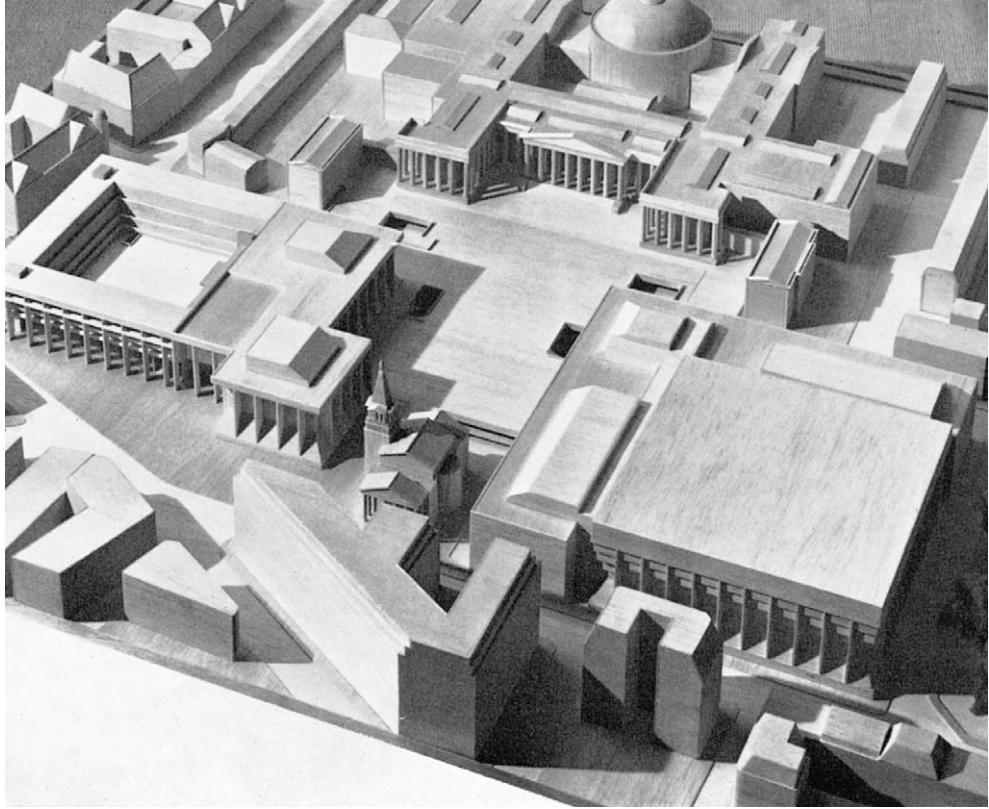
Three monuments

Three much discussed buildings were completed in 1997: the British Library in London by Colin St J. Wilson & Partners, the Getty Center in Los Angeles by Richard Meier & Partners and the Guggenheim Museum in Bilbao by Frank O. Gehry & Associates to list them in the chronological order of their inception.

Colin St J. (Sandy) Wilson started to design a new British Museum Library in 1962 in conjunction with Sir Leslie Martin. The site was an area south of the British Museum in Bloomsbury and included Hawksmoor's St George's church of 1716 – 31. The plan and model show that there were to be large square buildings on either side of an extended forecourt. The new buildings were encircled by weighty piers somewhat reminiscent of Harvey Court in Cambridge, a residential building for Gonville & Caius College, also by Martin and Wilson dating from 1957 – 62. The architecture could be described as formal, making gestures towards the classical portico of Sir Robert Smirke's original British Museum. As at Nîmes, an existing monument exerted an influence.

Political machinations and a burgeoning heritage lobby, as well as an enlargement of the brief, produced a search for another site. This was found on a large disused plot of land west of St Pancras Station. Here a quite different design emerged, different not only because it was on a different site and the programme had somewhat changed but because of a shift in attitude. The powerful neighbour was now Sir George Gilbert Scott's St Pancras Hotel and Station block in an exuberant red brick secular Gothic of 1865 – 71. But there were probably other reasons at work as well.

While at the Architects' Department of the London County Council, Sandy Wilson was captured early in his career by the work of Le Corbusier. His housing was greatly influenced by the Unité d'Habitation in Marseilles. Later enthusiasm encompassed both neo-classicism and the organic tradition and he has commented how these two kinds of architecture

face each other in startling clarity on adjacent sites in Berlin: Mies van der Rohe's National Gallery on one side of the road, Hans Scharoun's Philharmonie and his State Library on the other side. 'Nowhere else in the world of building is there a debate of such intense polarity nor exemplars of such authority' (Wilson, 1996, p.101). It is a debate which is also inherent in two of his major projects: the Civic Centre in Liverpool and the British Library in London.

The Civic and Social Centre was to stand next to St George's Hall by Harvey Lonsdale Elmes of 1840 – 54, a striking neo-classical monument on a podium. The centre is a strongly geometric design with a pin-wheel plan; slab-like offices straddle the contours and set up urban axes. Elmes's work shows an awareness of Schinkel whose Altes Museum (1823 – 30) in Berlin, and particularly its open portico, Wilson greatly admired. The design for the Civic Centre faced a good deal of public criticism. It was a gesture that arguably was an aggrandisement of civic authority and no longer meshed with public perception; its era had passed. Due to a variety of reasons, including financial stringency, the project was eventually abandoned.

When Sandy Wilson turned to the design of the British Library (now divorced from the British Museum) on its new and larger site, Scharoun rather than Schinkel was dominant. It was the organic tradition, what Wilson called the 'other tradition', which would mould the design and especially the general character. The British Library was in effect the national library and the library of 'last resort' and thus clearly a building of national significance; probably justifiably a monument. But monumentality and modern architecture were in many minds uncomfortable companions. Lewis Mumford had written in 1938 in his undeniably influential *The Culture of Cities* that 'the notion of a modern monument is veritably a contradiction in terms: if it is a monument it is not modern, and if it is modern, it cannot be a monument' (Mumford, 1940, p.438). Monumentality was in Mumford's view and that of many others linked to classicism

and its more recent expression, neo-classicism as exemplified by the public buildings of Karl Friedrich Schinkel, for example. This was considered alien to an architecture of democracy. Hitler's and Speer's misappropriation of a gargantuan classicism only reinforced widely held opinion; the architecture of the enlightenment was vulgarised and entrapped as the architecture of fascism.

Alvar Aalto, primary exponent of the other tradition, became an appropriate model for the design of the library on its new site. Aalto had in fact spoken of democracy and architecture and, perhaps somewhat patronisingly, of an architecture for the 'little man'. Since winning a competition for the design of a local library in 1927, Aalto had designed a number of significant libraries in Finland and Germany – at Viipuri, Wolfsburg, Seinäjoki, Rovaniemi – but it was not the functional aspects of these buildings which were a precedent but their visual appearance, their style, though this label would, I suspect, be anathema to Wilson.

The obeisances to Aalto are visible in the horizontal massing, the sloping roofs, the use of red brick, the protection

Right
Alvar Aalto Institute of Technology, Otaniemi
1955 – 64, main auditorium ceiling
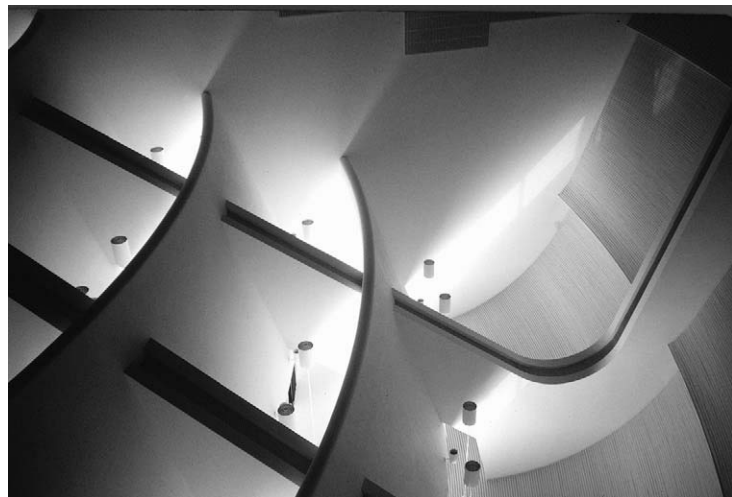
of columns and internally in the stair and handrails, and most of all in the magnificent luminous entrance hall that echoes the great hall at Otaniemi and the central gallery of the North Jutland Museum of Arts in Aalborg, Denmark of 1969 –73 by Elissa and Alvar Aalto and Jean-Jacques Baruël. On any visit to the library in the company of Sandy Wilson he will make frequent reference to his acknowledged 'homages' to Scharoun, to Aalto and, in one room, to James Stirling.

Sandy Wilson has also often referred to a painting by Antonella da Messina of *St Jerome in his Study* now hanging in the National Gallery in London (Wilson, 1996, p.50). The late 15th century painting shows the saint in a wooden ædicule within a large Gothic space. It is a picture of the scholar in his personal space surrounded by his information source, able to concentrate on the task before him but still aware of the outer world. It has become a much reproduced icon – I had used it as the frontispiece to my book on library design in 1970 – that encapsulates what is needed if reader and book are to come together in what Wilson has called a 'privileged aura'. The influence on the design of the furniture in the reading rooms is discernible. When Sandy Wilson was exhibiting the design of the British Library in the British Pavilion at the 1996 Venice Biennale he made a carving of St Jerome by Joe Tilson the centre-piece of his double height 'spolium' wall, a montage of samples, prototypes and other fragments from the library.

It has been suggested that there is an element of a vernacular idiom in the library complex (Fawcett, 1980, p.891). Certainly it is unlike Aalto's buildings in the centre of Helsinki: the Rautatalo offices, the Enzo-Gutzeit Headquarters or the Academic Bookshop building. The library is much more akin to Aalto's designs on the Campus of the Institute of Technology at Otaniemi on the edge of Helsinki. Some of the criticism of the British Library which occurred while only its exterior was visible, thus before it was possible to appreciate the grandeur of some of its internal spaces, may have been partly due to its

Above
**Colin St J. Wilson &
Partners, British Library,
London** 1997; entrance
court with St. Pancras
Hotel & Station in the
background

Right
Alvar Aalto, Institute of
Technology, Otaniemi,
Finland 1955/1961–69; main
building
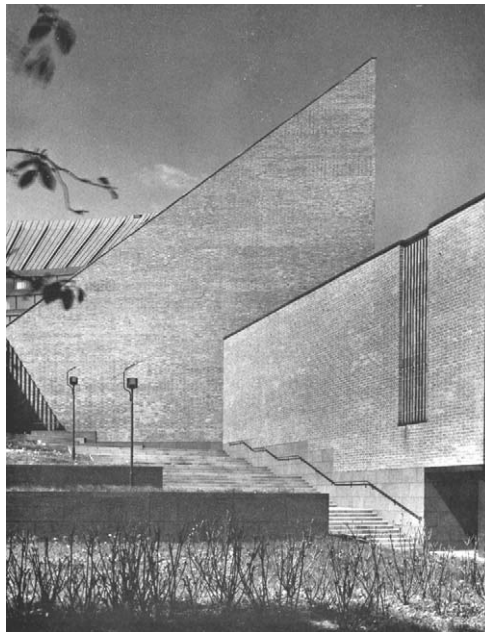
unexpected non-urban quality, partly to its absence of monumentality. Our expectant eye was frustrated by what we saw: the expectation of monumentality that might have been apparent from obvious historical continuity was absent; so was a sense of innovation in view of the familiarity of the model. It may well be that a critic writing in fifty years' time will face neither of these difficulties since expectations will be different. We need to be aware that our recognition of what constitutes the initial problem is determined by the time in which we operate, as is our appreciation of the outcome.

The design and construction of the Getty Center in Los Angeles was fraught but, at fourteen years, not as protracted as that of the British Library. It had all the characteristics of a huge building project, both in terms of obstacles and achievements. The mere completion of a group of buildings costing close to a billion dollars is in itself a triumph for the client, the architects and engineers, and the contractors. Such a project is not an everyday occurrence. Fortunately it has been documented both in its early stages and after completion (Williams *et al*., 1991 & 1997; Meier, 1997 and Brawne, 1998). There is thus evidence from the client, the architect and outsiders.

In 1983 the Getty Trust invited expressions of interest from thirty-three architects who had in their opinion produced distinguished work. The list contained a high proportion of stars in the architectural firmament and hardly any outside it. By November 1983 the list had been reduced to seven: Batey & Mack, Fumiluko Maki & Associates, Richard Meier & Partners, Mitchell Giurgola, I.M. Pei & Partners (Henry N. Cobb Jr), James Stirling, Michael Wilford & Associates and Venturi, Rauch & Scott Brown. Members of the selection committee travelled to see buildings by these architects.

Finally the committee submitted three names to the Trustees: Maki, Meier and Stirling. The sifting process continued and it was not until October 1984 that the final decision to appoint Richard Meier & Partners was announced.

This detailed and extended selection procedure makes it all the more surprising that at a certain stage the Trustees asked Meier to depart from his known and accepted vocabulary. They especially turned against white metal panels, a material which was most closely associated with Meier's architecture. Jim Stirling, on hearing that he had not got the Getty and that Meier had been chosen, reputedly remarked bitterly 'they'll get another washing machine' (Girouard, 1998, p.230). That they did not get a washing machine is due to a number of forces, each demanding innovation.

The site for the Getty is a wonderful hill-top overlooking the Los Angeles basin: the Pacific Ocean on one side, frequently snow-capped mountains on the other. A host of labels has been applied to the Getty: acropolis, hill village, campus, belvedere.

Below
Richard Meier & Partners, The Getty Center, Los Angeles, California 1984–97
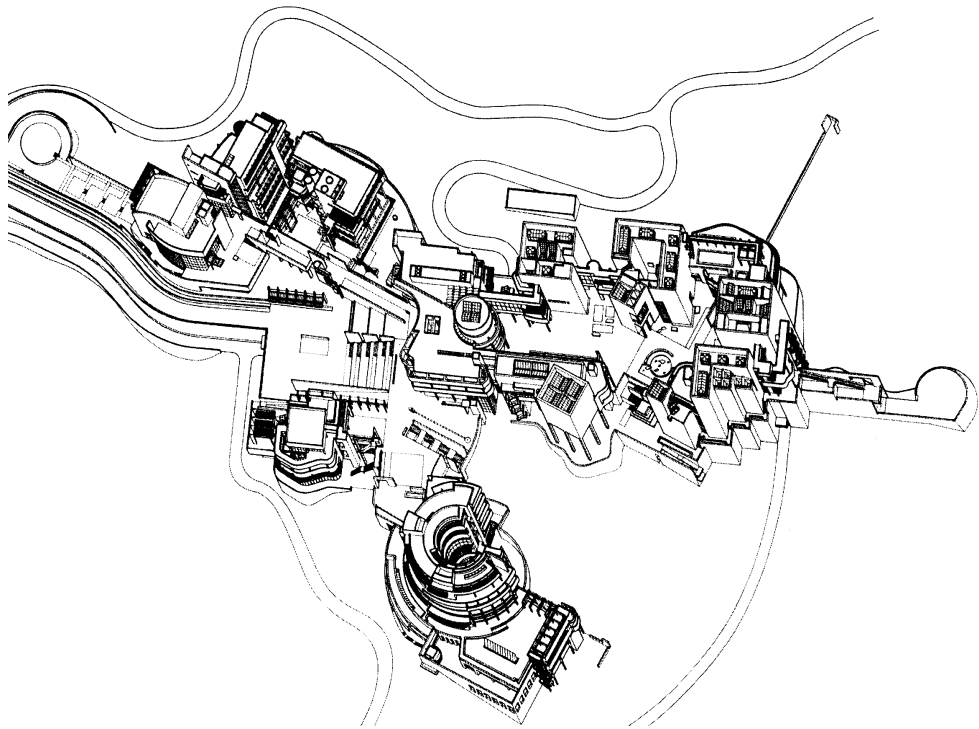
Each one is appropriate and each one evokes a particular model. The model which, however, is most in evidence is Meier's own previous architecture, an architecture deeply concerned with light and the creation of luminous forms. It is strongly reminiscent of the Baroque and especially the Baroque churches in Southern Germany which he visited on a study tour while resident architect at the American Academy in Rome. Later the architecture of Sir John Soane was also to become important.

The site did not have an adjacent Roman temple or a Victorian Gothic railway terminus. What it did have was a group of vociferous and politically powerful neighbours who made a host of stipulations about height, night-time use, access and especially the colour of the building; white was out. In the design sequence starting with P_1 the error eliminating stage (EE) was not only performed by the designer but equally by many others: the client, planners, fire officers, cost consultants, in fact by anyone who is able to exercise any power and alter what they hold to be 'errors'. The Brentwood Homeowners Association was in this case a powerful lobby.

From about 1964 to the early 1970s, Richard Meier was a member of a loose association of architects in New York whose work was published in 1972 in a publication entitled *Five Architects*. The group's designs tried to develop the legacy of Le Corbusier and particularly what might be described as his middle period. Although the influence of Le Corbusier was not to leave Meier, its relevance lessened. As Meier remarked in an interview: 'Certainly, Corbusier was very important to me many, many years ago but he is less so now. He hasn't diminished in my opinion but perhaps he's not as relevant to my work today as he was' (Brawne, 1999, p.20).

Other models are in evidence at the Getty. The plan of the galleries is based on those of the Frick Collection, a Beaux Arts mansion of 1914 on Fifth Avenue converted into a museum in 1935. The section controlling daylight is modelled on the Dulwich Art Gallery in London designed by Sir John Soane and

opened in 1819. Two historically and geographically separated but admired models were the beginning and then much amended. As Meier said in the same interview:

> 'The section of the Dulwich Picture Gallery and the way in which the top-light enters the Getty seems to me to have a particularly wonderful quality. The pictures are seen by the visitor illuminated totally by natural light. At the very beginning of the design process John Walsh, the Director of the Getty Museum, wanted picture galleries in which at any time during the day one could see all of the paintings in the collection totally illuminated with natural light.
>
> 'What Soane created at the Dulwich Picture Gallery are very simple gallery spaces, one running into the next, an enfilade of alternating spaces which are cubes and double cubes. At the Getty it is quite different: in plan the gallery spaces are defined squares and double squares but the movement system is not a sequence of enfiladed rooms. At the Getty, light comes through the skylight, and is diffused by the layers of louvers at the top of the angled roof; it's that angle which refracts light in a way which washes the walls and washes the paintings with light.
>
> 'At Dulwich there is a slope of approximately 40° towards the skylight and at the Getty we have a much higher angle of about 60° in order to allow more light into the space and it's diffused in a very different manner: through the louvers, rather than the scrim which you see at Dulwich.'

The movement system at the Getty depends on a different and much discussed model: the Uffizi in Florence. The building was begun by Georgio Vasari in 1560 to house thirteen magistrates and guilds (hence its name), had its topmost storey converted into ducal galleries from 1581 onwards and had a

major conversion by Ignazio Gardella, Giovanni Michelucci, Carlo Scarpa and Guido Morozzi in 1956. What made the circulation system interesting was that it was arranged hierarchically: there was a primary route around the elongated courtyard from which the galleries could be reached. These were occasionally interconnected making groups. The U-shaped primary route had views of the courtyard and across the Arno to the Pitti Palace. It was a day lit, outward looking space that ensured contact with the town. The galleries, on the other hand, were inward looking spaces for the display of art. What was also significant was that galleries could be bypassed so that it was possible to see the early Tuscan and Florentine paintings on one day, for example, and the works of Michelangelo and Raphael on another without going through the same spaces twice. On any visit there was also always that relief and re-orientation which the glazed primary route provided.

The Getty adopts a very similar pattern. Its long central museum courtyard with its pool and fountains takes the place of Vasari's urban corridor. The primary route is, however, placed on the outside so that the views are not of the courtyard but of Los Angeles and the Pacific Ocean. As in Florence, the end of the courtyard is bridged leaving an opening that frames a prow of the building and the city beyond. Unlike the Uffizi, the route is at two levels. On the upper level the galleries are top lit and are for paintings, on the lower level the galleries for the decorative arts – primarily furniture – are artificially lit. Within the U-shaped layout, the arrangement on both floors is a clockwise historical sequence. Stairs in the pavilions make it possible to see the works on display either floor by floor or to see the decorative arts and paintings of a particular period by going from one floor to the next. The system has remarkable flexibility; the Uffizi was a highly apt model.

The role of precedent in the case of the external cladding of the Getty was quite different; exclusion played an important initial role as it does more frequently than we are willing to
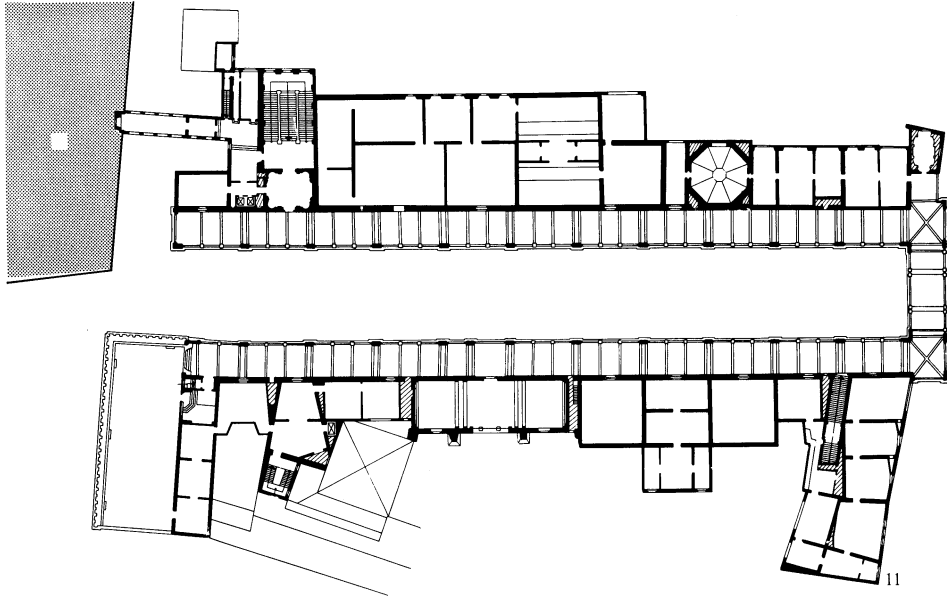
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acknowledge. Very often we reject or even refuse to consider solutions because they have unfavourable connotations.

White colour coated panels were ruled out because of the Trustees' wishes and the neighbouring Homeowners' Association's objections. Stone seemed the natural answer, not least because of its association with public buildings, with monuments. What was essential for Meier's architecture was, however, to find a light coloured stone which had the light reflective qualities of metal panels. Luminous surfaces reflecting the brilliant qualities of the Southern Californian light were the key to making spaces.

An extended search for a suitable stone involved viewing large samples. It eventually concluded that travertine was the most appropriate choice on the basis of colour, weight and cost.

Travertine in its polished form had, however, become associated with hotel lobbies and second rate Middle Eastern

buildings; it carried an unacceptable visual overload. A rougher
surface would cast shadows and create a more three-dimen-
sional and, in essence, a more massive effect. In order to pro-
duce such a surface, a special guillotine was developed at the
factory near Rome, close to the quarry where the travertine orig-
inated. The riven surface of the stone slabs is now a visual char-
acteristic of the Getty; a close-up photograph forms the dust
jacket of Meier's (1997) *Building the Getty* in which he wrote:
'... I had set myself the contradictory task of using stone in such
a way that one would be aware of both its weight and thickness
and of its non-loadbearing status as a rain screen.' In the
design sequence P_1 to P_2 a great many initial problems are self
imposed and often arise from visual choices.

In his penultimate valedictory paragraph in the same
book Richard Meier makes a perceptive assessment of his con-
tribution:

100 | 200 | 300 |

Upper Level Plan
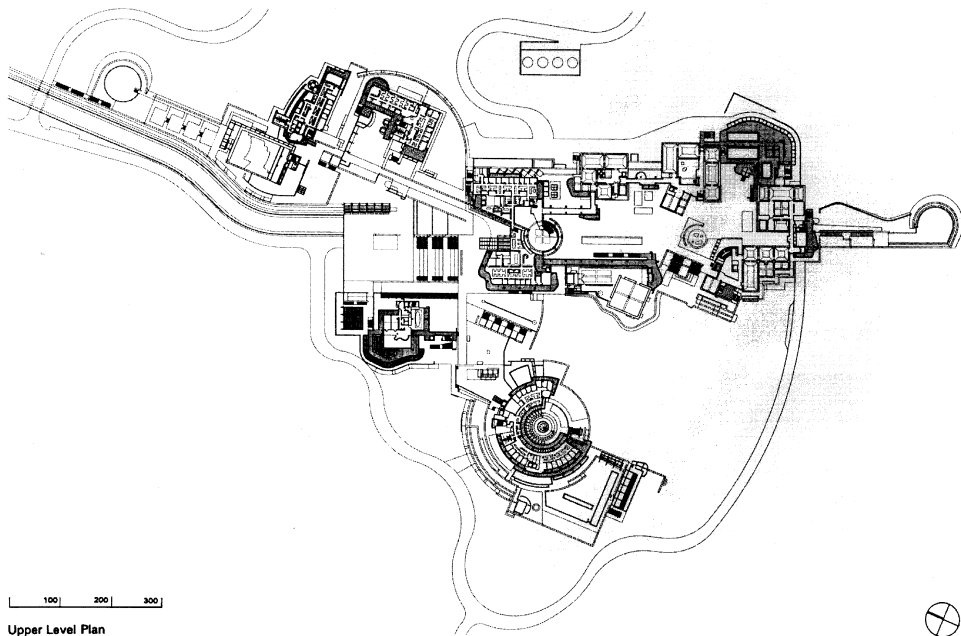
'Those familiar with contemporary architecture will no doubt concur that my approach is evolutionary rather than revolutionary. While the creation of tectonic form must entail the introduction of totally new elements, my work remains grounded in the heroic tradition of the modern movement dating back to the end of the 1920s. I would rather be remembered for the overall civic balance of my work and for its modulation of light and space rather than for any kind of idiosyncratic display of form as an end in itself.'
(Meier, 1997, p.193)

Frank Gehry's Guggenheim in Bilbao at first glance suggests a revolutionary and novel form that perhaps has no model. It is questionable whether that conclusion can be justified. The museum shop, for instance, sells vases by Alvar Aalto without in the showcase giving an attribution. Many unfamiliar

Below
Frank O. Gehry & Associates, The Guggenheim Museum, Bilbao, Spain 1991–97; entrance side facing the town; the building is clad in titanium 0.3 mm thick

with the vase might with some justification decide that it is a design by Frank Gehry. It has the same curved slanting walls and complex geometry as the atrium of the museum.

The choice of architect was, as at the Getty, the result of a limited competition. Frank Lloyd Wright's spiralling Guggenheim facing Central Park in New York had already shown the significance of architecture in establishing a museum. Three architects, all of whose work was known and presumably favoured, were selected: Arata Isozaki who was the architect of the conversion of a former industrial building in Lower Manhattan into the Guggenheim Museum SoHo; Coop Himmelblau from Vienna who had very recently won second prize in the competition for an arts and media centre in Karlsruhe, and Frank Gehry known to Thomas Krens, the director of the Solomon R. Guggenheim Foundation, who was to play a crucial role in both the selection of the architect and of the site. At the end of July 1991 Frank O. Gehry & Associates were selected. The inclusion of both Gehry and Coop Himmelblau

on the list meant that there was some predisposition towards a
fluid non-rectangular architecture, in fact, some expectancy.
Coop Himmelblau with Günter Domenig and Günter Behnish
were among the earlier exponents of this style. It is perhaps not
entirely coincidental that these architects were based in Central
Europe where a freer version of Baroque was an everyday visual
occurrence. The Baroque was also, arguably, a more dominant
element of the architectural landscape in Central Europe than,
say, in France or Scandinavia. Central European baroque had,
moreover, as its predecessor an extremely exhuberant Gothic
as in the work of Peter Parler or Benedict Ried. This is not to
argue for the existence of a *Zeitgeist* or to insist on regional
characteristics but to record the tenacity of tradition.

Frank Gehry was born in Toronto in 1929 but studied at
the University of Southern California and the Harvard Graduate
School of Design. Public recognition came to him for his work
in California. This was characterised by the use of cheap every-
day materials – corrugated metal, chain-link fencing, exposed
steelwork – and resulted in dynamic, nervous multi-layered
forms. He has labelled the result 'cheapscape architecture'
and also as 'no rules' architecture (Nairn, 1976, pp. 95–102).

Writing a short piece for the 1980 edition of
Contemporary Architects, Gehry has described his attitude at
the end of the 1970s as:

'I am interested in finishing work, but I am interested
in the work's not appearing finished, with every hair in
place, every piece of furniture in its spot ready for
photographs. I prefer the sketch quality, the tentative-
ness, the messiness if you will, the appearance of "in
progress" rather than the presumption of total resolu-
tion and finality. The paintings of Cézanne, Monet,
DeKooning, Rauschenberg, to name a few, compared to
the hard edge painters, Albers, Kelly, etc – perhaps the
comparison makes my point more explicit.

Left
Monastery Church at Bechyne, end of 15th to early 16th century

Below
Frank O. Gehry & Associates, Spiller House, Venice, California 1979–80

'I have been searching for a personal vocabulary. This search has been far ranging, from childlike exploration of my fantasies – a fascination with incoherent and seemingly illogical systems – to a questioning of orderliness and functionality.

'If you try to understand my work on the basis of fugal order, structural integrity and formalised definitions of beauty, you are apt to be totally confused.

'A client's programs are interesting to me but are not the driving force in creating his building. I approach each building as a sculptural object, a spatial container, a space with light and air, a response to context and appropriateness of feeling and spirit. To this container, this sculpture, the user brings his baggage, his program, and interacts with it to accommodate his needs. If he can't do that, I've failed.

'The manipulation of the inside of the container is for me an independent, sculptural problem and no less interesting than the design of the container itself. This manipulation tests the adaptability of the space for a program that by now can have changed several times.

In my work the perception of the object is primary. The
imagery is real and not abstract, using distortion and
juxtaposition of cheap materials to create surrealistic
compositions.

'All in the pursuit of firmness, commodity, and delight.'

Except for the words 'cheap materials' that assessment
is equally applicable to the Bilbao Guggenheim and the build-
ings that precede it. Several of the larger institutional buildings,
such as the American Institute in Paris, for example, which
Gehry designed before the Guggenheim, were no longer done
in the almost throw-away materials of his Californian houses
but were rendered or clad in masonry. Somehow, those that had
rendered exteriors, such as the Vitra International Furniture
Museum at Weil am Rhein, Germany, of 1989, seem more suc-
cessful, less forced, than those covered in masonry like the
American Center in Paris of 1994. Perhaps render still has some
of the casual attributes of corrugated metal and chain-link fenc-
ing. Bilbao represents a significant shift. The use of a steel
superstructure and a cladding of shimmering titanium scales
(0.38 mm thick) made fluid forms appear natural; the building
was like a thrashing fish with its tail out of water. The most rele-
vant model came from two of Gehry's earlier creations: the
Fishdance restaurant in Kobe, Japan of 1987, also on the
water's edge and overlooked from an elevated bridge, and
the Fish Sculpture built for the Villa Olimpica Complex in
Barcelona in 1992. Both were in metal and with a fine grained
skin. There is a suggestion that fish exercised an almost sub-
conscious influence. Gehry has said in an interview, remember-
ing excursions to the market with his grandmother: 'We'd go to
the Jewish market, we'd buy a live carp, we'd take it home to her
house in Toronto, we'd put it in the bathtub and I would play
with this goddamn fish for a day until the next day she'd kill it
and make gefilte fish' (Arnell & Bickford, 1985, p.XVII).

We come, it would seem, even to highly original projects
with mental baggage. This does not mean that we set about

always very consciously to rummage around for an appropriate model. We have an expectant eye that sifts and selects and is influenced by what is possible at a particular time in history. As Gehry said in another interview:

> 'I was not as conscious that it (the Bilbao Guggenheim) had something to do with what I did before until later because you know, I'm just looking at what I see. I tend to live in the present, and what I see is what I do. And what I do is I react. Then I realise that I did it before. I think it is like that because you can't escape your own language. How many things can you really invent in your lifetime? You bring to the table certain things. What's exciting, you tweak them based on the context and the people: Krens, Juan Ignacio, the Basques, their desire to use culture, to bring the city to the river. And the industrial feeling, which I'm afraid they're going to lose, for there's a tendency to make Washington Potomac Parkway out of the riverfront . . . See, the bridge is like a gritty anchor. You take the bridge out and it's a whole different ball-game. So I think I was responding to the bridge, the toughness of the waterfront, its industrial character. The program Tom (Krens) came up with was MASS MoCA, big industrial volumes of space . . . And I knew all of that when I started sketching.'
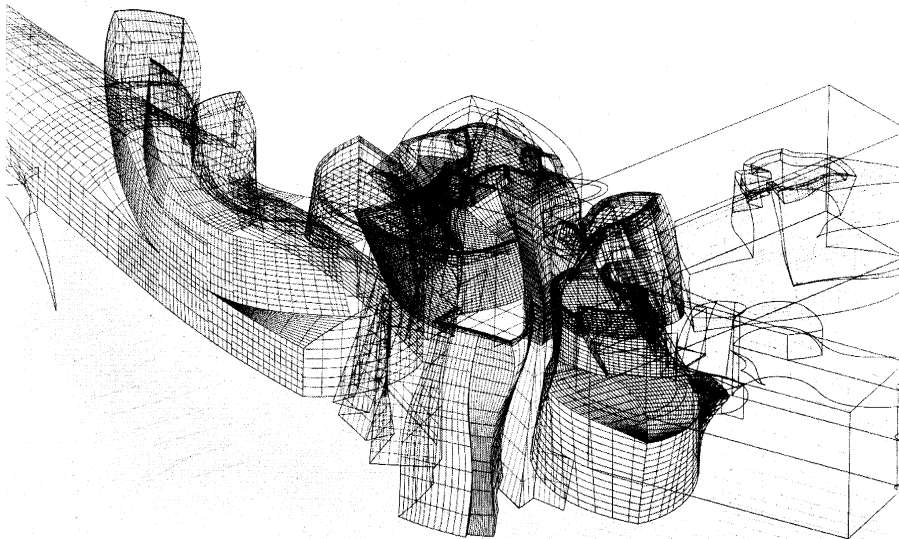> (van Bruggen, 1997, p.33)

Extremely powerful computers made the Guggenheim possible; it could hardly have been created at an earlier period. Both design and construction, and crucially the transfer of design information to manufacture, depended on a computer program originally developed for the French aerospace industry. CATIA, as the program was called, produced wireframe diagrams which could be translated into two-dimensional steel fabrication drawings. There were also implications on erection.

'Gehry's office wryly notes that Bilbao was built without any tape measures. During fabrication, each structural component was bar coded and marked with the nodes of intersection with adjacent layers of structure. On site bar codes were swiped to reveal the coordinates of each piece in the CATIA model. Laser surveying equipment linked to CATIA enabled each piece to be precisely placed in its position as defined by the computer model. This is common practice in the aerospace industry, but relatively new to building.'
(Annette LeCuyer, 1997, p.44)

As in most Baroque domes and in Alvar Aalto's church in Vuoksenniska, Imatra designed in 1956, the Guggenheim interior does not follow the outlines of the exterior. The internal volumes are dominated by a 50 m high pivotal space from which the galleries radiate. Within that soaring height columns have

Below
Frank O. Gehry & Associates, Guggenheim Museum, Bilbao, Spain 1997; computer generated wire diagram of building

one curved shape at the top, another at the base with twisted surfaces in between. Jim Glymph, a principal in Frank O. Gehry & Associates, has said that 'Frank is a big fan of Baroque architecture' (Bruggen, 1997, p.138) but no Baroque architect could have drawn or built the shapes which exist in Bilbao. The galleries occur on three floors and have a variety of shapes. Art is placed in the most appropriate space rather than having universal display areas which are allegedly anonymous. Gehry had worked and been friends with too many artists not to be aware of that fallacy. The most spectacular gallery is a 130 m long space that dips under the bridge and which is top lit by sky lights set in a complex curved ceiling. The sinuous surfaces of the architecture are reinforced by equally sinuous surfaces of rusting steel which are the walk-through sculpture by Richard Serra, specifically created for this site.

The only galleries which do not conform to the general pattern of non-orthogonal spaces are two galleries on the west side and the six principal painting galleries. The latter are arranged as three galleries on each floor superimposed upon each other. Interestingly, and perhaps surprisingly, these exhibition spaces return to an earlier and much used typology and are a sequence of top-lit enfiladed rooms. The twist is in the section. The centre of the upper gallery is placed under a skylight. That centre is surrounded by a large box of display walls which do not touch the ceiling; it is a kind of room within a room. Seen from the gallery below, however, it turns out to be a light funnel which directs daylight into the lower gallery. It is a cunning and novel use of the section, extending the effect of a skylight to a lower floor.

All three buildings have made a strong impression on the public consciousness: Bilbao has become an international tourist attraction, the Getty has been visited by unprecedented numbers, the British Library has won high praise from its readers. Each is individual in its expression and in its architectural starting point. Yet each has been designed with some reliance
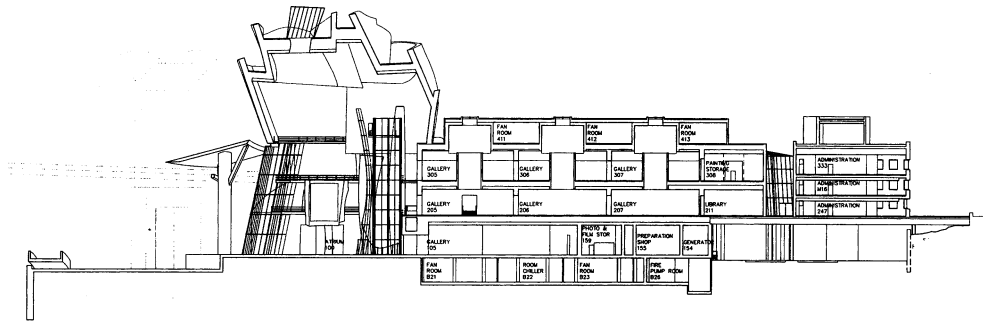
on pre-existing models. These are not necessarily within archi-
tecture; Wilson admired the painting of *St Jerome in his Study,*
Gehry says he looked a lot at the cutouts of Matisse, 'at these
big long shapes just casually cut . . . at the awkwardness of
them' (Bruggen, 1997, p.116). Most often, however, it is the
architecture of the past which provides the most relevant mod-
els and this is hardly surprising. Nor is it surprising that that
architecture is very frequently the earlier work of the architect;
we inevitable re-use the forms with which we are familiar, for
which we have a preference. Which is why we can distinguish
a Wren church from a Hawksmoor church.

Before we use models in the tentative solution, in the
design stage, we are involved in problem selection. We cannot
and do not solve all the problems which exist at that time in that
project. This is primarily the case because a great number of
problems are, as it were, self inflicted. There are the demands
set by the brief which require resolution but in addition to that
we ourselves see problems or have leanings to particular reso-
lutions which makes for individual responses. Both P_1 and TS
(see p. 34) are also, in historical terms, time dependent.
Problem recognition and what is imaginable are conditioned by
the world around us.

It is the severity and nature of the self-imposed prob-
lems which are the test of architectural greatness. To satisfy the
architectural programme of spaces, adjacencies, circulation,

service provision and so on is a difficult and necessary task. It is the basis of much design. In the last resort, however, it is a journeyman's task. Plans can be generated by computer in many instances given a set of rules. Poetry and delight are the task of the master and arise from self-imposed necessities. It is also the solution of the problems which we have set ourselves which produces the greatest agonies and delights of design.

Witnesses

The same issue of the *Architectural Review* – December 1997 – which illustrates the Bilbao Guggenheim also devotes space to the art gallery for the Ernst Beyeler collection designed by the Renzo Piano Building Workshop on the edge of Basle in Switzerland. The architecturally controlling element is the roof plane. This is a 1500 mm (5 ft) deep layer which consists of perforated metal, operable louvres and structural glass. Above it are white glass louvres diffusing light. Renzo Piano had previously given great importance to the roof in the museum for the

Right
Renzo Piano Building Workshop, Beyelar Foundation Museum, Basel, Switzerland 1993–97

Menil Collection in Houston which he designed with Peter Rice. The later Twombly Gallery by Piano in the same 'museum campus' also subdues walls and emphasises the ceiling. It might be said that this is hardly surprising since all the buildings display works of art where the control of light must play a very important part; there have after all been endless attempts to find an ideal solution through the manipulation of the overhead plane.

Below
Frank O. Gehry & Associates, Vitra International Furniture Museum, Weil am Rhein, Germany 1989

Piano uses the roof to provide that control; Gehry tends
to use the whole volume. He had done so earlier at the Vitra
International Furniture Museum in Weil am Rhein, Germany –
just across the border from the Beyeler Collection – and the
Frederick R. Weisman Museum in Minneapolis.

The above two paragraphs contain facts. They also,
however, imply conclusions which are inevitably assumptions.
Even where there is a seemingly confirmatory statement by
Gehry that 'I approach each building as a sculptural object,
a spatial container, a space with light and air . . .' which has
already been quoted, it is unwise to make categorical claims.
We may see similarities, deduce sources, have acknowledge-
ment of influences and yet remain unsure that any conclusions
we draw actually match the design process which
occurred.

I therefore propose to turn to written statements by a
number of significant architects which might contain their
opinions on the characteristics of the design process. This is
not to put faith in such statements as infallible pronounce-
ments; too often architects write what turns out to be a post-
rationalisation. Nevertheless these writings represent
published material which has presumably been checked and
approved; we are assessing a considered opinion by the person
most involved and not by an outsider.

An exhibition was held at MIT in May and June 1979 of
six examples showing process in architecture. The catalogue
recorded interviews with the architects concerned
(Cruickshank, 1979). Donlyn Lyndon – with Moore, Turnbull and
Whitaker one of the designers of the condominium at the Sea
Ranch on the Pacific coast and also one of the authors of *The
Place of Houses* (Moore *et al.,* 2001) – was one of the six exhibited
and interviewed. Lyndon's statements are both general and
specific. (LL is Lance Laver, DL is Donlyn Lyndon.)

> LL: In what way is Islamic architecture a source for the
> courtyard?

DL: I was interested when I was in India by the tenuous nature of the cross-axial order in most Islamic buildings. A building like the Taj Mahal, even, for instance, is controlled and orderly when seen on axis; yet because of the multiple domes, the four minarets, and the two buildings to either side, if you move off axis, it becomes wildly picturesque – all those pieces start juxtaposing in new ways. Then going around in places like Fatehpur Sikri, it was clear that the same thing happened internally in a courtyard building, especially because many from Islam are organised as a square with pavilions on their centers which make the cross axis. If you stand at the cross axis, it's serene and all in place; and when you move off it, you get a complicated, rich set of three-dimensional juxtapositions. The reference to Islamic architecture is in the courtyard being made not principally by walls (the boundary), but by pavilions (the four faces). The idea here was to use those front pavilions to make the cross axis, and to establish major points as a building size and frame of reference. Meanwhile all hell is breaking loose in places to go, places to sit, places to look down from, places to look up to, things to pass under, etc – it's a tension between the clear and the complicated.

LL: What other references or influences besides the New England row house model and Islamic architecture framework did you have here?

DL: One is influenced by virtually everything. We spent a lot of time looking at the brick blocks of the traditional Providence buildings. The idea of making a porch with benches to either side – obviously interpreted quite differently here – is a common New England theme. We were interested by adjustments made as Providence's brick houses meet the ground – and the intersecting stairs that slide out sideways. I thought that a gate that everybody was going through ought to be a triumphal

gate, and they normally had niches with people's sculpture in them: so we ought to have niches with pay phones, thinking that the only legitimate way to get figurative sculpture in aediculae at the present time would be to have pay phones that would invite people to stand in the niches. But we didn't actually do that here.

It is perhaps rather obvious that nearby architecture and great monuments which made a deep impression while travelling and were probably seen with an expectant eye, should be within the mental baggage of the designer.

The same exhibition included Louis Kahn's Yale Center for British Art in New Haven, Connecticut. Kahn had died in 1974 while the Center was still under construction. It was finished by Pellechia & Meyers. They were interviewed with Jules Prown who had persuaded Yale University to appoint Kahn and who was director of the Center from 1968 to 1976.

'In some cases, we were able to use recent precedents that we knew Lou would pull out of the drawer. Lou used to say, "What did we do on the so and so job?" He had reached the point in his career where he had developed his own vocabulary and his own details: "Let's see what

Right
Louis I. Kahn, Yale Center for British Art, New Haven, Connecticut, model of first project March 1971
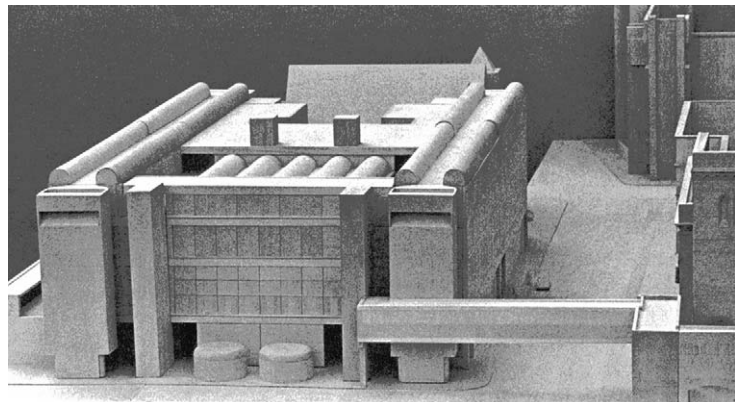
we did there." Then he'd make a modification and see where something was appropriate. Wherever a precedent existed, we would test it ourselves. Sometimes nothing existed, or sometimes there was a little sketch or drawing that had never been worked out in all of its glory for every situation, like his grouping of switches.'

It could be objected that what Marshall Meyers remembers is a case of pure expediency; it just saves time and money to look up something that exists. The phrase 'had developed his own vocabulary and his own details' hints, however, that that is too simple an explanation. It would be tempting to conclude that details have more extended validity than general form but the conclusion would be faulty. As Meyers explained in the same interview:

> 'The earlier Yale project started as a take-off of Kimbell, a one sided situation with this vault, light coming in from the side.'

There is a model of the March 1971 submission which shows the top floor as a series of vaults as if the Kimbell, then under construction, had been lifted up and placed on top of a three storey building. Cost cutting eventually led to the design which was built. It was the 'error elimination' stage as in so many other projects. There was a return to the P_1 with an altered problem recognition.

> Kahn had also said in an interview in 1972 that:
> 'It is also true that in the work completed is the mass of qualities unexpressed in this work which waits for the opportunity to release. I would never feel bored to be given a commission similar to the one I just did – just executed? just satisfied? or maybe "just did" is better . . .'
> (McLoughlin, 1991, p.312)

P_1 to P_2 is not surprisingly an iterative process in the work of any architect.

Some architects have made statements which relate to both the initial problem recognition, the general approach to the project, as well as to the eventual forms which were adopted. Daniel Libeskind is one of these. His descriptions are extensive and confirm his belief that buildings need a story, a narrative that informs the design. His much discussed Jewish Museum is a case in point. Early on in a talk given at Hanover University on 5 December 1989, he said:

'I felt that the physical trace of Berlin was not the only trace, but rather that there was an invisible matrix or anamnesis of connections in relationship. I found this connection between figures of Germans and Jews; between the particular history of Berlin, and between

Below
Daniel Libeskind, Jewish Museum, Berlin 1988–99; ground floor plan
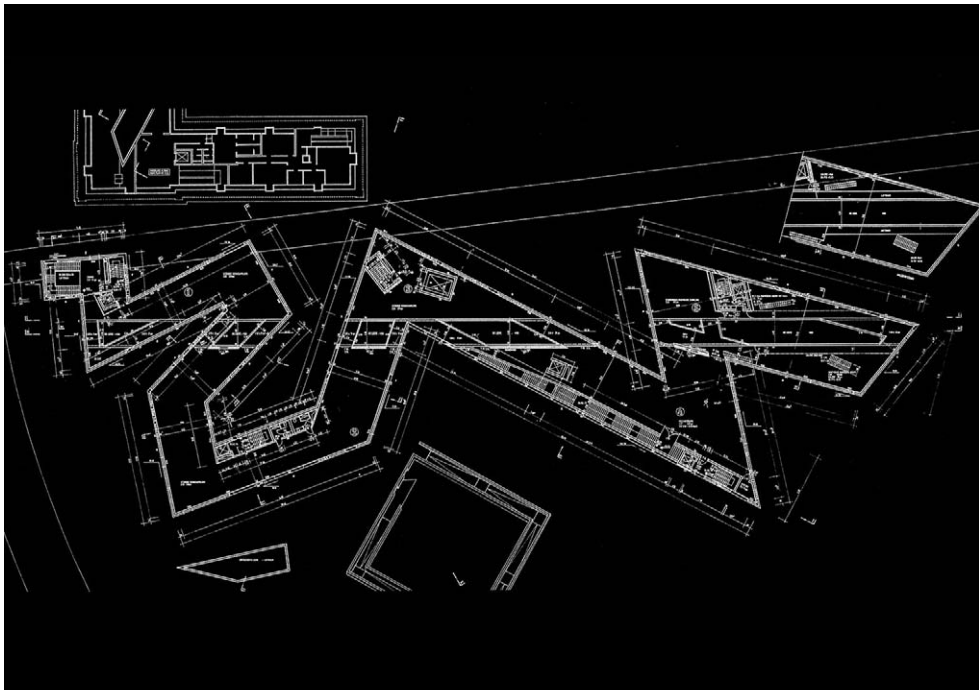
the Jewish history of Germany and of Berlin. I felt that certain people and particularly certain scientists, composers, artists and poets formed the link between Jewish tradition and German culture. So I found this connection and plotted an irrational matrix which was in the form of a system of squared triangles which would yield some reference to the emblematics of a compressed and distorted star: the yellow star that was so frequently worn on this site, which today is green.'

He went on to enumerate three other aspects and then went on to say:

Right
Jacob G. Tschernichow, Study of a multiple-fold from *Die Grundlagen der modernen Architektur; Ehrfahrungsmässige experimentelle Forschungen,* 1930
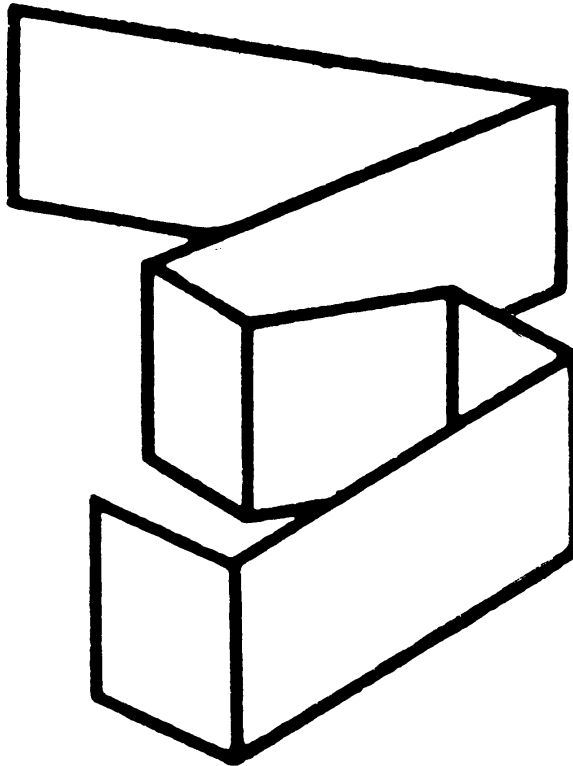
'To summarize this four-fold structure: The first aspect
is the invisible and the irrationally connected star which
shines with the absent light of individual address. The
second one is the cut through Act II of *Moses and Aaron*
which has to do with the non-musical fulfilment of the
word. The third aspect is that of the departed or missing
Berliners; the fourth aspect is Walter Benjamin's urban
apocalypse along the One Way Street.
(Libeskind, 1992)

Was the star of David the natural springboard since the
museum was devoted to the Jewish presence in Berlin or was
it also at least sanctioned by a number of forms which were the
subject of Paul Klee's paintings in the 1920s. Kurt W. Forster
makes a strong case for the pictorial influence in his
introductory essay in the same exhibition catalogue which tran-
scribed Libeskind's talk. Forster adds a telling illustration taken
from *Foundations of Modern Architecture* by Jakob G.
Tscernichow published in Leningrad in 1930 and used in
schools of architecture.

Doubts also arise since the design of the Jewish
Museum was preceded by a work called 'Line of Fire' dating
from 1988 in which highly jagged folds are cut by a straight line
incision. The Berlin museum was also carried out concurrently
with the design of the Felix Nassbaum Museum in Osnabrück
which houses a series of paintings but is made up of the same
characteristically vigorous and broken folds.

The fact that Libeskind uses an almost identical visual
vocabulary for three projects in no way invalidates the arch-
itectural significance of his Jewish Museum or of the other
two designs. What it may do, however, is to emphasise the
inevitable need to make visual choices and that these choices
are most frequently made on the basis of known and preferred
forms.

They are also made very often as a result of a reaction against some existing trend; the new becomes a criticism of the old or, to put it another way, the old no longer represents an acceptable explanation. As Libeskind remarked in an interview:

'Architecture is at a renaissance, a rebirth of ideas. People are getting tired of high-tech façades and simply functional issues. People want architecture to be part of their life as they've always wanted it to be . . . One has to enjoy what one is doing. One has to have fun with clients, with the public. One has to celebrate life which is always very vulnerable. The fatal ideologies of the last century destroyed some of the humanity and possibility of being. It's a good time to reassess and think about what is possible – to think that things are not over but might be beginning in a different direction.'
(Isaacs, 2000, p.51)

Libeskind's description given in his Hanover talk also highlights the difficulty of using verbal or musical ideas since there is no real correspondence between those ideas and a three-dimensional form. However strong and explicit the narrative, there is still an inevitable need to choose and determine a form, and that form is, as a rule, part of the initial problem recognition. Verbal thinking is not a substitute for non-verbal design.

At the beginning of the 21st century the Jewish Museum in Berlin stood empty of exhibits but was much visited; the spaces were the exhibits. The only labels were some descriptive sentences by Libeskind which provided the kind of background he described in his talk. Without such verbal explanation no uninitiated visitor could grasp the symbolic intentions inherent in the design. It is inconceivable, for instance, that anyone would understand that the slanting windows are derived from lines on the city map which link the homes of prominent Jewish families to the museum; detailed explanation is essential.
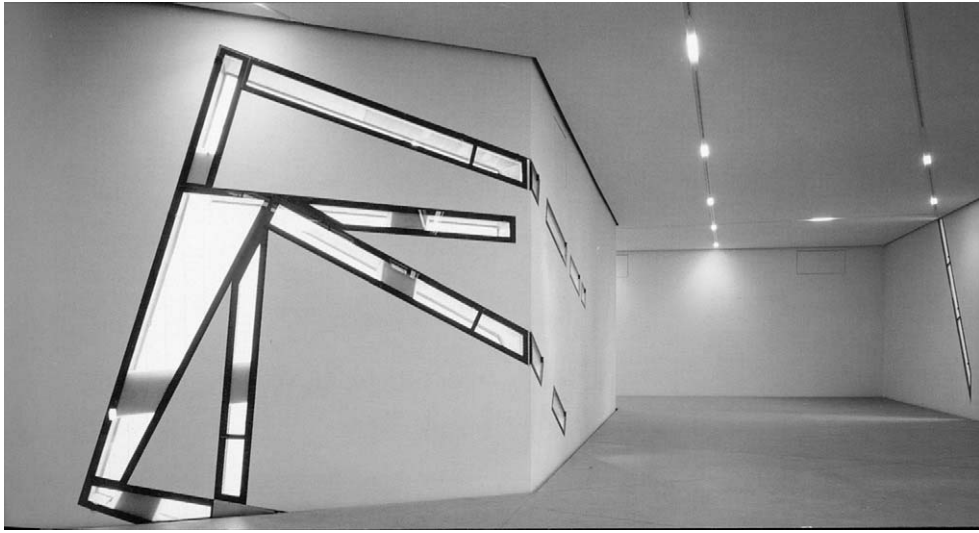
When I look at Epstein's sculpture of the Madonna and Child on a wall in Cavendish Square in London, for example, and see the Christ Child with outstretched arms, I understand that this symbolises his embrace of humanity as well as foretelling the crucifixion. I 'read' these meanings because the sculptor and I share a common iconography. I can of course admire the sculpture and the Jewish Museum without being aware of any symbolism but will miss meanings. This is only to point out the danger of loading architecture with symbolism it cannot support and then questionably ascribing to it design initiatives.

Daniel Libeskind and Frank Gehry are both building in Berlin and are part of the incredible crane-proliferating activity that has taken place in the centre since the re-unification of Germany. In a very different way but making an equally powerful impact on the city are the buildings by Renzo Piano. These are derived somewhat more from the nature of materials and the technologies of building than the Jewish Museum or Gehry's bank. All three architects must be aware of each other's

Below
**Renzo Piano Building
Workshop;** Debis Site,
Potzdammer Platz, Berlin,
1992–2001

Below
**Frank O. Gehry &
Associates**, DZ Bank
Headquarters, Pariser
Platz, Berlin 1995 – 2000,
main atrium

designs working in the same city at the same time. The results are, however, dramatically different.

In view of what we see it is not surprising that Piano has written in his 'log book':

> 'Knowing how to do things not just with the head, but with the hands as well: this might seem a rather programmatic and ideological goal. It is not. It is a way of safeguarding creative freedom. If you intend to use a material, a construction technique, or an architectural element in an unusual way, there is always a time when you hear yourself saying, "It can't be done", simply because no one has ever tried before. But if you have actually tried, then you can keep going – and so you gain a degree of independence in design that you would not have otherwise.
> 'While we were building the Centre Pompidou, we had to make a structure out of pieces of cast metal. The entire French steel industry rose up in arms: it refused point-blank, saying that a structure like that wouldn't stay up. But we were sure of our facts, Peter Rice above all, and passed the order on to the German company Krupp. And so it was that the main structure of the Centre Pompidou was made in Germany, even if the girders had to be delivered at night, almost in secret. This was one case in which technique protected art. Our understanding of structures set free our capacity for expression.'
> (Piano, 1997, p.18)

The introduction to the log book is an enthusiastic and heart-felt statement about what it is to be an architect. The opening page reads:

> 'The architect's profession is an adventurous one, a job on the frontier. The architect walks a knife-edge between art and science, between originality and memory, between the daring of modernity and the caution of

tradition. Architects have no choice but to live danger-
ously. They work with all sorts of raw materials, and I
don't just mean concrete, wood, metal. I'm talking about
history and geography, mathematics and the natural sci-
ences, anthropology and ecology, aesthetics and tech-
nology, climate and society – all things that architects
have to deal with every day.

'The architect has the finest job in the world because . . .
We are left with the adventure of the mind, which can
bring as much anxiety, bewilderment, and fear as an
expedition to a land of ice and snow.

'Designing is a journey, in a way. You set off to find out,
to learn. You accept the unexpected. If you get scared
and immediately seek refuge in the warm and welcoming
lair of the already seen, the already done, it is no journey.
But if you have a taste for adventure, you don't hide, you
go on. Each project is a new start, and you are in
unexplored territory. You are a Robinson Crusoe of
modern times.

'Architecture is an ancient profession – as old as hunt-
ing, fishing, tilling the fields, exploring. These are the
original activities of human beings, from which all oth-
ers are descended. Immediately after the search for
food comes the search for shelter. At a certain point the
human being was no longer content with the refuges
offered by nature, and became an architect.

'Those who build houses provide shelter: for them-
selves, for their families, for their people. In the tribe, the
architect performs a role of service to the community.
But the house is not just protection: this basic function
has always gone hand in hand with an aesthetic, expres-
sive, symbolic yearning. The house, from the very begin-
ning, has been the setting for a quest for beauty, dignity
and status. The house is often used to give expression
to a desire to belong, or to a desire to be different.

'The act of building is not and cannot be just a question of technique, for it is charged with symbolic meaning. This ambiguity is only the first of many that mark the profession of architecture. Any attempt to resolve the ambiguity is not the beginning of a solution – it is the first sign that you are giving up.'
(Piano, 1997, P.10)

I quote at length since not many architects have been so explicit. It would be easy to assume from these opening paragraphs that Renzo Piano's method of working is entirely based on intuitive leaps. On the contrary, Piano is very careful to describe the design process. He does so in terms that are highly analogous to the Popperian iterative sequence.

'Designing is not a linear experience, in which you have an idea, put it down on paper, then carry it out and that's that. Rather it is a circular process: your idea is drawn up, tried out, reconsidered, and reworked, coming back again and again to the same point.

'As a method it seems very empirical, but if you look around, you realise that it's typical of many other disciplines: music, physics, astrophysics too. I once discussed this with Tullio Regge and Luciano Berio, and the analogy was clear – one was talking as a mathematician, the other as a musician, but the essence was the same.

'In scientific research you have to deal with equations with too many variables. In nature, the variables are virtually infinite. So you fix some on the basis of an intuition that stems from your experience. At that point it becomes possible to solve the equation. Then you test what you have found. If it doesn't work, you start again. You formulate another hypothesis, you go back over what you've done, and so on. In the process, you narrow the circle, like a hawk closing in on its prey. Note that

circularity, in this sense, is not just methodology, and
still less procedure. It is, to use high-sounding words, a
theory of knowledge. Trying over and over again is not
just a means of correcting mistakes. It is a way to under-
stand the quality of a project, or of material, light, sound.'
(Piano, 1997, p.18)

Piano is far from being alone in the clear way in which he
describes the nature of architectural design. Edward Cullinan,
working in London and sharing with Piano a belief in the signifi-
cance of how buildings are made, has recorded his attitude in
an interview with Edward Robbins.

'Some people who are struggling to become architects
push pens and pencils up and down the page desperate-
ly looking for a solution, hoping that the drawing will
produce the solution or the concept. But it never does.
I think that one person or a group of people working
together have to have an energetic concept of what it is
they are trying to make in their heads or their imagina-
tions, and that drawings are then, as it were, a test of the
concept. And in our case, the doodle tends never to be
plans, sections, or elevations. They're nearly always
three-dimensional doodles. They are as much for
individuals to clarify things for themselves as to one
another. So they are used two ways: as a clarification
for oneself and for spreading the notions . . . From very
early on in our tests of notions we do things that look like
working drawings. We do things that are very large,
screw-them-together drawings, which is also a test of
the idea. So some of these sort of finished ready-to-
build-it working drawings go right through to the end
of the project and some of them die with the idea. We
embark on very thoroughgoing tests so we don't mind
how elaborate the drawings are that get thrown away in
the process. The first chapter is about doodles and then
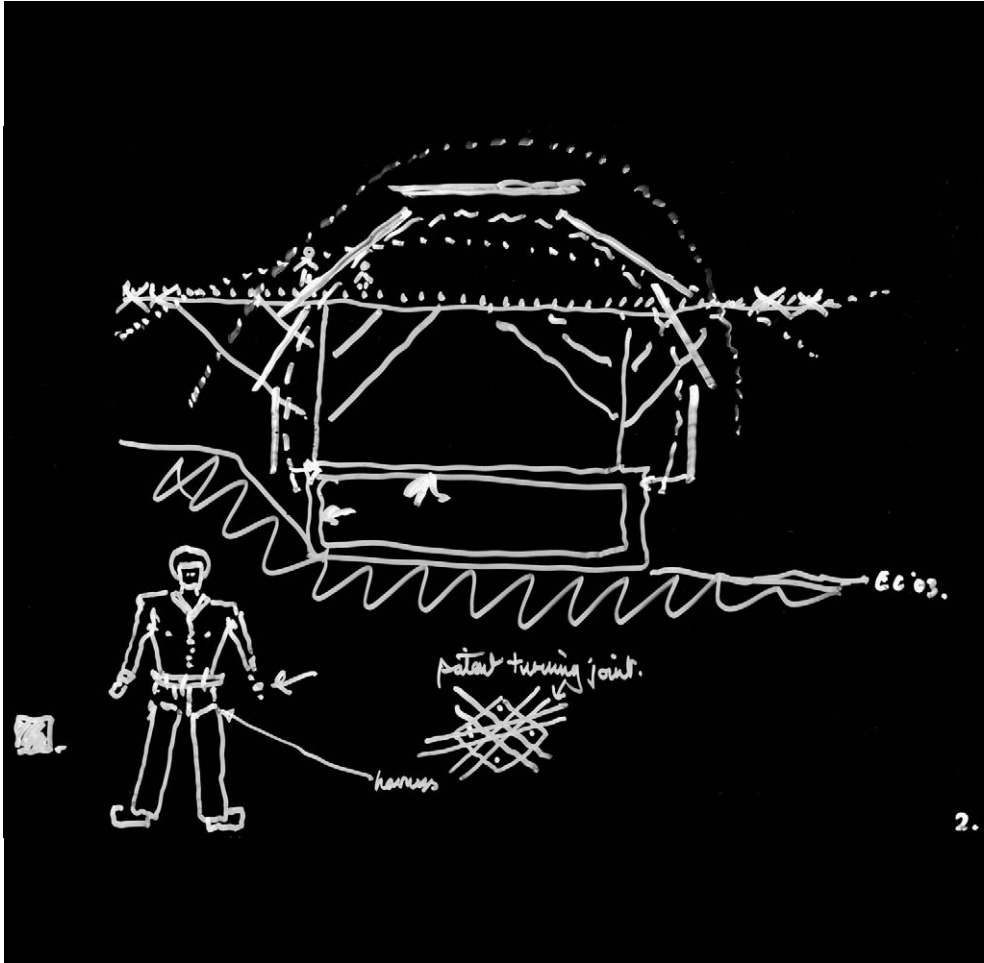
detailed drawings which are to test what we're thinking. Then the second chapter is like doing pictures of what we've already got.'
(Robbins, 1994, p.58)

Cullinan is not only making another description of the Popperian sequence but also emphasising the fact that in

contemporary architecture design almost always involves more than one person. Drawings become doubly important as a way of communicating.

It could be argued that these quotations all stem from the 20th century and that perhaps the concept of design as an autonomous topic is a modern invention. And to some extent that would be correct.

The history of architectural theory is very much more concerned with product than process, with the visual attributes of buildings rather than any investigation of how they came to be, irrespective of their appearance. In a sense it is much more historically biased rather than searching for explanatory ideas. Past concerns have centred on the nature and origin of the orders, on symbolism, on the difference and essential characteristics of columns and walls, on the necessity or avoidance of ornament, on the relation of beauty and proportion, on architecture and the city and, virtually in every period, on how architecture ought to satisfy functional requirements as well as artistic ambitions. The subject was the built world around us, not the mind of the architect.

There are of course exceptions. An early and notable example was Leon Battista Alberti (1404 –72), architect, painter, writer, inventor, athlete. He wrote his most influential book, *De Re Aedificatoria*, in the middle of the 15th century. It was not published until 1486, fourteen years after his death. In the second paragraph of his work he makes clear that

> '… Him I consider the architect, who by sure and wonderful reason and method, knows both how to devise through his own mind and energy, and to realise by construction, whatever can be most beautifully fitted out for the noble needs of man, by the movement of weights and the joining and massing of bodies. To do this he must have an understanding and knowledge of all the highest and most noble disciplines. This then is the architect.'
> (Alberti, 1988, p.3)

Alberti is anxious throughout the *Ten Books* to make a distinction between *lineamenta* and *materia.* Though they are clearly related, *lineamenta* has been variously translated as design, idea, form, measured outline but always in some way linked to drawings as an activity of the mind. Similarly he makes a distinction between *lineamenta* and *structura,* between design and construction, where *lineamenta* must precede *structura.* Our use of contemporary terms such as design for *lineamenta* may not literally correspond to the original Latin, as Joseph Rykwert, Neil Leach and Robert Tavernor emphasise in their translation of *On the Art of Building in Ten Books* (Alberti, 1988). Nevertheless, the sense that there is a premeditating activity pursued by the architect is not in doubt. Alberti makes this clear in the First Book.

> '. . . let lineaments be the precise and correct outline, conceived in the mind, made up of lines and angles, and perfected in the learned intellect of imagination.'
> (Alberti, 1988, p.7)

Thinking & drawing

In architecture, design and drawing are inseparable. Whether
the drawing is by hand or computer is, for the moment, irrele-
vant. What matters is the translation of a thought into some
visually discernible artefact. By drawing I mean both making
marks on a two-dimensional sheet or screen and making
exploratory three-dimensional models. They are investigatory
tools that are an essential element of the design process.

 Drawings become a tool through communicating to
the designer and the recipient of the design. Their ability to do
so depends on certain conventions which need to be under-
stood. In this sense architectural drawings – plans, sections,
elevations – differ from other drawings, from drawings as
works of art. We know at once the difference in character and
intention between a drawing of a pavilion on a Japanese scroll
and a plan and section of a similar building, to take an example
where there is in fact a superficial resemblance between the
two.

 These conventions are largely necessary because the
drawing is only an analogue of the building; it is always different
from the building. However hard the drawing tries to be 'accu-
rate' or 'atmospheric' it inevitably retains the qualities and
appearance of a drawing. What is equally important is that

> '…drawing in architecture is not done after nature, but
> prior to construction; it is not so much produced by
> reflection on the reality outside the drawing, as produc-
> tive of a reality that will end up outside the drawing. The
> logic of classical realism is stood on its head, and it is
> through this inversion that architectural drawing has
> obtained an enormous and largely unacknowledged
> generative power: by stealth. For when I say unacknowl-
> edged, I mean unacknowledged in principles and theory.
> Drawing's hegemony over the architectural object
> has never really been challenged. All that has been
> understood is its distance from what it represents,
> hence its periodic renunciation ever since Philip Webb

rejected the whims of paper architecture – while continuing to draw prodigiously. There are all sorts of curious reminders as to the subliminal acceptance, beneath the level of words, or its singular priority within the art of architecture, if art it be, such as in architectural portraits, where, as a rule but with few exceptions . . . architects are portrayed with their drawings, as are sculptors with their sculptures and painters with their canvases, estranged, for posterity, from the results of their labour, the clients more usually retaining the privilege of being portrayed with the building.'
(Evans, 1986, p.7)

Some architects have modified or perhaps even ignored the conventions in an attempt to convey impressions rather than a likeness. Significantly, Zaha Hadid calls her architectural drawings 'paintings' perhaps in an attempt to distance them from conventional images. Nevertheless they still inevitably remain analogues.

Of all the conventions used by architects it is the plan which is the most curious and unreal; a horizontal cut which reveals all the spaces on one level at the same time and from a point of view which never exists for the ordinary user; only low walled ruins reveal their plan form clearly. Yet it is fundamental to architecture even if somewhat mysterious to laymen since it presumably requires a difficult mental conversion which translates two-dimensional outlines into three-dimensional volumes understood by an observer looking parallel to the plane of the plan.

The importance of the plan in architecture stems, one suspects, from the constructional necessity to set out walls on the ground. This primary need then also becomes the first step in the design process. It is precisely this drawing of the plan as the first abstraction and analogue of the building which makes Le Corbusier's statement 'the plan is the generator' so correct

and so in line with everyday design experience. Kahn makes a
very similar statement: 'The plan expresses the limits of Form.'
Form, then, as a harmony of systems, is the generator of the
chosen design. The plan is the revelation of the Form. Yet Le
Corbusier goes on in *Vers une architecture* to say: 'A plan is not
a pretty thing to be drawn, like a Madonna face; it is an austere
abstraction, it is nothing more than an algebrization and dry-
looking thing.' As is the case of many other architects, verbal
statements do not always correspond with design practice.
The similarities between the forms in many of Le Corbusier's
paintings and the shapes on his plans are too obvious to be
accidental. They have been the subject of frequent and
convincing analysis.

It is highly probable that Le Corbusier's dismissal of the
visual values of the plan stems, on the one hand, from a glorifi-
cation of the apparent rationality of engineering and, on the
other, from a need to disagree with the teaching of the Ecole des
Beaux-Arts where the aesthetics of the plan played an impor-
tant role. There existed an implicit and perhaps even more
explicit assumption that there was a direct connection between
a beautiful plan and a beautiful building.

We owe the notion of such a link to Alberti, yet making
that connection has its dangers as well as possible – but uncer-
tain – benefits. For instance, it can hardly be questioned that
Kahn created a powerful and readily understood visual order in
almost every plan he drew during the last twenty years of his life.
What is more debatable is whether that plan order was always
equally legible to an ordinary observer moving about his build-
ings. The open pavilions of the Bath House making a cruciform
are readily understood because of their small size and the ability
to comprehend the entire building from its centre. At Bryn
Mawr, however, what one sees from the outside is a building
with two re-entrant right angles, a slate-clad wall which through
its faceted nature simply breaks down the mass of the building.
At the Exeter Library the magnificent central space reveals its

Below
Mies van der Rohe, Brick
Country House 1923; plan
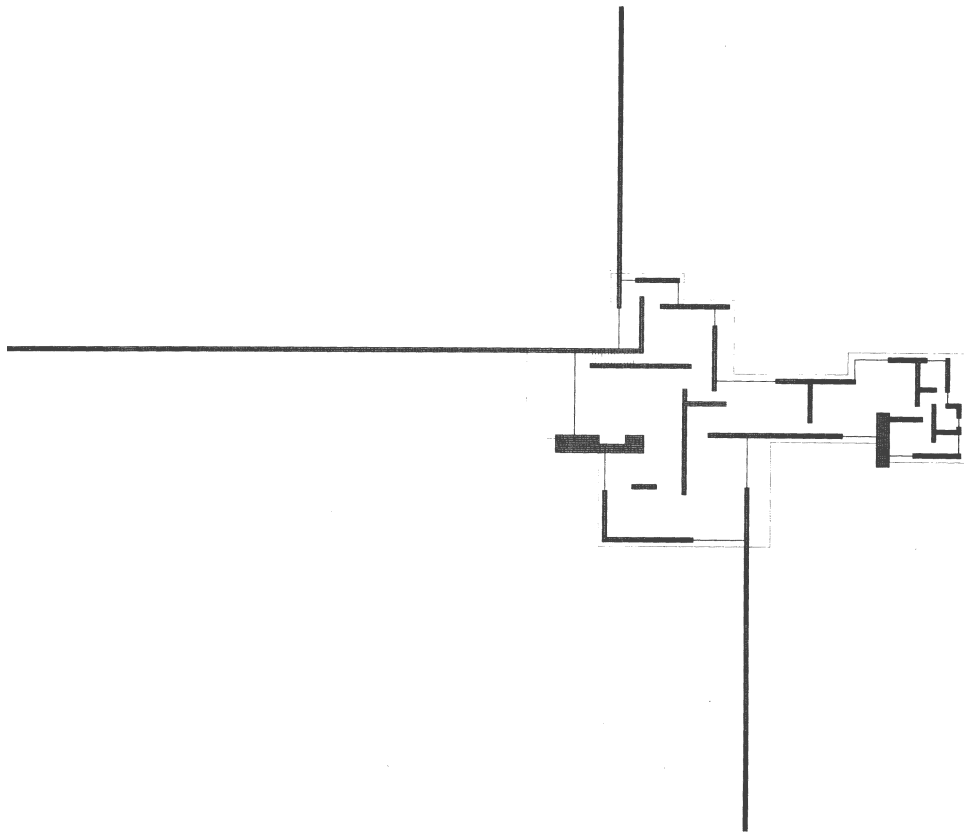
symmetry on all four axes but the servant spaces which are so
visible on plan in each of the four corners, emphasising the
diagonal symmetry, make very little impact on the viewer either
from the centre or when moving about on a floor. It could also
be argued that the towers of the Richards Medical Laboratories
are much more easily understood as an almost picturesque
assemblage of vertical elements than as an array of bi-axially
symmetrical units.

The fact that the obviousness of the plan is not always
mirrored in the building we sense in use, seems to me in the last
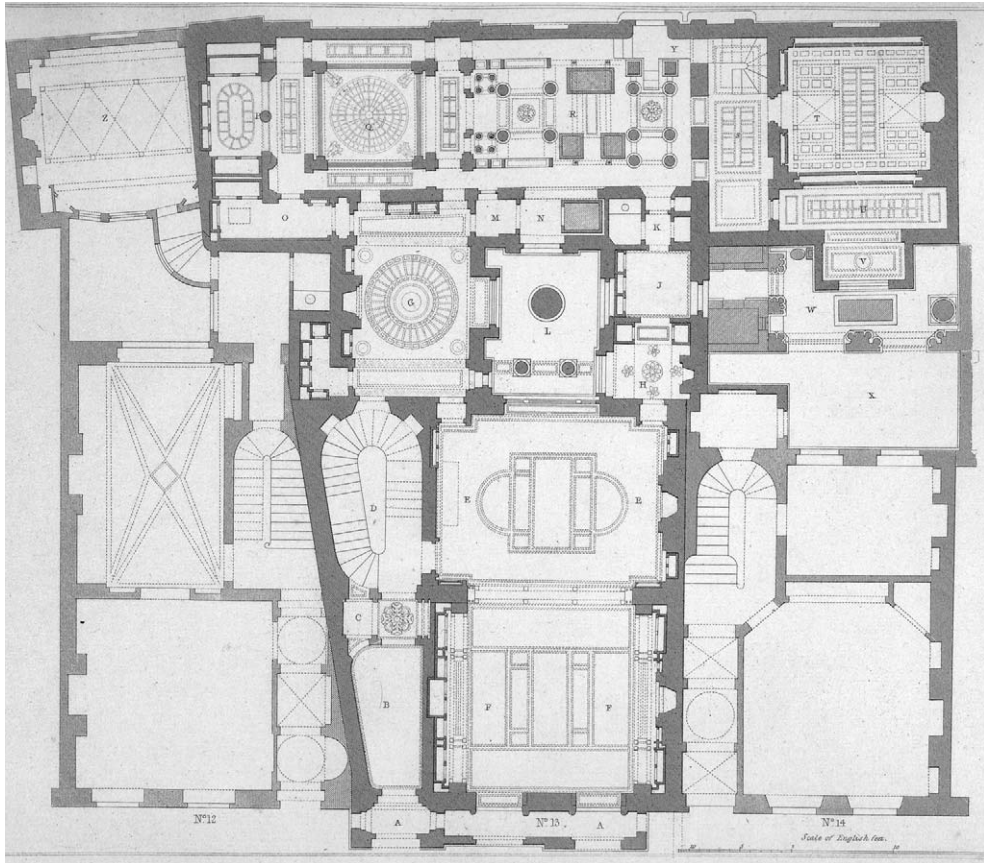
Sir John Soane, 12, 13 &
14 Lincoln's Inn Fields,
London; ground floor plan;
plate 1 of John Britton, *The
Union of Sculpture &
Painting*, London, 1827

resort not to be crucial since the plan drawing is after all only a
tool. What is important is that the way in which Kahn used that
tool – insisting on a deep order visually displayed by building
mass – made it possible for him to create an architecture of
nobility and seriousness, of gravity in the literal and metaphoric
sense, which can best be described as the Doric of the late 20th
century.

   On the other hand, what makes the plan of Mies van der
Rohe's Brick Country House of 1923 so appealing is the dynam-
ic disposition of dark lines on a white ground that also meshes

with our expectation of freely disposed spaces as a hallmark of early modern architecture. Similarly if we look at the quite different figure/ground relationship of the symmetrical masses of a Renaissance church we have some inkling of the kind of building which is being drawn. Our eye translates the plan into some spatial configuration on the basis of our previous experiences that gave us a tutored and expectant eye. Although we make that translation we can have no certainty as to what a three-dimensional reality might be. A plan of Sir John Soane's house at 12–14 Lincoln's Inn Fields in London at the time of the architect's death in 1837 gives no indication of its real complexity, primarily because it does not – and cannot – adequately record what happens on the ceiling.

A series of sections and elevations would enlarge our understanding but still be dependent on our memories. Both sections and elevations are single views from a fixed position and do not represent that vital ingredient of spatial awareness, our movement through space, our kinaesthetic experience both horizontally and vertically. Computer simulators are a significant advance but – as yet – do not capture the subtleties of vision dependent on the movement of the head and eyes, on changing focus from space to detail and on the difference in visual acuity between central and peripheral vision which are all so critical to our full appreciation of architectural space. There is also a simple perceptual problem: if we look at a picture the same image appears on each retina, if we view a solid three dimensional object, a different image appears on each retina (see p.112 & 116)

As we are dealing with a visual medium, the aesthetics of the plan are unavoidable despite a conscious awareness that the plan is a convention, probably even a confusing and perverse convention. There is an expectation that the plan has some congruence between the general characteristics of the building and the pattern of the plan. This may not be a well founded expectation but it is difficult to deny its existence.

We somehow feel that, just as an experienced tracker can identify an animal from its footprint, so we can judge a building's configuration from its plan, or at least think we should be able to do so. This may to some extent be a matter of experience, but certain signals are obvious and do not need a trained eye.

The plan of the Carolingian church in Fulda in Germany, for instance, conveys immediately a sense of simplicity as well as an overt symbolism of Christ's cross. This is very different from the late 15th century plan of the nave and presbytery of the Church of St Barbara in Kutná Hora in the Czech Republic. Although the two church buildings share a generic plan form, we are instantly aware of greater spatial complexity at St Barbara. This is mainly conveyed by the convention of showing what is going on overhead, in this case complex late Gothic vaulting. Both churches conform in their plans to the rules of Euclidian geometry. Many plans of castles, on the other hand, show non-Euclidian attributes that come about from a concern with contours and the needs for defence. These abstract shapes now give us visual pleasure though we fully understand that may never have been a deliberate intention.

The importance of the appearance of the plan is highly significant at the time of design. We judge the plan not only on its ability to resolve functional aspects through the disposition of spaces and its indication of volumetric qualities but also simply as a two-dimensional abstract. Our eye is beguiled by the marks on paper; I admire the lines of the plan of St Barbara even though I can never actually see that plan pattern in the building as it is on paper.

The known limitations of architectural drawings do not prevent them from fulfilling three crucial and distinct functions: as part of the thinking process of design, as an indication to the client and users of what the building will be like, and as a set of specific instructions to those constructing the building. All three can be done manually or be computer aided, or a combination of
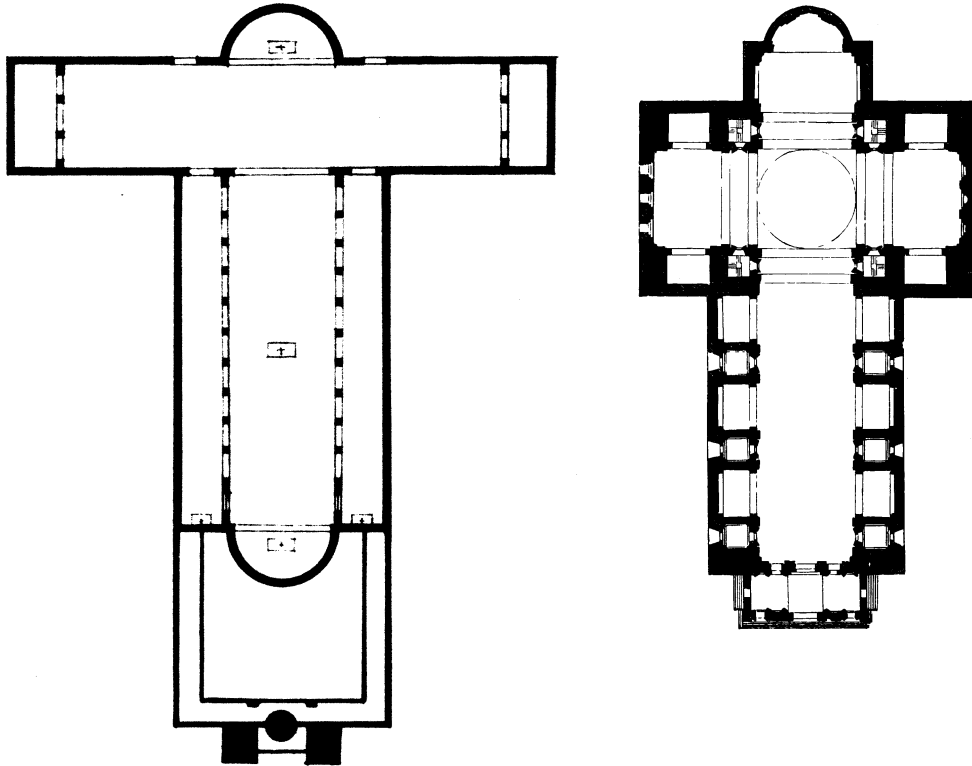
Above, left
SS. Salvator & Bonifatius, Fulda, Germany 791–819; plan of Carolingian church and atrium

Above, right
Leon Batista Alberti, S. Andrea, Mantua, Italy 1470–

the two. The difference between the three is of intent and execution. It is the first function which is at the moment the most relevant to this discussion.

When Erich Mendelsohn does a small scale pencil sketch of the Einstein tower in Potsdam in 1920 or when Mike Davies of the Richard Rogers Partnership produces a series of rapid concept sketches in May 1996 for the Millennium Dome, there is an inevitable and perhaps necessary imprecision. The first thoughts can only concentrate on certain primary intentions, on certain gestures which are indications but remain open ended; they are tentative answers to the hypothesis which had formed in the mind. In that sense they resemble a painter's

Right
Church of St Barbara, Kutna Hora 15th century; vaulting plan of nave and presbytery
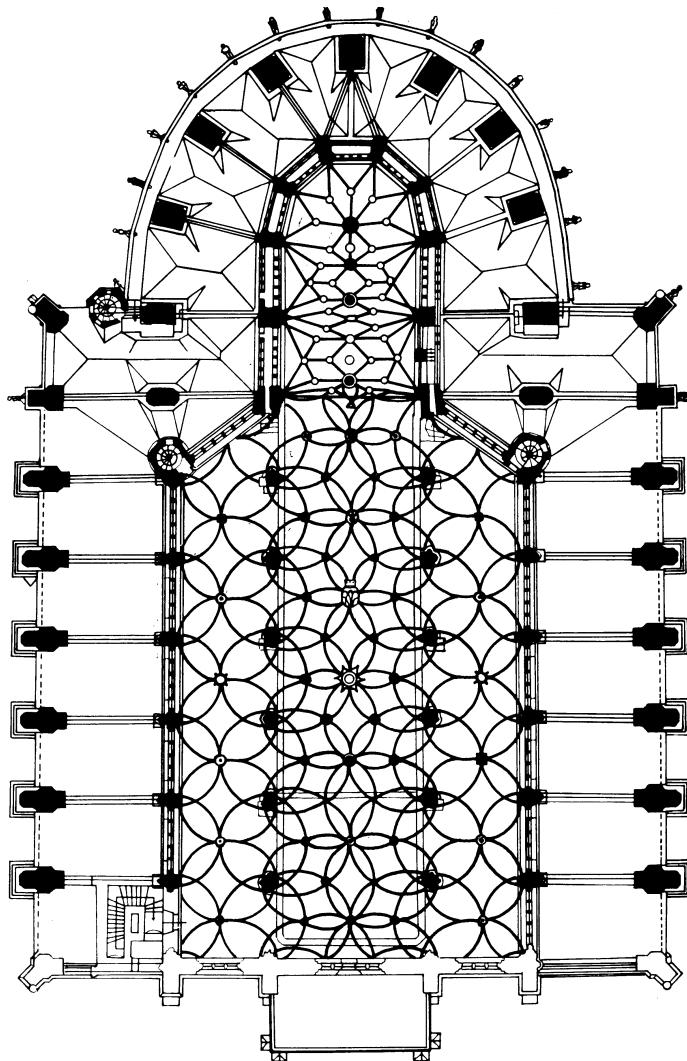
early explorations through drawing. They differ significantly, however, since a painter's sketches will be translated into another two-dimensional picture, an architect's probings are the beginnings of a three-dimensional form at a dramatically different scale.

Like a painter's work, however, architects' drawings are also the result of eye and hand co-ordination, even if done on a computer. They are the nearest to a craft activity that occurs in the design sequence. It is therefore not surprising that in several cultures there is the story of the ruler who asked an architect to design him a building and was so pleased by the result that he had the eyes of the architect gouged out or his hands cut off so that the building could not be repeated.

Drawings issued to a builder or manufacturer, unlike sketches, need to be precise and unambiguous. This is often achieved by drawing details full-size or even, as sometimes in the case of aluminium extrusions, twice full-size. This is very much in the tradition of mediæval architects who drew up plans

'...in the tracing house which was a room set aside for the purpose. The tracing-house floor was covered in plaster on which the architect drew in life size part of a vault or of some other feature of the church, indicating every possible aspect of it. The carpenters were then called for, and they, using special planks, cut out templates from which the stone was then shaped.'
(Gimpel, 1983, p115)

Below
Richard Rogers Partnership, The Millennium Dome, London 1999; early concept drawing by Mike Davies, May 1996
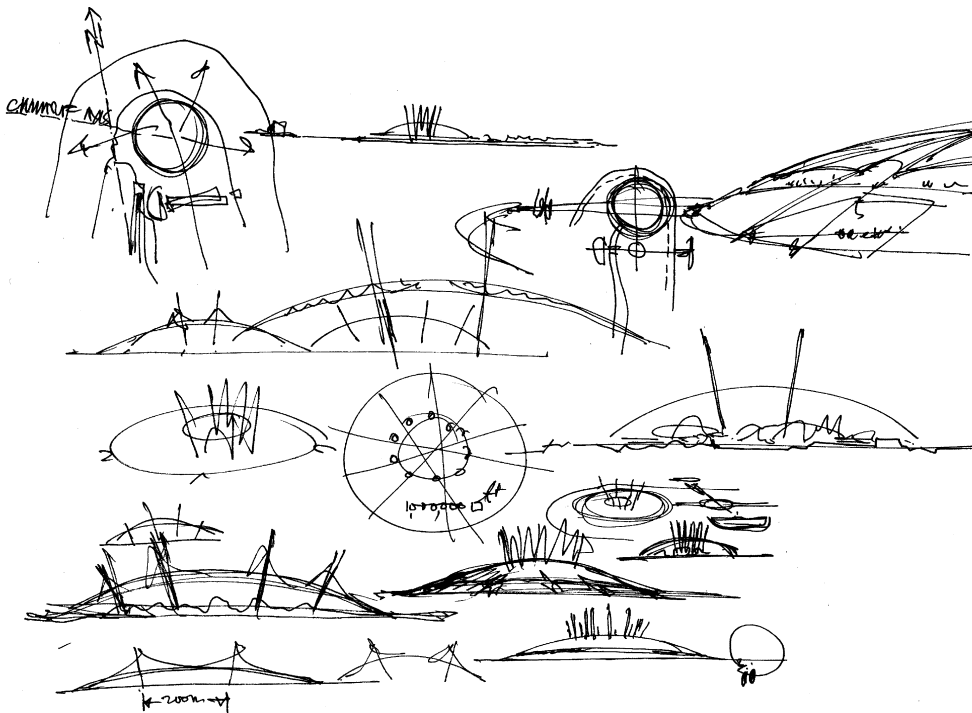
The drawings we show to users and clients raise partic-
ular difficulties. Mendelsohn's bold soft pencil marks meant
something to him which was unlikely to correspond to what
the scientists who would work in the building could imagine.
Different expectant eyes are at work. Are we to present meticu-
lously detailed perspectives of the project or should we in some
other manner convey the atmosphere of the building and its
spaces? Neither computer visualisation nor three-dimensional
models resolve that dilemma. The disparity in size is always a
serious and insurmountable obstacle. Quite apart from form,
colour and texture are also very size-dependent.

Other non-verbal media have similar, if not even greater,
difficulties. There is, for instance, in music no aural connection
between black marks on lines and the sounds we hear per-
formed; the convention of musical notation is more abstract.
Dance has equal problems of finding ways of recording the
movements imagined by the choreographer.

Models made of unpainted wood or some white sheet
are often preferred by architects because they distance them-
selves from the toy-like qualities of miniature buildings. Models
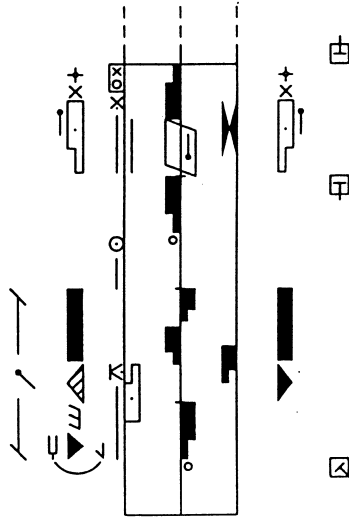may on occasion be built for very specific and limited purposes:

Right
Erich Mendelsohn, pencil
sketch of tower at
Potsdam, 1920
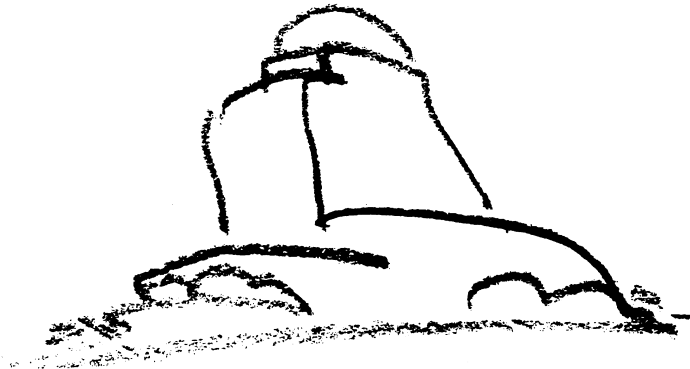
a transparent acrylic model may reveal the anatomical arrangement of floors but say nothing about how it would feel to be inside the building.

In many periods there is a general reciprocity between architects' drawings and the formal architectural vocabulary. The choice of axonometric projection; of a bird's eye view tilted usually at 45 degrees, suggests an emphasis on the juxtaposition of masses rather than the frontal impression of façades so dominant in renaissance architecture. The intentions behind a drawing such as that for a cathedral in Freibourg by Alberto Sartoris exhibited in 1931 is very similar to those that influenced the view of the High Museum in Atlanta, Georgia, of 1980–83 by Richard Meier. Many drawings from the office of James Stirling reverse the axonometric making it a worm's eye view that negates the roof but emphasises the ceiling. Choisy had used the method in the 19th century to explain in a single drawing the plan, section and vaulted ceiling of cathedrals.

To look at another 19th century illustration, say the view of the Gardener's House in Charlottenhof near Potsdam by Karl

Right
Alberto Sartoris,
Freibourg Cathedral com-
petition submission, 1931

Below right
**Choisy, Santa Sophia,
Istanbul;** plate from
'Histoire de l'architecture'
1899; Le Corbusier used
Choisy's drawings in
*'Towards a New
Architecture'* 1927
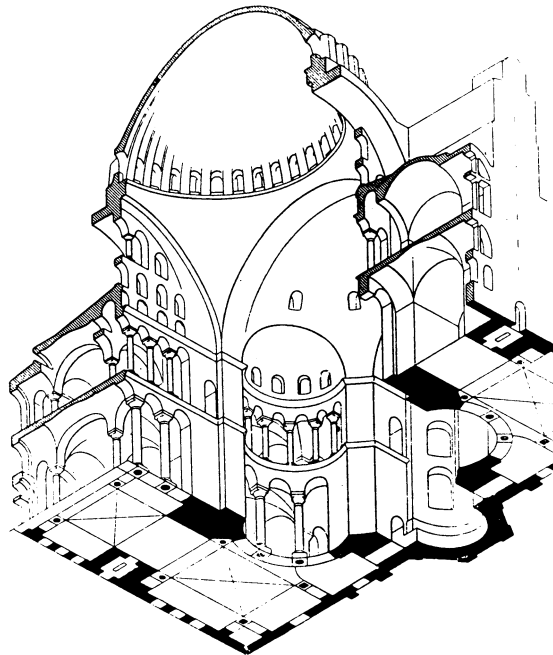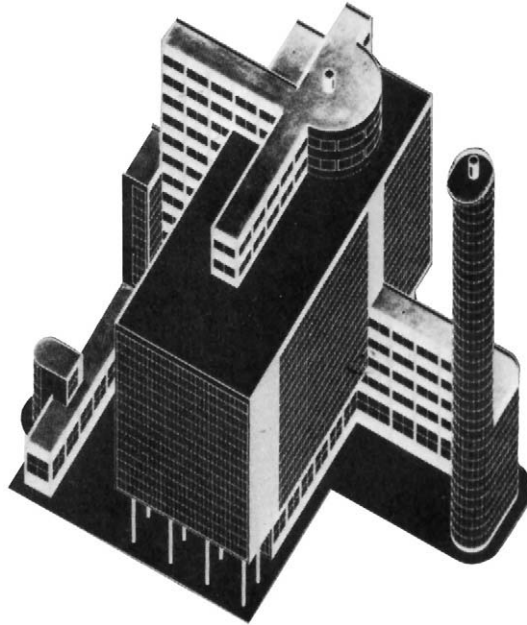
Friedrich Schinkel of 1834 – which appeared as an etching in the *Sammlung architectonischer Entwürfe* published first in serial form between 1819 and 1840 – is to become aware of quite different intentions, not just a different style. First of all it is an engraving and has been worked by another hand. Most importantly, however, the perspective drawn after the building has been designed is a picture of a building in its setting, not an exploratory drawing in the design process. Hence the emphasis on planting, water, the boatman in the gondola, the swans and their reflection. The important relation between architecture and landscape as in Bath or the Regent's Park terraces in London is of course characteristic of the neo-classical period and clearly influential in this engraving; Palladio did not draw his villas in their rural setting.

In terms of continuity and innovation, drawings are arguably neutral; we are equally able to draw the traditional as well as the advanced. We need sophisticated software programs in order to be able to depict certain complex forms such as those of the Guggenheim in Bilbao. Moreover the parts making up that building could not have been made without the use of computer aided design (CAD). The same would be true for

Below
Karl Friedrich Schinkel, Perspective of the Gardener's House in Charlottenhof near Potsdam; engraving from the *Sammlung architectonischer Entwürfe*, published in serial form between 1819 and 1840
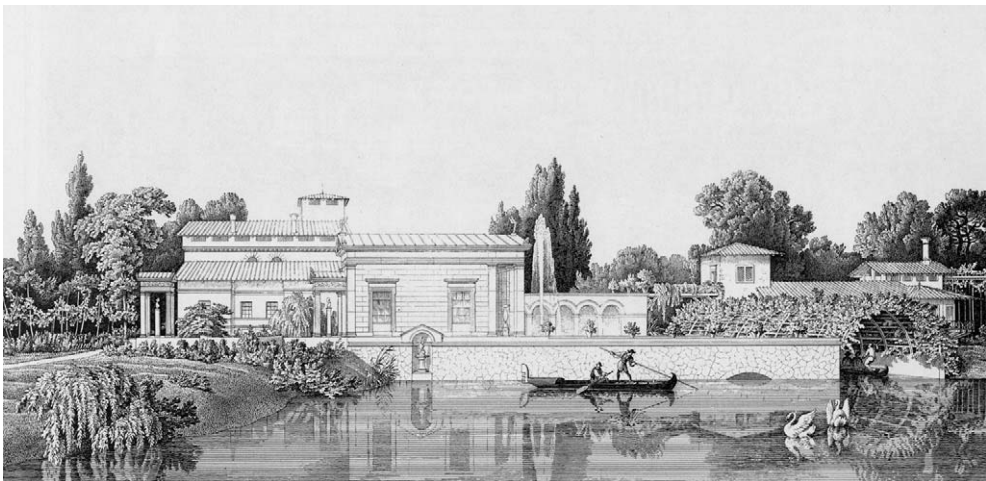
a structure such as the Millennium Dome in London. It would seem therefore that certain forms of innovatory architectural and engineering design can only be created because of the availability of programs which allow the buildings and their structures to be drawn, calculated, manufactured and assembled.

The fact that drawing is only an analogue of the building also allows for architectural ideas that might not be realisable either because of cost or the lack of certain technologies to be presented. The history of speculative and fantastic architecture is long and honourable. Drawing in that sense makes innovation easier and thus more likely. Many of the highly exuberant buildings we associate with expressionist architecture, for example, were hardly buildable at the time of their inception. They, however, record in their spontaneity the almost stormy vitality which was their starting point; they were clearly also highly polemical and thus a criticism of existing practice. They represent a visionary tentative solution.

At the other end of the spectrum it is probably true to say that buildings with minimal innovation, such as the vernacular architecture of many societies, are able to dispense with drawings altogether. There is no criticism of the existing forms and methods of construction, no reason not to continue what had been done earlier. There is thus no need for a tentative solution as an analogue; it is possible to erect a barn, a house, a shrine by simply building them from the ground up, using the experience embedded in a tradition.

When drawings become a necessity, and are the essential tools of the design and construction process, they are probably not socially neutral. Drawings give, or at least appear to give, power to a particular profession. As Edward Robbins, a social anthropologist, concluded his analysis of the role of drawings:

'In the end, for better or worse, without the empowerment drawing provides architects to take conceptual

Right
Max Taut, Blossom House 1921; watercolour, ink and graphite sketch

command over what they are designing and without the
authority and the concomitant control this gives them
over the making of architecture, the practice of architec-
ture and our built environment would not be what they
are today. Nonetheless, opening up a dialogue about
drawing between anthropological outsider and archi-
tectural insider, even to the degree that one voice, the
anthropologist's, appears critical, can only help broad-
en architectural possibilities. The way we use and
understand media, and the relation of the virtual to the
real, are today being rapidly transformed. As a result,
how we allocate social responsibility and position to
those cultural actors who use these media and deal with
the relation of the virtual to the real will also be trans-
formed. If architects are to play a role in these changes
and if they are to realize the full potential of what lies
ahead, they must examine their practices in the present.
A dialogue about drawing among architects and
between architects and others is a crucial place to
begin.'
(Robbins, 1994, p.300)

It would be foolish to deny that drawings represent a
mystique and therefore some kind of power, almost the essen-
tial trappings of a priesthood, quite apart from their function as
transmitters of instructions. If we want non-architects to play a
greater role, to make decisions or at the very least to understand
the process of design decisions, how can this be done without
the use of drawings or models? Both are limited and capable of
manipulation. As architecture is a visual medium, I see no way
round. Words are certainly not the answer; there is no direct
correspondence between words and three-dimensional reality.
Robbins does not indicate how to surmount this obstacle, how-
ever much he encourages us to try. It does not seem likely that
electronic means of depiction will solve the problem; they are

after all only another form of drawing which equally empowers the designer. Arguably virtual reality might give even more credence – and standing – to its creator because of its higher verisimilitude.

Was it like this?

Whether we are intent on pursuing continuity or innovation, or probably a combination of the two, the past is of relevance. It is either the source of an initial model or simply something to be continued uncritically. Can we, however, ever read and understand the past, even the recent past, with sufficient certainty or are we always in the position 'that what we think of as someone else's past was never anyone's present'? It is a question of considerable relevance to the preservation and restoration of old buildings, to the demands made by institutions claiming to safeguard our heritage and to our general understanding of how to approach the past.

In order to know the past we rely on some form of document, using the term in its widest sense: on a treaty, an account book, a building, painting, photograph, a surviving eye-witness and of course on earlier histories which themselves depended on some documentary evidence. In the case of architecture we have to rely heavily, though not solely, on visual evidence. Manuscripts of Vitruvius have come down to us with no illustrations except for one diagram in the margin though Vitruvius refers to illustrations which should be at the end of several

Below
John Wood the Elder, Queen's Square Bath, England 1728; south elevation
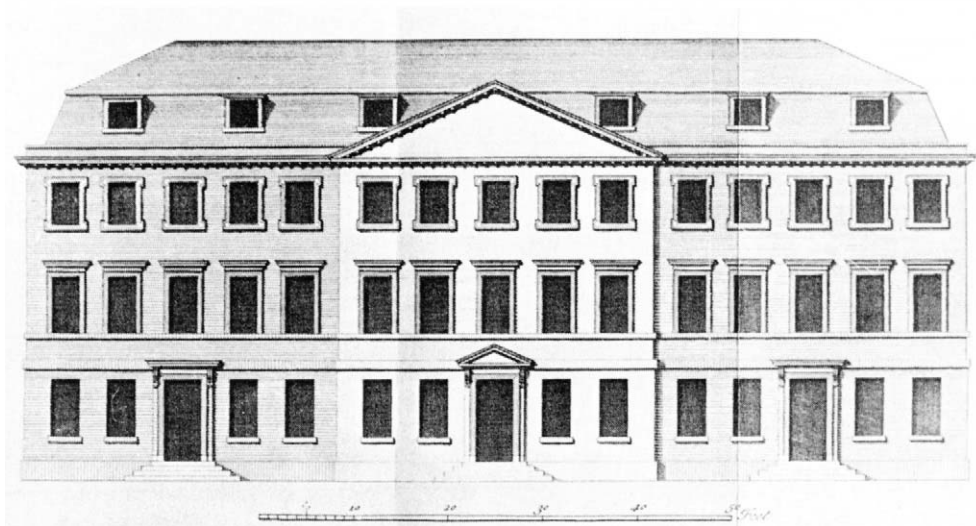
books. Vitruvius was nevertheless able to give us a very considerable insight into Roman architecture, much of it however dependent on the survival of built Roman remains.

These remains give us clues but are of necessity in an alien setting; even a well preserved temple like the Maison Carrée in Nîmes can convey little of its original impression. We see the surviving structures with different eyes. Perhaps we might come a little closer if we looked at paintings of buildings which were done not long after their completion; if we could see the building as the past saw it. I remember once asking Henry-Russell Hitchcock why he always used rather faded black and white slides in his lectures. He maintained that these were closer to some original view because as a rule they excluded the overhead wires, the buses and cars, the street and shop signs.

The complexities of the issue become evident in a seemingly trivial planning application to replace glazing bars at 25 Royal Crescent in Bath in 2000. The building is part of the great neo-classical Crescent by John Wood the younger built between 1767 and 1775. The typical elevational drawing of that period shows windows as either white or black; there is certainly no sub-division of the glass on the drawings. This was a convention which was widespread and pre-dated the work of both John Wood the elder and the younger. We know that contructionally the drawings were an impossibility since such large panes of glass did not exist and in any case the windows had to be openable. Contemporary pictures of Bath clearly show buildings with glazing bars on all the windows. Was the convention therefore purely one of convenience or did the dark openings represent some desirable simplification of the elevation that made the contrast between solid and void more obvious. Would John Wood in fact have welcomed the alterations that occurred in the Victorian period when large sheets of glass made it possible to have only a meeting rail on vertically sliding sashes? The openings were now closer to his drawing and therefore, on one argument, more correct. Even

Below
**Giovanni Battista
Piranesi**, Piazza del
Popolo 1746?–48?, etching
from his *Vedute di Roma*

contemporary drawings are an uncertain and possibly untrust-
worthy guide.

What contemporary depictions do most successfully
is to create a context and an atmosphere that is different, which
may seem strange and may, hopefully, shock our too-expectant
eye into an altered perception. Giovanni Battista Piranesi's
etchings of Rome, his *Vedute di Roma*, issued from probably
1746 onwards, show the city in the middle of the 18th century.
They include both ancient ruins and more recent renaissance
buildings. A view of St Peter reveals that it was surrounded by
unmade roads, had a horse trough nearby and washing hang-
ing on the line. The same unmade roads and ruts are even clear-
er in the view of the Piazza del Popolo; beyond the Egyptian
obelisk are the twin churches of 1662 by Carlo Rainaldi and the
three axes into Rome marked as much by tracks made by coaches

8.3
Piazza Colonna, Rome,
at the time of Pope Sixtus
V, 16th century (detail)
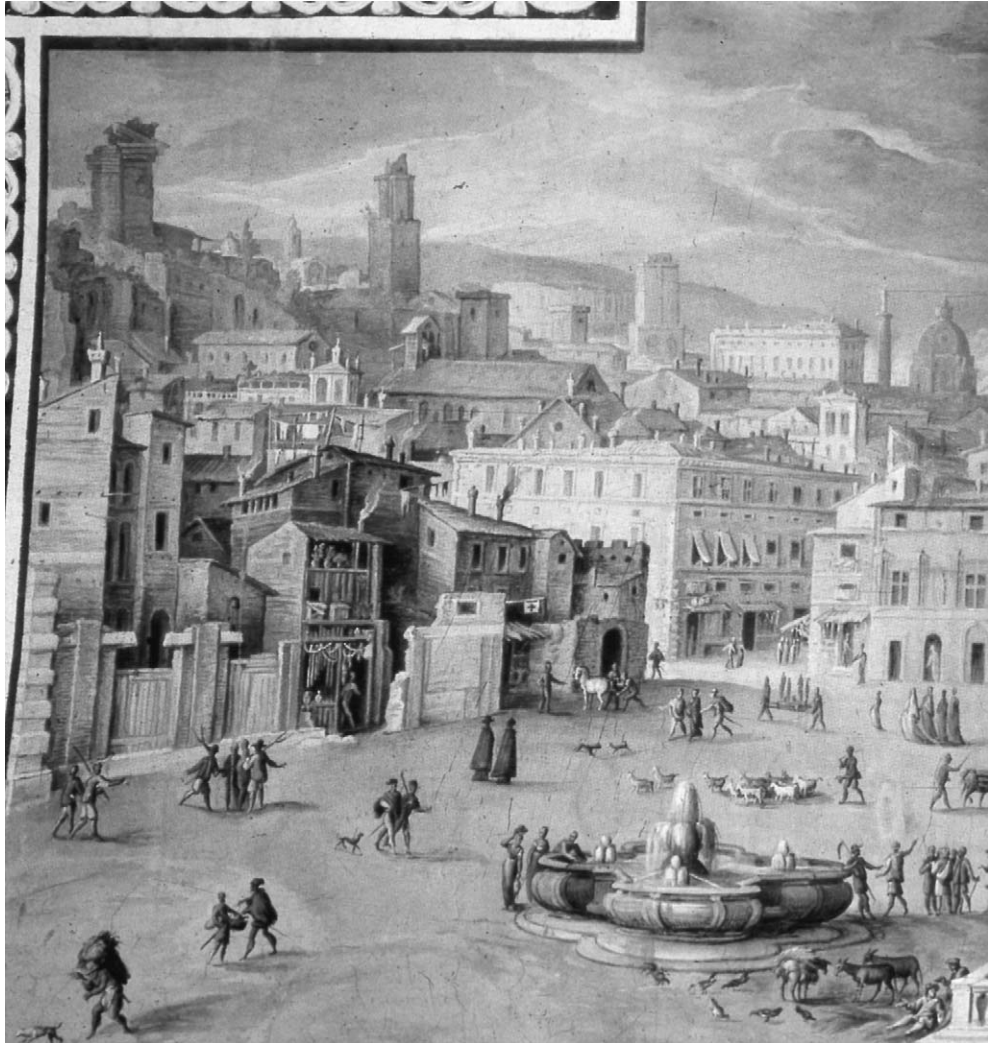
as buildings. In the etching of the Forum Romanum there is
what looks like a hay wagon drawn by oxen and some fenced in
livestock being inspected by several men. Similarly a 16th cen-
tury painting of the Piazza Colunna in Rome at the time Sixtus V
who was pope from 1585 to 1590 — includes among those using
the piazza a goatherd and his flock, several horsemen, a smith

shoeing a horse, several donkeys carrying loads and a group
of men with pitchforks. Ambrogio Lorenzetti painting a fresco
of the 'Allegory of Good Government' in the Palazzo Publico in
Siena in 1338 has a flock of sheep being herded within the town
walls. Five hundred years later a view of the Round Tower and
the Church of the Trinity in the centre of Copenhagen in 1840
has a large farm wagon piled high with hay blocking out part
of the church. The animals being herded through the town
would, moreover, feed on any vegetation so that a tree-lined
avenue was a highly unlikely occurrence.

     For centuries and over large parts of Europe the city was
an urban farmyard. This lasted well into the 19th century and
even then streets were hazardous with horse dung and mud.
It was in such a setting that the buildings we now see against
smooth roadways and pavements were originally viewed.
Our standard notion of urbanity is a 20th century invention.

     So is our mental picture of interiors. We assume, for
instance, that furniture in a room would be disposed within the
space. During much of the 18th century in England, chairs, side-
boards and candle stands were ranged against the wall and
only brought forward when required. The centre of the room
was, in a sense, a void. The greatest difference was, however, at
night. Many paintings show how very small pools of light exist-
ed and how anyone reading or doing needlework sat extremely
close to the candles or oil lamps. Only the table was illuminated;
the rest of the space was dark. To lessen the sense of gloom,
mirrors, polished metal plates on sconces, gilding and cut
glass chandeliers, where these existed, were introduced to
sparkle and reflect. Candles were expensive and prone to
smoke – as well as always a fire hazard – so were not used in
profusion except by the wealthy on special occasions. The
open fire provided some light as well as flicker.

     Although there had been a number of improvements to
oil lamps – especially to the French Argaud lamp with its glass
funnel – it was the advent of illumination by gas which very

THE SUSPICIOUS HUSBAND

markedly altered the appearance of the room. The whole space
became brighter and no longer was it necessary for a family to
cluster around a candle. Gas was in domestic use in London
around 1815, a gas light company having been established three
years earlier. The light came from a controlled flame until the
introduction of the incandescent gas mantle in about 1887 when
a reasonably strong light became possible. Even if, despite the
ubiquity and flexibility of electric light, we still place candles on
the dinner party table, it requires a serious leap of the imagina-
tion to visualise the alternating gloom and glare of a single can-
dle in an Italian palazzo or a Georgian house.

Candles change the appearance of colour. Their placement on the table flatters the complexion because of the light's emphasis on the red end of the spectrum. Gas light was, on the other hand, condemned as it tended to make people look greenish. Under whatever light, colour is something we associate with interiors. Mostly it is applied colour. We do not make the same instant connection between applied colour and the exterior; today polychromy is a startling exception, yet it was not always so. We have for so long been accustomed to looking at Greek temples or Gothic cathedrals as pure stone structures and have admired them for exactly that unified quality of material, that we deeply resist the suggestion that they might have been coloured; that they might have been more like a contemporary south Indian temple – to make an extreme suggestion – than the white limestone forms we imagine from the ruined remains of antiquity.

That colour was used on parts of Greek temples is not in real dispute. Traces of colour have been found and are recorded particularly in the first half of the 19th century. For instance blue, red and yellow paint was found on the cornice of the Parthenon (Dodwell, 1819). These fuelled the Polychrome Controversy in which the architect-archaeologist Jacques-Ignace Hittorf and Gottfried Semper, architect and historian, were the most active in making claims for polychromy, perhaps even for a consistent colour system. They had some written support from Vitruvius (1983) who stated in Book 4 Chapter II that trygliphs were painted with blue wax. This seems, however, to refer to the timber prototypes which are being discussed in that chapter.

Semper believed that in Greek temples:
'The white marble never remained naked, not even the parts intended to appear white; but the layer of colour by which they were covered was rendered more or less transparent, to enable the white colour of the marble to appear through it. In the same manner, coloured or

polished marbles, granite, ivory, gold and other metallic portions of the edifice, were all protected by a coating of transparent colour. Further proof is afforded by Egyptian monuments in granite, and by many passages in ancient authors referring to this practice.'
(Semper, 1851, p.243)

As a result his vision was utterly different from ours but probably equally romantic and probably equally questionable.

'The prevailing colour of the temple burned with all the glowing beauty of the setting sun. The colour may be defined as of a yellow red, very vapoury, resembling that of the finest terra cottas. In fact the general appearance of the temple would precisely resemble the appearance of a fine day in an eastern climate.'
(Semper, 1851, p.245)

Semper's enthusiasm was triggered by both a desire to spread his views, which included the belief that walls had their origin in coloured woven hangings, as well as to foster a 'revival' of polychromy. Very similarly our enthusiasm for white Attic temples is, no doubt, influenced by a sympathy for 20th century white architecture.

In England, polychromy was strongly championed in the 19th century by Owen Jones in three publications: *Plans, Elevations, Sections & Details of the Alhambra* (1842 – 46), *The Polychromatic Ornament of Italy* (1846) and the *Grammar of Ornament* (1856). It was, of course, much easier to accept that an unfamiliar Islamic palace in southern Spain should display colour than that it should occur on the Parthenon, quite apart from the fact that the evidence – that of durable tiles – was still much more visible. What was uncertain in the 19th century and continues to be uncertain today is the extent of the use of colour in classical temples: were only certain elements picked out or was the whole building

colour washed? Even small areas of colour, however, would hardly conform to our accepted view of what characterises a Greek temple.

As we come closer to our own time, our appreciation does not necessarily become more accurate. We are completely conditioned to colour in the interior of Gothic cathedrals: painted ceilings, bosses, occasional wall paintings and of course the brilliant colour of stained glass. We tend in fact to be surprised when there is an absence of stained glass and white light enters the space. The outside is, however, another matter. We expect to see stone, or sometimes brick as at Albi, so that the west façade of Orvieto Cathedral of about 1310 – 30 seems a curiosity. Its horizontal stripes of different coloured stone combine with coloured marbles and mosaic to produce a vivid polychromy that almost comes as a shock.

Someone imbued with northern Gothic may dismiss Orvieto on geographic grounds since it resembles, to paraphrase Semper, 'the appearance of a fine day in a southern climate'. It would be dangerous to do so and ignore surviving evidence which is admittedly scarce. Paint has been eroded and chemically broken down by pollution, particularly since the 19th century. The analysis of paint fragments taken from the west front of Exeter Cathedral, for instance, indicates that large areas were coloured – mainly green, red and orange (Sinclair, 1991, pp.116 – 33). It is quite likely that Exeter was not an isolated instance.

During the lengthy restoration of the West Front of Wells Cathedral fragments of paint were again discovered surviving in crevices of the stonework.

The examples – the urban farmyard, the characteristics of artificial light and the use of colour – have been chosen to suggest that our vision of the past may be faulty or, at the very least, likely to be highly partial. The present, as well as our current imagining of the past, is no safe clue to a correct, that is

truthful, representation of the past. Perhaps this does not matter and is, in any case, a misguided effort. The past is not here to be mimicked but to be mined; it is there for our eye to see what may be relevant and to use it as a critical *starting* point of something new. An excessive interest in the correct and a desire to simply copy may make us miss what could in fact be relevant. An insistence on a verisimilitude which is not achievable and would always be spurious is certain to hinder imagination and invention. The renaissance may have been so innovative and so successful precisely because the evidence of the antique was so vague at its start.

We accept – not necessarily always consciously – that etchings,   **111**
photographs, models, film or electronic simulations do not
convey the whole reality of a building. Frank Gehry's
Guggenheim has been illustrated in professional journals,
Sunday colour supplements and shown on television, yet the
pilgrimage to Bilbao continues unabated. It is as if we had to
touch the building to experience it fully.

      Walter Benjamin and others have discussed the pitfalls
of re-presentation. Ivan Gaskell, for instance, in his book on a
single picture by Vermeer, *Woman Standing at a Virginal* of 1672
describes how a mid-19th century etching of the painting makes
the woman avert her eyes. This was to have it conform with con-
temporary convention which held that only courtesans gazed
back (Gaskell, 2000, p.135). We become aware that there has
been some interference, that this is not a simple and total corre-
spondence between the original and the re-presentation. In
architecture, as in verbal translations between languages, this
is in any case an impossibility; if there were total correspon-
dence, it would be a clone of the original building.

      As often as not the problem is that the medium of re-pre-
sentation is unable to replicate or even mimic the characteris-
tics of the original. This is particularly acute in the case of
architecture. Buildings are as a rule experienced by a moving
observer, even if that observer stops from time to time to give
particular attention to some space or detail. This sequential
viewing of images necessitates movement through space as
crucial to the total experience. Even if there is no muscular
movement, as say by an observer in a wheelchair, the need to
travel through a building and to have to refocus the eye continu-
ally is a vital element of our perception. There is as yet no ade-
quate reproduction of that kinaesthetic experience. It depends
very considerably on being at full scale; computer 'fly-through'
simulations or views within a three-dimensional model are
sensed differently, as has already been suggested, not least
because the eye is at a constant focus and does not have to
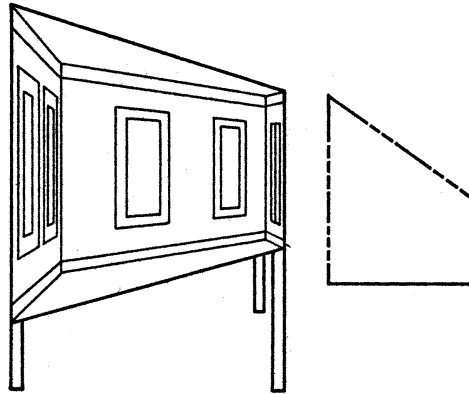
move in order to keep the object of interest at the centre of
the retina.

The problem is, paradoxically, that the photographic re-
presentation shows us too much. The whole picture is in focus
while in reality we see images clearly at the centre of our cone of
vision but less so at the periphery. That cone of central vision has
an angle of only about 2°; less precise peripheral vision gives us
the context for the small-scale detailed information. As a result
we are continually moving our eyeballs and, if necessary, our
head in order to maintain images in clear vision. Use of the wide-
angle lens only compounds the unreality of the photograph.

What information we do absorb from photographs, film
or computer images is of course very largely dependent on our
visual memory. The expectant eye is at work as has been demon-
strated by the Ames experiments, for instance. We refuse to see
a rotating trapezoidal window as anything but a normal oscillat-
ing rectangular window frame where perspective distorts the 90°
angles. Further research also showed that African boys from
rural areas, where rectangular windows are rarer, were less sus-
ceptible to this illusion than those from urban areas or European
boys (Vernon, 1962, pp.149–50). This is not to suggest that such
perceptual fallacies are a continuous occurrence, but only that
we are heavily reliant on visual memory.

Below
Henry Parker, Student
measuring the Temple of
Castor & Pollux in Rome;
watercolour made to illus-
trate the Corinthian order
for Soane's Royal
Academy lectures 1819; the
Soane Museum London

The period when travel had a very direct effect on design was in the heyday of the Grand Tour, that mainly 17th and 18th century journey to Italy in search of the roots of the classical tradition in architecture and sculpture, and the more recent renaissance tradition in painting. The journey was primarily made by members of the wealthy aristocracy who frequently included an artist, architect or scholar in their retinue. The pilgrimage, with all its difficulties as well as its social pleasures, was often seen as part of the necessary education of a young gentleman. It is thought that Inigo Jones went to France, Germany and Italy between 1598 and 1601 in the train of Lord Roos. Between 1612 and 1615 he was to go to Italy again as a special guide to Thomas Howard, Earl of Arundel, and his wife. The design for the Queen's house at Greenwich date from some years after his return from Italy; the Banqueting House in Whitehall from 1619–22, four years after his return from his second visit.

The Napoleonic Wars at the end of the 18th century disrupted travel in Europe. Interest moved eastwards. In Britain this had been stimulated by Robert Wood's *Ruins of Palmyra* (1755), Stuart & Revett's *Antiquities of Athens* (1762) and Robert Adam's *Ruins of the Palace of Diocletian at Spalato in Dalmatia* (1764). Travellers went beyond Italy to Greece, the Middle East and Egypt. Neo-Grec became a style and, especially after Napoleon's conquest of Egypt, Egyptian motifs found their way into architecture and interior decoration.

The influence of travel has continued unabated. We use it both as verification of what we have seen reproduced and as a source of precedent. As Sir William Chambers put it in the 19th century, 'travelling is to the architect as the university is to a man of letters'. The destination of travel has fluctuated since the 18th century even if Italy hardly ever lost its appeal. In the middle of the 20th century, Scandinavia, the USA and the works of Le Corbusier in France were at different times the goal of architectural pilgrimage; at the end of the century Barcelona and Bilbao moved to the top of the list.

Below
Thomas Jefferson, The
Lawn, University of
Virginia, Charlottesville,
Virginia 1817–26; the rotun-
da and Pavilions II & IV

Photography has, of course, had a huge influence in the 20th century and was associated with travel; first through black and white prints and then colour transparencies. It is now difficult to imagine how lectures on architecture were conducted without the aid of coloured slides. Most students' awareness of historically significant buildings comes from seeing their representation projected on a screen. This must affect judgement, not least because the photographer has chosen a preferred viewpoint. It is the photographer's eye, and not our own, which filters the information.

There is also a simple and unavoidable reason why the photograph or any other two-dimensional representation is unable to replicate our normal view of a three-dimensional object. Leonardo was aware that looking at a sphere the left eye sees slightly further round the left and the right eye further round on the right. Stereo vision was not defined until 1838 by Charles Wheatstone, a physicist, who wrote:

> 'It will now be obvious why it is impossible for the artist to give a faithful representation of any near solid object, that is, to produce a painting which shall not be distinguished in the mind from the object itself. When the painting and the object are seen with both eyes, in the case of the painting two *similar* pictures are projected on the retinae, in the case of the solid object the two pictures are *dissimilar*; there is therefore an essential difference between the impressions on the organ of sensation in the two cases, and consequently between the perceptions formed in the mind; the painting therefore cannot be confounded with the solid object.'

The great number of books published on architecture are highly dependent on photography. The reputation of a considerable number of architects is based on our appreciation of their work as published in journals and books. Personal verification is sometimes a shock; the spaces in Frank Lloyd Wright's Taliesin West, for instance, seem much smaller than one would infer from photographs. Books are, nevertheless, powerful transmitters of precedent and influence model choice.

The most influential book in the history of western architecture is probably Palladio's *Quatro Libri*. A style that dominated Britain for much of the 17th and 18th century, was prevalent on the east coast of America and had its effect on building in other colonies during the 18th century and the beginning of the 19th, can be traced back to Palladio's illustrations. Just how important the several translations and editions of Palladio's 'Four

Books' were can perhaps be judged by the fact that Thomas Jefferson (1743–1826) – president and architect – travelled to Italy to study rice cultivation but never saw a building by Palladio. He did, however, own a copy of the 'Four Books' in Giacomo Leoni's translation published in 1715. Although Jefferson was, later in his life, to admire and be influenced by French neo-classical architecture, the work of Palladio remained both fountainhead and touchstone. Jefferson's Palladian 'The Lawn' at the University of Virginia is among the most significant buildings of the early days of the new republic (Brawne, 1994).

The value of books may lie in their wide distribution facilitating the establishment of a style, of a sufficiently generally accepted vocabulary of characteristic forms. The significance may also be due – perhaps paradoxically – to the fact that they are less defining than actual buildings. Because illustrations convey less information than the building itself, we are free to add to that information and to use it more selectively. Or to put it another way, we are left with a greater opportunity to innovate. What is true for book illustrations holds equally for images seen on screen produced by a disk.

Buildings in our immediate surroundings or those seen while travelling, together with illustrations and computer images, are all stored in our visual memory to emerge when relevant, as part of our non-verbal thinking during the tentative solution stage of the design sequence. Our memory is also part of that awareness which influences our first selection of the initial problem; we impose a problem on ourselves, for instance, because the current visual expression appears unsatisfactory but something seen elsewhere or in books seems more appropriate, more acceptable, thus affecting both problem recognition and the tentative solution. Memory plays a huge and vital role in all visual thinking.

The vernacular & style

We travel not only to see the Parthenon but also the white-washed clusters of houses on the Aegean islands. We admire both but recognise the difference in intention and creation. We also admire without necessarily seeing both – or either – as a possible model.

Architects of the past used the temple frequently and in different ways as a model, rarely the vernacular. Many architects of the present may refer to the vernacular rather than the temple. It seems that our eye may be pleased by what it sees, yet not necessarily accept it as a model. Non-verbal thinking is just as selective as verbal thinking. We want, as it were, to say something and select the relevant memory as the precedent. It is highly analogous to scientific discovery which is not a random search but a selective pursuit of an answer which is already partly formulated as an assumption. Or as Pasteur put it 'chance favours only the trained mind'.

In terms of continuity and innovation, the vernacular is clearly the prime example of continuity; an innovatory vernacular is a contradiction in terms. The vernacular is a prime but certainly not the only example of survival over a long period. The funerary temple of Queen Hatshepsut at Deir el-Bahari on the Nile dating from 1511–1480 B.C., designed by her architect Senmut, uses what can best be described as proto-Doric columns. A thousand years later the Doric column is widely used in classical Greek architecture, is modified by the Etruscans, is employed by the Romans in Italy and elsewhere and becomes one of the characteristic features of neo-classicism in Europe in the 18th and 19th centuries. The form shows extraordinary tenacity over three and a half thousand years.

Despite the longevity of vernacular forms as well as of the Doric column we instinctively place them hierarchically in different categories. This is not necessarily a value judgement though it frequently turns out to be one. The trulli of Apulia, for example, occur frequently in the area surrounding Alberobello, are difficult to date and differ little from each other. Churches

in Alberobello and the surrounding villages are, however, not circular buildings with conical stone roofs except for a recent church in Alberobello which has the roof of a trullo but incorporates it very consciously in the design as a genuflection to the vernacular.

If we move south to a town like Lecce with its flamboyant Baroque we frequently find churches as part of the continuous street façade but distinguished from the simple urban buildings on either side by a greater geometric order, a higher density of decoration and a marked increase in scale. The visual signals are unambiguous and acknowledged by everyone. The same thing happens in the Piazza Navona in Rome as in many other places in continental Europe.

What also distinguishes the churches from their neighbours is that they are built in a recognisable style, a visual vocabulary belonging to a particular period. There were visual choices and these were made consciously. The assumption that it is possible to dispense with style – a frequently voiced tenet of the architects of the modern movement – is a fanciful concept. As long as visual choices are possible and indeed necessary, a style emerges. Because architects of the early part of the 20th century disapproved and found meaningless the styles of the 19th century and particularly the battle between Classical and Gothic, does not logically lead to the abandonment of style even if this were possible. To believe that the determination of form can arise solely from purpose assumes a level of determinism which is never experienced in practice and which presupposes the total impossibility of making visual choices. What of course happened in Modernism was that a new style simply arose, or as Adorno phrased it 'the absolute rejection of style becomes style' (Adorno, 1979). It is akin to a position of total disbelief which is itself a powerfully held belief.

The rejection of style as a determinant is rooted in the view that every architectural problem needs an entirely in-

Right
**Beidha, Southern
Jordan ca.7000–6000 BC**;
semi-subterranean
dwellings and stores
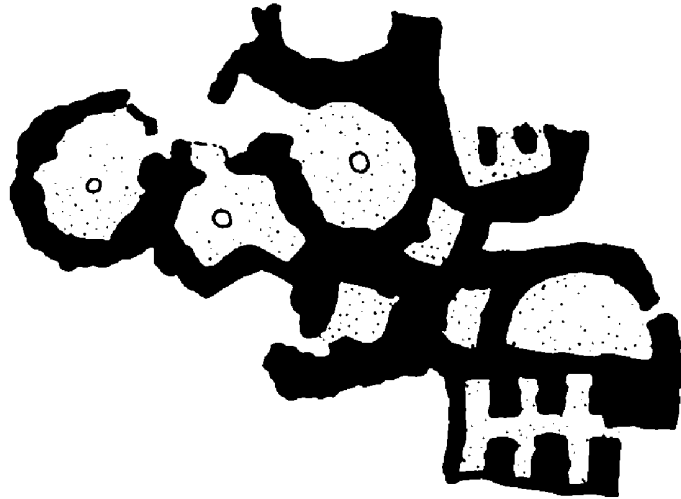
novative solution and, therefore, could not use any elements
from an existing visual language, from a style, however much
that style may be evolving. Style also works by both inclusion
and exclusion, it implies the acceptance of some forms and the
rejection of others. The choice of cladding material in the case
of the Getty Center, which has already been discussed, shows
how we can start by choosing to exclude a whole range of pos-
sibilities simply on the connotation that is inherent in those
elements. It would be difficult to imagine that Richard Meier
would choose to do a red brick building. This may be due to the
inability of dark brick to produce light reflective surfaces – so
characteristic of Meier's architecture – and, equally, to the
connection between brick and a colonial architecture in
America. Visual selection, sometimes based on non-visual
beliefs, invariably plays its role. This is independent of the
degree to which the design may be innovative; just as it is
unlikely that Meier would use red brick so it is improbable that
Zaha Hadid would use any brick for her curved flowing shapes,
quite apart from any constructional difficulties which might
arise.

By exclusion we reject a wide range of possibilities including possible styles, by inclusion we settle on an accepted and limited set of forms. In retrospect that limited set becomes a definable style: Romanesque, Perpendicular Gothic, Art Nouveau.

There is no single and convincing explanation for the trulli of Apulia. The local guide book ascribes a tax law to their origin: because the stones are laid dry they count as temporary buildings. Another explanation would be the constructional rationale of building a conical roof over a circular plan in which successive courses project over each other. Yet another might be that this is an ancient form which has survived long after its original purpose or necessity had validity. There were houses circular in plan built of dry stone walling eleven thousand year ago in the Near East, some with domical roofs made of pisé or mud brick. Outside Beidha in Southern Jordan there is a group of buildings dating from about 7000 B.C. with a plan remarkably like that of a group of trulli. Visual memory is able to operate over remarkable time spans.

Ever since Vitruvius it has been conventional wisdom that the triglyphs on a classical temple are a residue from previous timber construction.

'In view of these things and of carpenter's work generally, craftsmen imitated such arrangements in sculpture when they built temples of stone and marble. For they thought these models worth following up. Thus workmen of old, building in various places, when they had put beams reaching from the inner walls to the outside parts, built in the spaces between the beams; above through their craftsmanship, they ornamented the cornices and gables with a more graceful effect. Then they cut off the projections of the beams, as far as they came forward, to the line and perpendicular of the walls. But since this appearance was ungraceful, they fixed tablets shaped as triglyphs now are, against the cut-off beams,

and painted them with blue wax, in order that the cut-off
beams might be concealed so as not to offend the eyes.
Thus in Doric structures, the divisions of the beams
being hidden began to have the arrangement of the
triglyphs, and, between the beams, of metopes.
Subsequently other architects in other works carried
forward over the triglyphs the projecting rafters, and
trimmed the projections. Hence just as triglyphs came
by the treatment of the beams, so from the projections of
the rafters the detail of the mutules under the cornices
was invented.'
(Vitruvius, 1983, p.213)

More recently there has been a counter argument – since
there are questions of structural logic as triglyphs occur on all
four sides of a temple – that the grooved shape of the triglyph is
derived from the votive tripods given to temples. In either case a
form survives tenaciously in our visual vocabulary the same way
as words survive long after their original meaning has been for-
gotten.

In the vernacular visual memory operates much less
consciously which is why a vernacular cannot be invented, it
simply has to occur. Style on the other hand is a question of
deliberate choice. So much so that it may, for instance, go
against structural logic. Stylistic convention ruled that the win-
dows on the important first floor of a Baroque palace in South
Germany should have an arched opening, those on the lesser
floors above and below a trabeated one. Yet, in many instances,
all three floors, as revealed by bomb damage after World War II,
were constructed with arched masonry openings, presumably
because of constructional ease. Thus because style is more the
result of premeditated selection, of in fact design, we assume
that it also has greater content.

The available and possible technology will always play
a powerful role. In technology we should subsume not only the

constructional techniques but equally the computational and
drafting techniques available to make valid designs. Portraits
of Baroque architects frequently show them holding a pair of
compasses/dividers; portraits of 21st century architects ought
to show them sitting in front of a computer. A design such as
Gehry's Bilbao Guggenheim or Nicholas Grimshaw's Eden
Project in Cornwall is entirely dependent on advanced compu-
tational methods. The tools available to test and communicate
architectural thought can enlarge the range of solutions in the
same way that materials and building methods can increase the
spectrum of the possible.

Materials

If, in terms of experiencing architecture, we accept the limita-   **125**
tions of drawings, computer simulations and scaled-down
models, then architecture needs to be a built reality in order to
be experienced fully. That in turn means that it has to be created
out of particular materials. When I am considering the design of
a building, I need at the outset, or at least very soon after, to be
concerned with the selection of the materials to be used in con-
struction. This is especially true for those materials which will
have an influence on spatial organisation and appearance. It
is highly significant whether I choose fair faced brickwork or
stainless steel panels as the walling material. This is unlike, say,
the choice of the damp-proof course. In varying degrees materi-
als are of necessity part of architectural thought.

Right
**Richard Meier &
Partners**, The Getty
Center, Los Angeles,
California 1984 – 1997; wall
of riven travertine
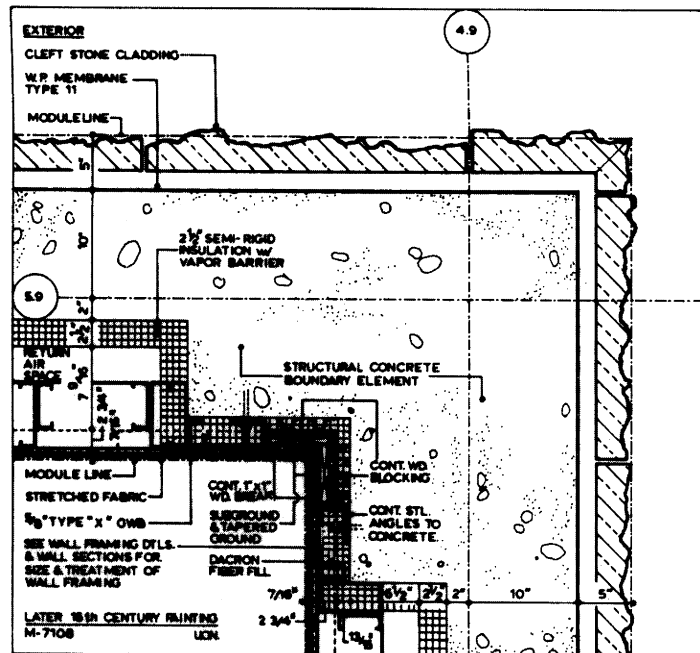
PLAN AT EXTERIOR WALL

We communicate those choices visually as we communicate other aspects: we draw horizontal lines to suggest brickwork or we simulate reflections to indicate glass. But the most detailed communication comes verbally by an annotation on the drawing or as a clause in the specification. We have to resort to words, to a non-visual medium, to be precise about the selection we have made.

Plans, sections and elevations have a level of precision in terms of the eventual building which is difficult to produce as far as materials are concerned: when I draw a straight line on plan and a vertical line on section I know this denotes a straight wall which is not inclined; if I draw a curved line I know this would be built as a curved wall. The line, drawn while I am designing, tells me nothing, however, whether the wall is in brick or stone or concrete. Large scale construction drawings can distinguish between these materials by conventional hatching but there are no means of doing so at the early design stage although the difference between materials is then also important.

There is, in other words, a visual correspondence between the drawing and the eventual building as far as form is concerned but not as far as materials are concerned. This has, I believe, significant repercussions on architectural thought. It is notoriously difficult to get architectural students to concentrate on the material aspects of architecture; on the solidity, reflectivity, texture, colour of the stuff that makes buildings. This disengagement is partly due to an unfamiliarity with the realities and complexities of the building site; but only partly. I believe the major difficulty – for students and practising architects – to be the absence of visual means which would record both shape and material simultaneously with equal precision. Moves to make design drawings more like constructional drawings are confusing rather than helpful. To draw the studs of a timber wall or the gap in a cavity masonry wall is to introduce information which is irrelevant as far as our visual understanding of the wall is concerned; it tells us nothing about the nature of the material

of the wall. On the contrary it produces a visual density of the drawing which is spurious.

Thinking about materials has a further complication: the effect of weather over time. Is the building to be imagined as it will be on completion or after twenty years? A great deal of architectural ingenuity has been expended throughout history on detailing which would minimise, or at least make acceptable, the effect of weathering. Overhangs, mouldings, drips are in

Below
Cornice detail showing 'weatherings' in stone;
from W.R. Jaggard's
Architectural Construction
manual

DETAIL Nº:58.

MASONRY.

DETAILS OF CORNICE
AND PARAPET WALL TO
FRONT WALLS of WORKSHOP
SHOWING STONEWORK JOINTS.

14'x5' FEATHER EDGE STONE MOULDED COPING.

SLATE KEY OR CRAMP

14'x5' FEATHER EDGE STONE COPING.

DRIP THROATING

SLATE CRAMP

3½' 5' CAPPING

DADO.

BASE COURSE

4'x1½' SLATE DOWEL

SADDLE JOINT.

PLINTH OR BASE COURSE

4'x1½' SLATE DOWEL.

CEMENT JOGGLE JOINT

CORNICE.

CEMENT JOGGLE JOINT

CEMENT JOGGLE JOINT

CORNICE.

CORONA

DRIP

BEDMOULD

SECTION THROUGH CORNICE AND PARAPET WALL.

SCALE OF FEET

certain climates an integral element of architecture, almost of decoration. Art history has been rather neglectful of the inevitable ageing of all buildings. A rare exception is Mostafavi & Leatherbarrow's *On Weathering: the Life of Buildings in Time*. Ruins are, apart from earthquake, fire and war, the ultimate result of the action of weather; of the reduction of the building to its barest skeleton.

The choice of materials may often be determined by their resistance to change or by their known characteristics over time. Copper acquires a green patina on being exposed to the weather, the duration before an even coating is achieved depending on climate and pollution. To short-circuit this uncertainty, it is now possible to specify pre-patinated copper as, for instance, James Stirling did for the roof of his ship-like bookshop for Electa at the 1991 Venice Biennale. It has since become widely used although it differs somewhat from copper that patinated slowly and gradually. On the other hand using Cor-Ten steel, an alloy of steel properly known as high-strength weathering steel, is a matter of being aware that the unpainted steel first colours a bright orange which after a year turns a darker red and eventually a deep brown with slight purple flecks. Eero Saarinen pioneered its architectural use at the John Deere building in Moline, Illinois with considerable success. It is a material which I have used and which I find appealing precisely because of its 'natural' weathering; it is a metal which has the characteristics of unpainted wood.

The fact that architectural thought needs to include the selection of materials does not deny that the choice may at certain times and in certain places be extremely limited. Senmut designing the mortuary temple of Queen Hatshepsut (1520 B.C.) opposite Karnak on the Nile had very little choice except to use stone: it was available and satisfied the requirements of permanence and significance. The labourers on the site would have had a similar but different restriction of choice for their dwellings. When Carlo Scarpa, on the other hand, was design-

Above
Carlo Scarpa, Brion
Tomb, San Vito d'Altivole
(Treviso) Italy 1969
onwards; low level opening
in chapel wall and serrated
concrete wall in water

ing the Brion tomb at San Vito d'Altivole in 1969 he decided on
mainly board-marked concrete and gold and enamel mosaic
tiles combined with occasional stuccoed panels. The L-shaped
site partially surrounds the existing cemetery crowded with
marble tombstones and monuments. Scarpa moved away from
the prevailing choice of material for funerary structures and
made out of small-scale faceted concrete almost a new materi-
al. In places he submerged it in water, an evocation of the foun-
dations of Venice that also plays on the symbolism of water in
both life and death.

The choice of material is, like other forms of visual selec-
tion, made on the basis of both inclusion and exclusion. In the
19th century the use of glass and iron was considered appropri-
ate in railway stations, urban shopping arcades and exhibition
buildings but not in churches. There was a proposal for a church
in 1856 constructed in iron in the Gothic style published in the

Below
Sigurd Lewerentz,
Church of St Mark,
Björkhagen, Sweden
1956–60
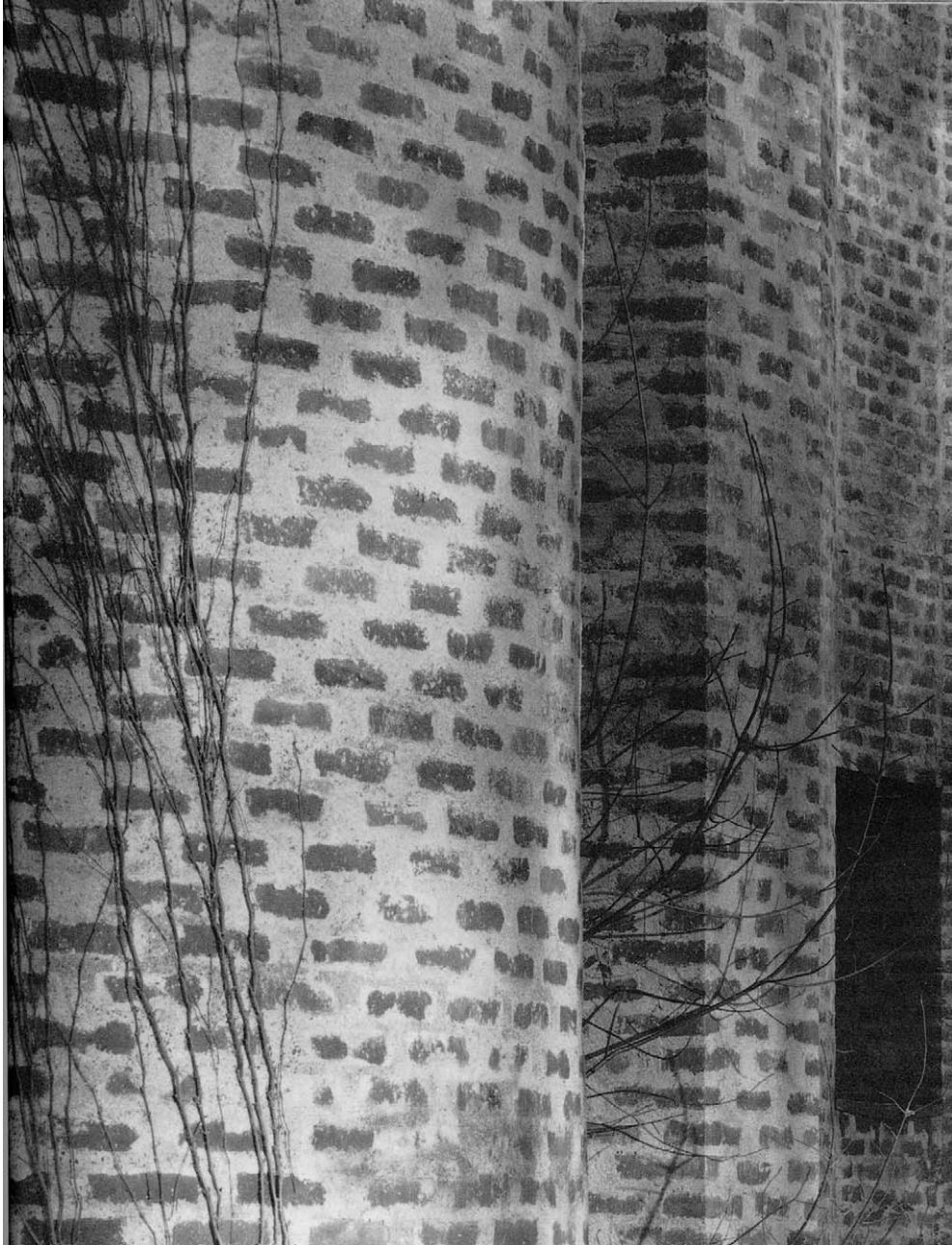
Ecclesiologist (Slater, 1856) which remained a project; built exam- ples are, in fact, extremely rare and continue to be so during the 20th century. When Sigurd Lewerentz, for example, used rolled steel sections in his Church of St Peter at Klippan outside Stockholm of 1963–66, he did so sparingly and probably because of structural necessity in a very dominantly brick building. The steel supports brick vaults to reduce their span and at the same time column and beam become a memory of the crucifix.

Lewerentz's church at Klippan and his earlier church at Björkhagen are both wonderful examples of taking a material – brick – and celebrating its nature with love. Lewerentz recognised that to make a wall you need both bricks *and* mortar. Both are given their due weight. Very frequent visits to the site persuaded bricklayers that there is more than one way of making a brick wall.

Both churches were built in a period when 'truth to materials' was a strongly held belief. Derived from Ruskin, perpetuated by Frank Lloyd Wright, it became a mantra of modern architecture, was confined to a limited palette of materials in Brutalism and then tended to become less significant towards the end of the 20th century. In its heyday it was a clear cut question of morality. The moral imperative has at the beginning of the 21st century, switched to green issues which affect all of architecture including, crucially, the selection of materials.

Clearly general attitudes in society bear on the visual choices made by architects; our eye does not operate in isolation. A casual leafing through architectural magazines of 2001 would, for example, show the frequent use of timber cladding. Wood is seen as a renewable resource which makes relatively small demands on energy in its conversion into a building material. The frequency in the same magazines would have been much less ten or fifteen years earlier.

Historically we associate certain materials with specific periods of architecture and specific localities. The conjunction of time, place and material is, however, a matter of the availability of resources. We make an immediate link between

Below
Nijo Castle, Japan; stone
fortifications, the standard
height of stone walls was 6
m (20 ft)

stone and classical Greek building. Yet the roofs of Greek temples were a timber construction but have simply not survived. The most advanced Greek timber techniques were probably employed in shipbuilding; the trireme was a sophisticated wooden construction. The Greeks may have felt about timber as the Victorians thought of metal in religious buildings.

Clearly the Japanese have no such misgivings. The Ise Shrine, the most holy centre of the Shinto religion, is in timber and, what is more, is rebuilt on an adjoining site every twenty years. But on the same island in Japan, at Nijo Castle, there are huge stone walls, some up to 40 m (130 ft) in height, built out of large wedge-shaped stones with their smaller side turned outward. Their own weight locks them in place and makes the wall earthquake-resistant (Drexler, 1955, p.140). It would be easy to argue that of course the walls are in stone as the building is a castle designed to resist attack and the argument would not be wrong. What the stone walls, however, demonstrate is that there was a capacity to build impressive masonry walls but not the choice when it came to religious buildings.

Any discussion of materials must acknowledge the poetic attributes of many building materials and their strong association with the craft of making, both by hand and machine. Architects do not themselves now exercise a craft on the building site but still find pleasure in choosing materials where there is evidence of craftsmanly skills. It is assumed that this pleasure will be sensed and enjoyed by others throughout the existence of the building; possibly even when in a ruined state. Most of that pleasure is visual, occasionally tactile.

The discussion must also acknowledge the absolute necessity of materials. Without them we cannot achieve what Jean Nouvel called in his acceptance speech for the Royal Gold Medal of Architecture at the Royal Institute of Architecture in June 2001, 'the miracle of the result'.

It would be misleading to claim that the arrangement of materials within a building is solely due to non-verbal thinking.

On the contrary, it is important to recognise that that arrangement, recorded on constructional drawings, occupies a considerable proportion of the total architectural thought devoted to a project. In the end little may be directly visible even though it needs graphic means to record the decisions. The thought is both verbal and non-verbal and is also dependent on known practice, on what can be constructed, what is approved by codes and bye-laws or what is within the budget.

Below
Behnish & Partners,
Hysolar Institute,
University of Stuttgart,
Stuttgart, Germany 1987

Charles Correa once remarked to me, perhaps in a moment of doubt (sometime before he was awarded the Royal Gold Medal for 1984 at Hampton Court when the Prince of Wales, in a lapse of good manners, thought it fit to attack modern architecture and, by implication, the recipient) that architecture is unable to sustain interest for the same length of time as a symphony or a great novel. It was as if architecture was too simple, too readily comprehended. My counter to that was that a great many complexities of architecture exist but are hidden from view; are an invisible architectural effort. An effort

Right
Carlo Scarpa, Annexe to the Banca Popolare, Verona, Italy 1973 and later (completed by Arrigo Rudi after Scarpa's death in 1978); bay windows on street façade

from which the architect designer may well get intellectual pleasure by the elegant resolution of a problem. It may be that high-tech architecture's ostentatious revelation of construction is an attempt to make the usually hidden visible.

The proliferation of different visible details in the work of Behnish & Partners – no adherents of the high-tech school – may be another way of searching for that visual density that might approach the musical density of a symphony or opera. The same might be said of the work of Carlo Scarpa and may explain the interest his designs have aroused; there is now a considerable body of literature dealing with his architecture and designs in glass and silver. On any visit to the Brion Tomb one is very likely to meet others making the same architectural pilgrimage, captivated by that visual richness that is rooted in Scarpa's Venetian background.

Structure

Structure is governed by certain inescapable laws: the law of gravity, Hooke's law on the relation of stress to strain within the elastic limit of a material, the distribution of bending moments in a beam or the compressive strength of a material, to list some obvious examples. Mathematical tests can be applied to a structural configuration to determine whether it will fail or carry the loads imposed on it using equations derived from the laws governing the behaviour of the selected material. Before these tests can be carried out, however, a shape and a material have to be chosen. This can simply be an I-section steel beam or a concrete slab and no significant design intervention is required. In a more complex problem there is the possibility of choice and that choice is, I would suggest, considerably influenced by visual preferences and model selection.

Below
Centre Pompidou;
gerberettes in the foundry
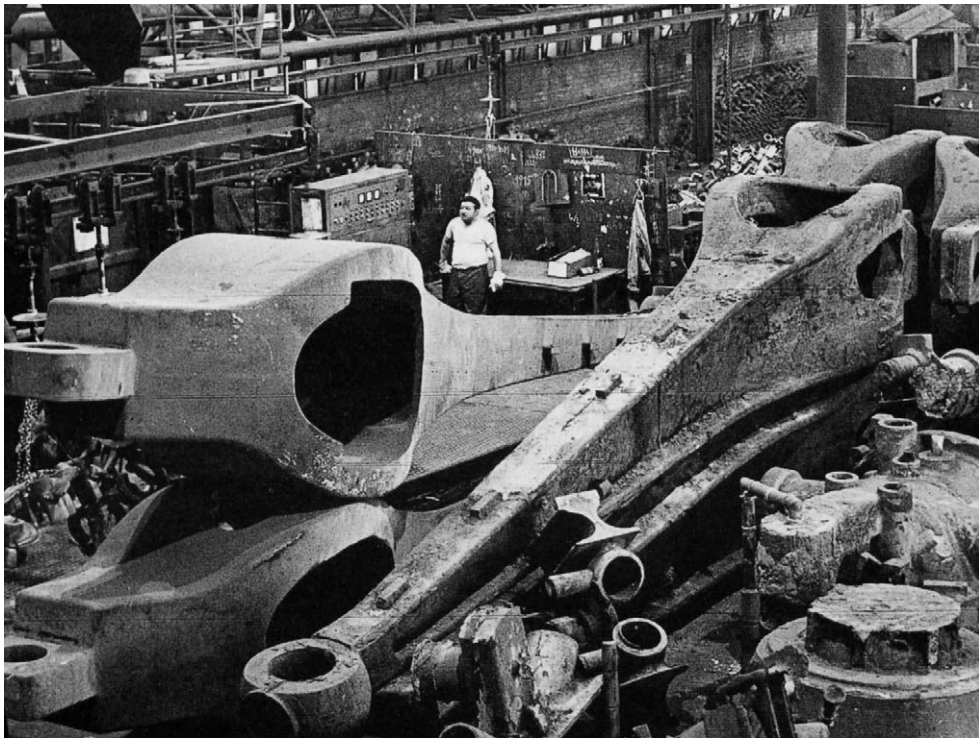
A beautiful and clear illustration occurs in the first chapter of Peter Rice's *An Engineer Imagines* (1994), the evocative autobiography published after his untimely death in 1992. It centres on the design of the structure of Centre Pompidou and particularly on the use of the gerberettes, the short-propped cantilevers beyond the columns.

Centre Pompidou, or Beaubourg as it was first called, was won in an open international competition by Renzo Piano and Richard Rogers in July 1971 from among 687 entries. Piano and Rogers had been encouraged to participate in the competition by Ted Happold who headed the Structures 3 group at Ove Arup & Partners, engineers, in London. Peter Rice was an associate and had returned to London three years before, after working for several years on the Sydney Opera House. The idea of structure as a framework was very much a current preoccupation. It suggested a permanent structural element which could carry a variable, perhaps even temporary, infill. Flexibility was the idea which acted as powerful motivation and could justify many architectural decisions. Large clear spaces, and thus long spans, were considered important if flexibility was to be achieved; the span at Beaubourg was to be 44.8 m (147 ft).

The competition drawing of the structure shows a braced external skeleton consisting of water-filled tubes which would provide the necessary fire resistance. The notion of a water-filled hollow structure clear of the building and therefore less likely to be exposed to extreme heat had been explored for some time previously by Ted Happold and Koji Kameya while in Kuwait in 1969, as were castings for joints (Happold, Sir Edmund, 'Essential Engineer' review of 'An Engineer Imagines' by Peter Rice in RSA Journal, January/February, 1995). The attack on P_1, the initial problem in the Popperian sequence, as far as the structure was concerned, was thus conditioned by current general ideas and personal interests. Clearly more orthodox structural solutions might also have provided

answers (not least putting a column in the centre of the span) but were rejected because of the way the initial problem was viewed. Problem recognition is one of the key determinants of design and is, as often as not, posed by the designer's own perception rather than arising entirely from a given condition, even in engineering.

This became even more obvious when the important joint between column and beam had to be explored. Rice was convinced of the importance of detail after his experience of working with Jørn Utzon in Sydney. This detail should, however, somehow show evidence of its making in order to make people 'feel comfortable'.

> 'I had been wondering for some time what it was that gave the large engineering structures of the nineteenth century their special appeal. It was not just their daring and confidence. That is present in many of today's great structural achievements, but they lack the warmth, the individuality and personality of their nineteenth century counterparts. One element I had latched on to was the evidence of the attachment and care their designers and makers had lavished on them. Like Gothic cathedrals, they exude craft and individual choice. The cast-iron decorations and the cast joints give each of these structures a quality unique to their designer and maker, a reminder that they were made and conceived by people who had laboured and left their mark.'
> (Rice, 1994, p.29)

Soon after winning the competition, Rice went to a conference in Japan and visited what remained of the buildings of the 1970 Osaka World Fair. There he saw a vast space frame with large cast-iron nodes which had been designed by Kenzo Tange as architect with Koji Kameya and Professor Tsuboi as engineers. He at once realised that cast steel had exactly the qualities he was seeking.

Design decisions were therefore made on the basis of, first, a criticism of existing answers – known solutions did not solve the problems as *now* perceived – and, secondly, a model which was recognised as relevant to P_1. This is not a question of copying but of being stimulated by an existing structure/building to pursue a particular direction for which there was an already established sympathy. In this case, as Peter Rice records, a 'fixation'; he was 'an engineer obsessed' (Rice, 1994, p.30).

The structural problem was compounded by the fact that on both sides of the clear span area there were zones of use: on the piazza side for vertical circulation, on the street side for service ducts and equipment. The structure had somehow to account for this a:b:a spacing in the cross-section. Various solutions were proposed but eliminated on either architectural or engineering grounds.

The eventual breakthrough came when: 'One of the team, I am no longer sure who, probably Lennart Grut – I know it was not me – suggested a suspended beam on a short-propped cantilever, the so-called gerberette solution named after Heinrich Gerber, a nineteenth century German engineer who invented this structural system for bridges. This solution simply and elegantly resolved all the conflicts. Naturally it was quickly adopted' (Rice, 1994, p.32).

It was then possible to proceed with the design of the other parts of the structure and to involve other members of the engineering design team who could work within the general ideas which had been established. What this part of the design sequence also makes clear is the extent to which decisions are dependent on the knowledge available at any particular time.

The state of current knowledge became even more significant when it came to calculation and specification. Cast steel was not a material which had been greatly studied and was only just coming into use in nuclear power plants and oil rigs.

The gerberette was calculated, drawn, modelled and the
process was iterated until a satisfactory solution emerged. This
process of error elimination, always gauged against the original
hypothesis, namely that the 'essence of the design given by the
use of cast steel was that each piece was separate, an articulat-
ed assembly where the members only touched at discreet
points. As in music, where the space between the notes defines
the quality, here it was the space between the pieces which
defined the scale' (Rice, 1994, p.34).

The great difficulties of manufacture and the problems
with contractors and the timetable, however worrying at the

time, have now faded into part of the remarkable story of erecting a monument which, with the Eiffel Tower, virtually symbolises Paris. What remains very clearly and has exerted considerable influence on very many subsequent buildings is the articulated exoskeleton and the flamboyant display of services. Centre Pompidou – as P_2, the end of a particular sequence – altered our perception of architecture.

Rice's description of this design sequence, a personal account of events which may be seen slightly differently by others, fits closely the P_1 to P_2 steps which are part of the Popperian description of scientific research and which, I suggest, can also be applied to design.

Structure has played a strong mythical role in architectural theory as the essential and irreducible logical part of architecture. This view owes a great deal to the writings and lectures of Viollet-le-Duc in the middle of the 19th century. John Summerson considers him one of the two supremely eminent theorists in the history of European architecture (Summerson, 1963, p.135) the other being Leon Battista Alberti. Yet his theories are highly questionable, even though a whiff of them still lingers, often unrecognised.

Viollet-le-Duc's view was that architecture, the making of architecture, involves logical reasoning. Obviously that reasoning could most readily be applied to structure. He had a romantic attachment to the Gothic of northern France where structure was laid bare and could be analysed visually. His diagrammatic analyses are thus of such buildings as Sainte Chapelle in Paris (1242 – 48) where he sets out to show that each element has a logical placement and that, furthermore, that logic is controlled by a need to produce an economy of structure. It is, of course, true that structure, taken on its own, can be falsified on grounds of economy.

That drive to produce the least – not always the cheapest – structure has not died out. Buckminster Fuller judged his domes by comparing weight of structure against area covered.

Right
Viollet-le-Duc, Design
for a Concert Hall in stone,
iron and brick which
appeared in *Entretiens sur
l'Architectur*, 1863 & 1872

E. GUILLAUMOI.

MDCCCLXIV.
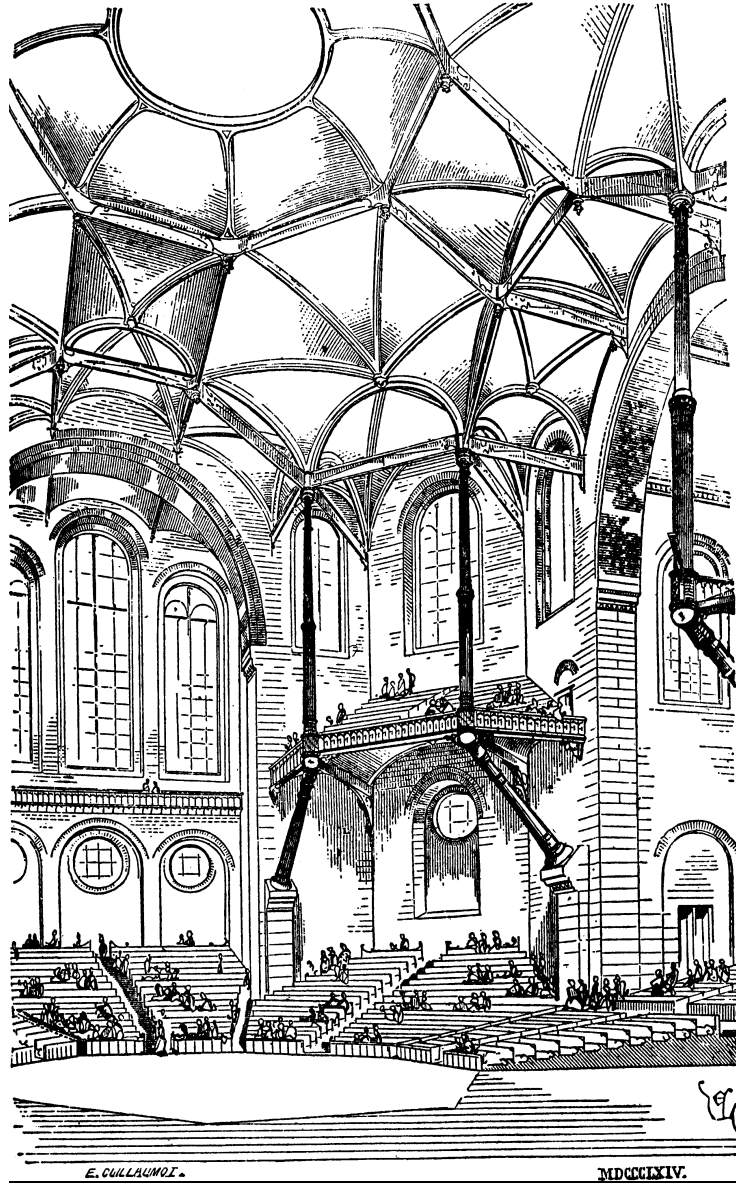
While this may be a useful and relevant measure, it is far from being the sole ground on which to assess structure or a building as a whole. The significant variables go beyond structure; to the relation of structure to space, to environmental services, to possibilities of recycling, to ease of erection and so on. Structural minimalism cannot be considered as an end in itself, however tempting that pursuit may be.

Light

Left
Richard Meier & Partners, the Getty Center Los Angeles 1987–97; travertine facing slabs with a riven surface

When we draw the initial thoughts of a design we make, as a rule, black marks on white paper. Black represents solids, white the space between the solids, between the enclosure. Yet those white areas are not empty, nor are the solids uniformly the same. Light affects both to varying degrees, and both are there to be manipulated by the architect. Strangely, we have no adequate graphic symbols which can record our first intentions as regards light. We can subsequently check what the effects may be by building either physical or electronic models, or both. At the beginning, however, we have to rely on memory and experience.

That light plays a crucial role in our sensation of space has been recognised for centuries. Gothic cathedrals are shrines of light and the Baroque produced some of the most dramatic as well as subtle sculpting of surfaces to direct light. This is not simply a matter of letting in sunlight; it is a question as to which surfaces are lit and reflect back light. Louis Kahn phrased it poetically as 'the sun never knew how great it was until it struck the side of a building' (Johnson, 1975, p.12).

Although light can be described as invisible, its effects are palpable and an inseparable component of architecture. As Richard Meier clearly acknowledged in an interview, '…For me light is the best and most versatile building material'. His Getty Center, on its Belvedere above Los Angeles, shows what that can mean in terms of the special light of Southern California. The Getty also demonstrates the close relationship between light and choice of materials; the group of buildings is hard to imagine constructed, for instance, in the kind of purple-tinged red bricks that Kahn used at The Phillips Exeter Academy Library. Significantly at the Kimbell Art Museum in Fort Worth, lit by the bright Texan sun, Kahn also clad his building in travertine. At the Getty the travertine slabs have been riven by a special guillotine so that the deep texture of the stone produces light and shade in the oblique sun, becoming less light-reflective and thus less glary, but still maintaining a luminosity of the surface.

In Finland Juha Leiviskä is equally clear that light needs to be thought of as a building material. Writing about Männistö church and parish centre in Kuopio he says that 'the most important building material of the church itself is daylight, which affects the space mainly as indirect reflections, which are at their most intense in the late morning, during morning service . . . I have tried especially to ensure that all components of the space, such as different kinds of walls with their works of art, the ceiling, the slanting gallery and the organ belong together and form an entity. The character of the spaces changes continually according to the seasons, the time of day, the sun and the clouds' (Leiviskä, 1999, p.130).

Leiviskä was first impressed by the qualities of reflected light on a visit to Southern Germany as a student. Balthasar Neumann's church at the Benedictine Abbey in Neresheim, started in 1750, continues to be referred to by Leiviskä in his writings to this day. He recorded some of the effects in watercolours during the trip and shows these in his lectures as an early and abiding influence. His teacher called the late Baroque interiors of southern Germany 'instruments for light to play on'. Leiviskä has spent much of his architectural energy creating contemporary equivalents to that Baroque poetry of light.

A comparison between the shafts of hanging textiles and the vertical building planes at Myyrmäki church and parish centre with the interior of Neresheim gives convincing confirmation to Leiviskä's statement that 'one possible model for Myyrmäki may well have been Neresheim, Balthasar Neumann's great abbey church in South Germany' (Leiviskä, 1999, p.74).

How light is reflected and what we read into the qualities of that reflected light affects our perception of the solids, of the black lines we draw; immaterial light changes the materials of building. At Bagsvaerd church, on the northern fringes of Copenhagen, Jørn Utzon, its architect, suspends a wave-like baldechino above the altar. It looks as light as clouds moving

Below
**Balthasar Neumann,
Benedictine Abbey,
Neresheim, Germany**;
the church was consecrat-
ed in 1792, nearly forty
years after the death of
Neumann

Below
Juha Leiviskä, Church
and Parish Centre,
Myyrmäki, Vantaa, Finland
1980–84
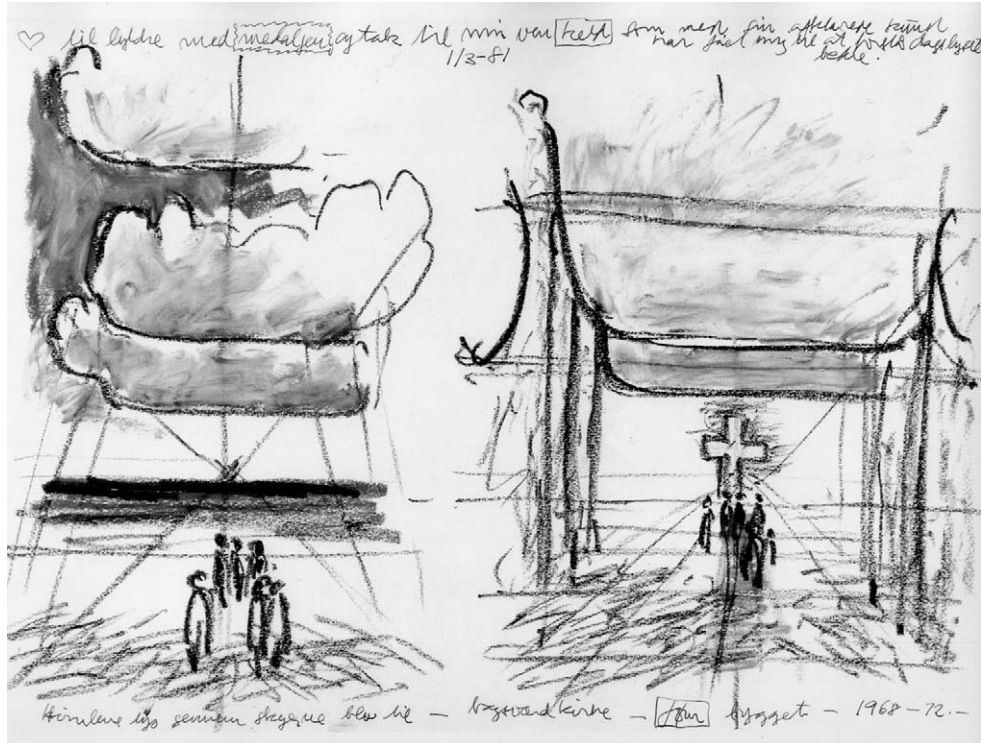
across the sky, yet is made of concrete. The effect of lightness is entirely due to the subtle graduations of light that play on the curved surfaces.

The reference to clouds is fully intentional. In two sketches Utzon tried to demonstrate the difference between a gathering on a beach and a congregation sheltered by vaults and columns. The sketches are, in a sense, an argument for the need to have architecture even in a holy interior that relies on being a consecrated space. The inspiration came to Utzon originally lying on a beach in Hawaii and looking up at the sky with its cylindrical clouds (Weston, 2002, p.280).

The two sketches, moreover, indicate the nature of non-verbal thinking most effectively. A problem exists: how to create a meaningful church interior in the late 20th century. Utzon goes

back to his earlier work frequently characterised by exuberant forms rising out of a solid plinth. In its most celebrated variant this occurs at the Sydney Opera House. For the church a particular tentative solution is suggested by a cloud formation which becomes enshrined in a sketch and eventually transformed into a shell-concrete structure, organised rigorously by a geometry of circles.

Light can perform another function that goes against the canons of orthodox moderism: the application of surface decoration. Charles Correa's Jawahar Kala Kendra in Jaipur, India (1986 – 92) demonstrates vividly the sharp patterning that is possible by architectural means under the tropical sun. It is not surprising that a similar image is on the cover of the book devoted to his work (Correa, 1996).

Right
Charles Correa, Jawahar Kala Kendra, Jaipur, India 1986–92; watercourt in Arts Centre dedicated to the memory of Nehru

Architecture & language

Architectural thought, as has been argued, is non-verbal thought. That is its essential characteristic. The elements of that thought, as well as the concept of architecture itself, become, however, part of our everyday vocabulary; they become metaphor and simile in our speech and writing.

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Foremost among any analogies would be the concept of God the Creator as the great architect. When we speak of someone being the great architect of a movement, for instance, we are reversing the analogy and attributing God-like qualities of creation to that person. The architect is seen in everyday discourse as the creator of something significant from virtually nothing. We do not make such comparisons with a cook although arguably the provider of food deals with the most basic human demand. The distinction may be due to the higher levels of thought we ascribe to the creation of architecture; also to its greater permanence.

The term architecture is often generally applied to the organisation of elementary parts which come together in a comprehensive way as in computer design. Such an organisation would be assumed to have *structure* and *foundations*, two elements of architecture that occur frequently in everyday speech. The difference between building on sand and rock has, as a simile, biblical antecedents. *Windows* and *doors* are equally common in general usage; we open windows of opportunity and close doors on undesirable activities. In a similar way we refer to a *vault* of heaven and to someone being a *pillar* of strength when we want to give praise. Extreme irritation may make a person hit the *ceiling* or *roof*, while surprise may make them fall through the *floor.*

The *house* plays, not surprisingly, a special role. We speak of the house of God and, significantly, not the palace or castle. We consider things, optimistically, to be as safe as houses and apply the term house to a royal lineage as in the House of Windsor. Among the building types, *cathedral* occurs frequently as in cathedrals of commerce or railway stations as

the cathedrals of the 19th century. Clearly there is an extended list of words and phrases relating to architecture which suggests an impact on non-architectural thought and the usefulness of such analogies to convey common meanings.

It is most important to distinguish any association between words used in everyday conversation with those with specific meanings in architecture from the suggestion that there is a general language of architecture as, for instance, used in John Summerson's title of his book *The Classical Language of Architecture* (1963). That is to ascribe to architecture the communicative powers of verbal language and therefore a very different proposition. Similarly it must not be confused with attempts to apply the concepts of linguistics to the analysis of architecture. Whether such attempts have validity is another matter and may, to some extent, hinge on whether or not the tools of verbal thinking are transferable to non-verbal thinking. That the rules of grammar may not be transferable has already been discussed in connection with Christopher Alexander *et al.*'s (1977) *Pattern Language*.

If by language we mean that there is a generally accepted correspondence between words and objects and concepts, then it may be possible to consider a similar correspondence between objects and objects as a visual language. I believe that this is what Joseph Rykwert has in mind when he makes comparisons between the upright human body and the orders of classical architecture (Rykwert, 1996). An argument that the column may be derived from the body – rather than a tree trunk, let us say – and to be a metaphor of that body is a comparison made in the visual realm. It can be discussed verbally after the column has been made but is not dependent on words for its creation. We do not assume that a group of elders came together and, after extended talk, agreed to make a column that mimicked the standing human figure.

The search for some relation between nature and architecture, and particularly that the origins of architecture should

Right
Animal skin on poles and
pegged down as tent
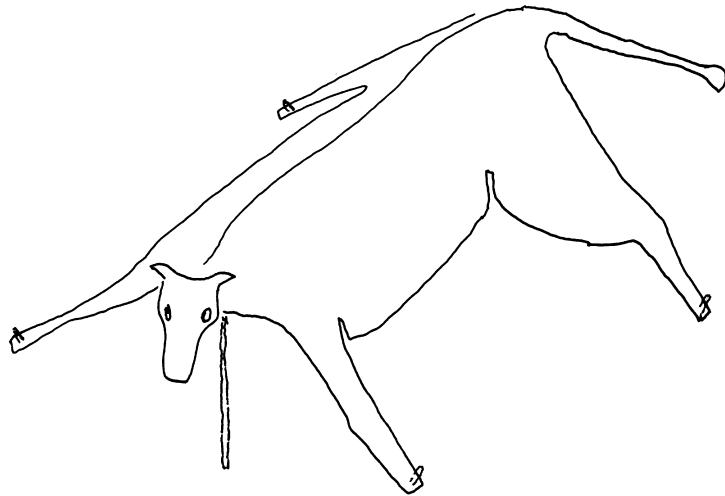
stem from nature, is not a recent pursuit. Antiquity gave gender characteristics to the orders – Doric masculine, Ionic feminine – and in the middle of the 18th century the Abbé Laugier writing his celebrated and influential *Essai sur l'architecture* attempted to derive the pediment from the intertwining branches of trees. Whether there is any truth to these connections is doubtful. As early man was not a forest dweller, it seems to me much more likely that the pediment is an echo of a tent made from an animal skin and three poles by hunters needing shelter. It may also be just possible that the animal head above the entrance to the tent had a reincarnation in the sculptural figures placed in the pediment. The search for roots in nature is of course part of the anxiety about the seemingly arbitrary and thus the necessity to find the ultimate, the true and only, source. The search for the fundamental is embedded in both the philosophical and the religious condition.
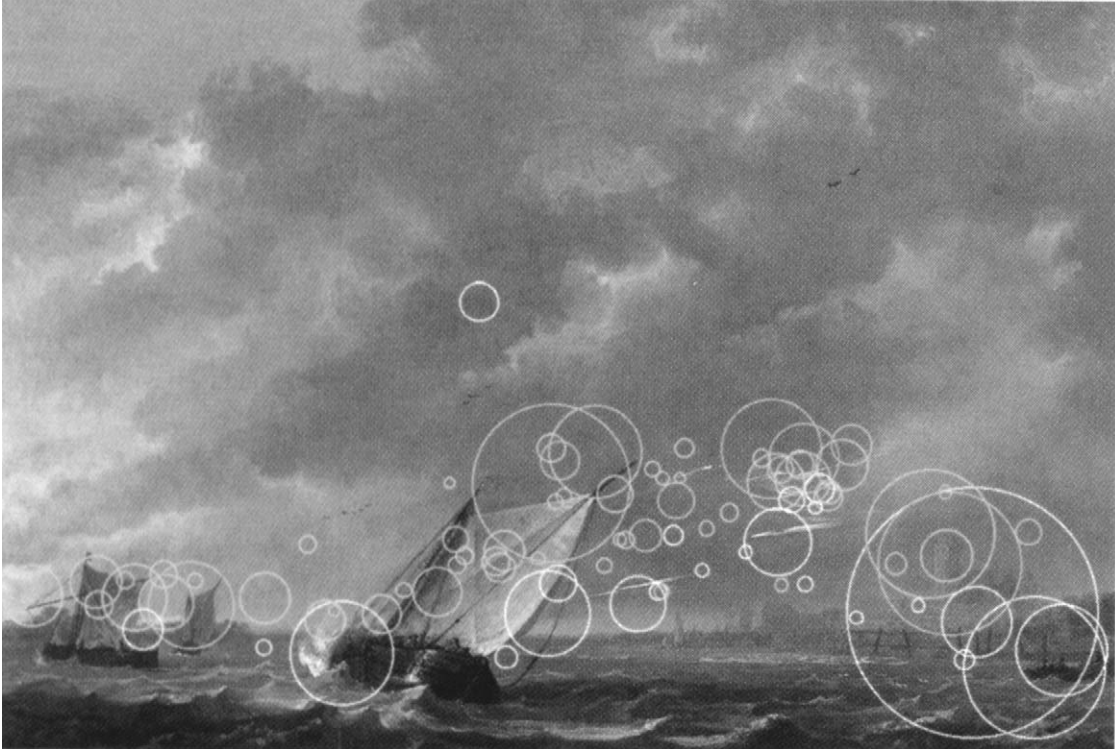
Looking at pictures

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It would be wrong – and unhelpful – to claim that architecture is the only discipline in which non-verbal thinking plays a powerful role or in which the competing claims of continuity and innovation are relevant. Obviously paintings and sculpture are created as a result of non-verbal thought. As in architecture, words are used to discuss a work afterwards or certain lines of non-verbal thought are laid down initially as a result of verbal discussion. Music and dance are also, presumably, derived predominantly from non-verbal thinking, as must be much of photography and film making. Landscape and garden design as well as furniture and other product design need also to be included in what would appear to be far from an insignificant category. It would seem, on the contrary, that large parts of the world which surrounds us every day owe much to non-verbal thinking. I would therefore argue that any discussion of non-verbal thinking is of general relevance and considerable significance.

The role of models is, for example, readily discernible in the history of painting. It is generally agreed that Japanese woodcuts had an influence on French Impressionists, that African tribal art as well as the wall paintings of Pompeii affected Picasso strongly and that the time-lapse photography of Muybridge affected Francis Bacon's vision of the human figure, to choose three groups of paintings considered innovatory which nevertheless have known antecedents. The whole of the renaissance and later neo-classicism were conscious movements to find what were considered to be appropriate models, yet they were still able to arrive at original solutions. Examples in all the arts are numerous; form feeds on form.

Many of the arguments put forward for the nature of architectural thought are likely to apply to the thought processes of other visual disciplines. An example from structural engineering was the topic of an earlier section despite, or because of, the claim frequently made by engineers that calculation rules their subject.

The visual arts and architecture collide most forcibly in museums and galleries. That contact may be disastrous or

fruitful; in either case it is highly instructive in terms of the arguments of this essay. If the exhibit and its container, the gallery, are both the result of non-verbal thinking, then how do these visually understood artefacts relate?

Museums, subsuming galleries in that term, are media of communication which are sensed by a moving observer seeing images in sequence. They differ thus from film or television, for instance, where a stationary observer watches moving images. As in architecture, we are involved in a kinaesthetic experience. This is certainly the case at the scale of even the smallest museum. It would seem, moreover, that the moving eye also comes into play when looking at a single picture. The notion, suggested by Leonardo that we take in a picture at a glance, and that therefore painting has greater merit than poetry, is erroneous.

> 'When looking at a picture we fixate upon one area, move our eyes and then fixate upon another, but we do not scan the picture evenly, centimetre by centimetre; instead our eyes seek out and concentrate on particular areas. One mechanism in which, during each fixation, we select the next area to be fixated upon, is not fully understood, but is a process controlled (consciously or unconsciously) by ourselves. We fixate on those areas that contain most "information", often completely ignoring areas we judge unimportant.'
> (Sturgis, 2000, p.64)

It could be argued that the way the painter thinks/creates the work is very analogous to the way the observer thinks/sees the painting. The initial sketch indicating the general arrangement corresponds to the visitor's first glance of the picture as a whole. The artist will then work on small areas just as the viewer will concentrate on selected areas in order to understand and enjoy the painting.

The reason for such concentration is largely physiological. Our foveal vision, the fact that we only see in sharp focus a very small area in the centre of the field of vision, demands rapid scanning in order to accumulate full information. If one looks at a picture from two metres away, a circular area of only about 50 mm (2 in) will be seen sharp and clear. Visual acuity drops off markedly away from this small area. The same problem occurs when looking at architecture and the implications have already been discussed in a previous section in connection with two-dimensional representations and scale models of buildings.

The rate of museum building has been unprecedentedly high in the past fifty years. The museum has become a hugely popular public building. In England in the year 2000 the number of visitors to the British Museum was 5.7 million, the National Gallery 4.65 million, the Victoria & Albert Museum 1.33 million and the newly-opened Tate Modern 5 million. There has been a corresponding increase in the literature on museums and museum building, particularly in Europe and the USA (which I have been partly responsible in swelling). Some of the discussion dealt with the question of lighting and particularly its frequent conflict with the stringent requirements of conservation demanded by many museum objects. It is, in a sense, a moral debate about the degree to which we are the custodians of the past with a responsibility to future generations. Other parts of the literature analysed circulation systems and their impact on the sequential viewing characteristic of the museum experience.

Most of the discussion, however, concentrated on the appropriate visual relation between object and display, between foreground and background; on to what extent 'noise', in information terms, needs to be eliminated or how much additional information it is permissible to add. Are differences in the display of markedly different artefacts necessary or justified? To take three examples from my own experience, should one exhibit neo-classical European paintings, the arts of Islam and the constructivist art of post-revolutionary Russia in similar or

different surroundings? Behind that question is the assumption that it matters how works of art are displayed, that indeed no work can be seen unrelated to its context.

In the writings on museum and exhibition design, the most frequently implied but also often stated suggestion – usually by non-architects – was that architects ought to strive for a 'neutral or anonymous' background. This is, of course, a fanciful concept. Every background – white wall or red damask – has some quality which is unavoidably present and which is in some dialogue, constructive or otherwise, with the object on view. We may make verbal specifications such an 'anonymity' but they have no visual equivalent. Architecture, even when seemingly ruled entirely by convention, is the product of thought; there cannot be an architecture of non-thought.

The office & the school

Perhaps it should be in reverse order, for we learn before we practice. On the other hand it is the office – or studio or workshop – which is responsible for architecture, for the buildings that surround us. It should therefore take precedence. An alternative view might be that both are important and that it is unprofitable to exaggerate the differences between them. Both are, after all, involved in non-verbal thinking and both are part of the culture of architecture. What may also be of some significance is that the way architecture is taught is very similar throughout most of the world. As a result there may be considerable similarity in how it is practised in large parts of the world.

Most of architectural education is based on project work. This is structured around a sequence which normally starts off with problem definition, continues as a number of sketch schemes which are progressively criticised and refined and then finally presented and judged. This is very close to the Popperian P_1 and P_2 sequence with considerable emphasis on both the tentative solution and error elimination stages in terms of both student effort and teaching time. The distribution of examination marks is a direct indication of where the emphasis is placed in a school of architecture. In most institutions, design project work is allocated 50% or more of the total available marks, by far the biggest percentage given to any single subject.

The sequence of work may be very similar in the office but the character of both the tentative solutions and the error elimination criticism may differ markedly. The serious temptation in the office, particularly the average office, is to neglect the tentative nature of the first solution and to go to a safe answer which follows a known type. A great many problems in architecture are self-imposed and it is very easy – and probably more lucrative – to avoid setting oneself too many difficulties; enough exist, as it is, to get any building off the ground.

The error elimination tests are likely to be more wide ranging in the office than the school and perhaps also more

decisive. They would certainly involve the client, cost consultants, planning authorities, legal building control officers, fire departments and most likely local community organisations and conservation groups. Each test would be different and specific and some would be contradictory.

Very few schools of architecture set design projects which are done collaboratively by architectural students, with students of different branches of engineering and of building cost analysis. The kind of design team which is formed in practice for any project of any size does not, therefore, exist in schools to provide some of the earliest error elimination.

In the office as well as the school, the P_1 to P_2 sequence is iterative. There is, as a rule, an attempt to improve the design, to answer some criticism, until a deadline is reached; sometimes very nearly beyond, as in the all-night sessions in the studio or in the office before a competition submission, which are part of the legend of being an architect.

The length of time spent on the various stages of any project is very different in a school and a practice. The major effort in the school studio is on the first stages of design, in the office on constructional drawings and site supervision. This colours the approach of much decision making; it may especially influence the choices made between innovation and continuity in the average practice.

The implications of the P_1 to P_2 sequence extend beyond project work into verbal thinking and particularly into the teaching of history. If P_1 and the subsequent P_2 are always related to a particular time, then perhaps architectural history is a series of hypotheses and not some kind of Darwinian rising curve of evolutionary progress. The Parthenon on the Acropolis cannot be said to be less good – or better – than say Ronchamp, to take another ecclesiastical building on a hill, just because of the time difference between them. It can be argued that there has been a progressive increase in the capacity to create greater and

greater clear spans, but architecture is not judged – and should **161**

not be judged – by the dimension of its biggest span.

The inevitable emphasis on non-verbal thinking has given rise to two suggestions: the first, that architecture is not a subject that has a place in universities; the second, that architecture needs to become more like other university subjects. Both are profoundly misguided and show a lack of understanding of the architectural process. To start with it needs to be remembered that if the assumption that the design activity follows the P_1 to P_2 sequence, then it is akin to the research activity in many sciences, both physical and social. Design forecasts

Right
Jørn Utzon, Own house in Majorca; the essence of house and reality expressed in diagrammatic plan and section
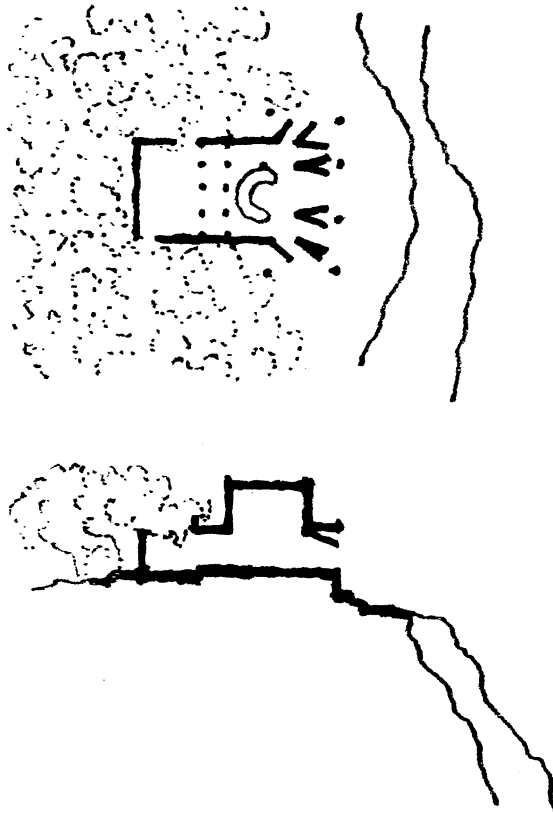
an event on the basis of past experience; exactly the path pursued by many academic endeavours. On the contrary, it needs to be argued that university subjects have much to learn from the teaching of architecture, especially from the one to one studio teaching as a guided co-operative effort between tutor and student and the open review sessions which normally count among the critics both staff and architects in practice.

Much of the time taken up in tutorial sessions consists of tutor and student speaking to each other but at the same time sketching, giving visual definition to words which could convey a number of alternatives. Verbal thinking is mixed with non-verbal thinking. The same thing happens in an office as a design is explored by two architects or an architect with an engineer or, indeed, when a project is discussed by a group. The depth of meaning in a sketch should never be underestimated; Jørn Utzon's plan and section of his holiday house overlooking the Mediterranean not only gives a general configuration but also shows the answer that deals with the bright light reflected from the sea. In a few lines its position on site, its volume and its control of the view are made clear. Nor should we forget the many purposes of that visual shorthand – the sketch. As a Norwegian educator put it:

> The sketch is communication
> – between 'me' and 'I'
> – between me and you
> – between student and teacher
> – between architect and client
> (Cold, 1995, p.60)

Does it matter?

The question as to whether we benefit from an understanding of the design process, from a possible theory, has a number of answers. None may be wholly definitive.

Viewed from a historical angle, the answer may well be that great architecture was created in the past without an awareness of the process which gave it birth. It is highly likely that Sinan, the most celebrated Ottoman architect, when designing the extensive complex of the Selimiye Mosque in Edirne of 1569–75, for instance, was aware of his Byzantine predecessors without analysing that awareness or drawing any general

Right
Sinan, Selimiye Camii,
Edirne, Turkey 1569–75
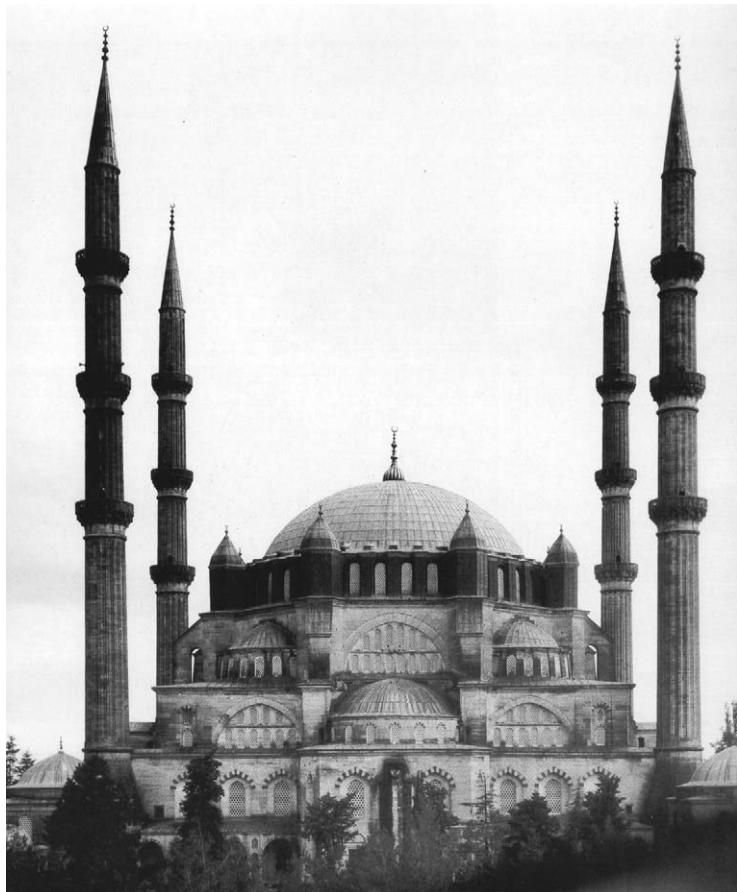
conclusions. Nor was he probably concerned to what extent he was continuing an existing tradition which he saw embodied in Hagia Sophia of over a thousand years earlier or whether he was innovating and establishing a significant variant on what had gone before. The present day view is that 'it is no exaggeration to say, that with this building Turkish mosque architecture reached its fullest expression' (Vogt-Göknil, 1993, p.81); that Edirne was the culmination rather than the inception of a movement. It is also difficult to imagine that Sinan could ever have guessed that at the beginning of the 21st century it would be the great range of kitchens at the Topkapi Serai in Istanbul with their dominant conical lead-faced roofs which would be influential – both consciously and unconsciously – in the design of stack-effect ventilators on energy conscious buildings.

Right
Sinan, Topkapi Serai, Istanbul ca. 1550**;** lead covered chimneys of the range of ten kitchens
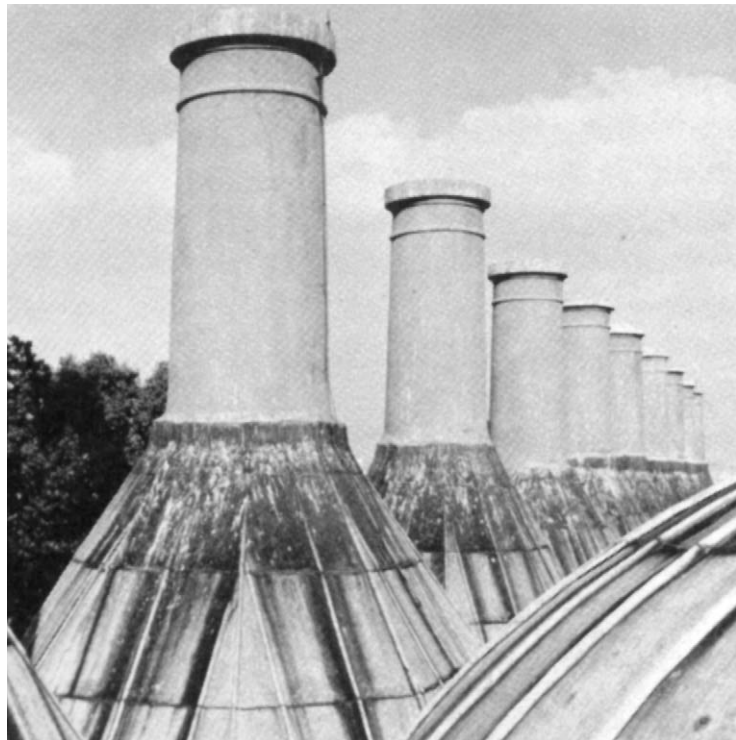
Sinan was a prolific architect although he only came to architecture at the age of 49, having first been a military engineer. His autobiography, dictated to a friend, survives but not a single drawing from his hand. We have no evidence of an exploration of themes as in the case of his near contemporary, Leonardo da Vinci. Only speculation is possible.

Speculation about the existence and effect of a theory of design becomes a good deal clearer at the end of the 17th century and in the 18th century when there was a conjunction of a number of ideas in France. Firstly there was the establishment of institutions to train architects for the Royal Building Administration; the Royal Academy of Architecture was founded in 1671, probably as a result of the King's and Colbert's – his comptroller general of finance – dissatisfaction with the awareness of French architects of the theory and aesthetics of architecture (Rosenfeld, 1977, p.177). Then in the 18th century there was the drive to codify and classify the world which is epitomised by the thirty-three volumes of the *Encyclopédie*.

In architecture the ordering drive was based on the establishment of a type. The word had a number of meanings but the main intention was to define a character and an order for different buildings largely based on their use. Additionally architects were to test their designs against the exemplary models of the past. As Quatremère de Quincy – with Blondel one of the chief protagonists – wrote in the *Encyclopédie méthodique*:

> 'One wishes that the architect who undertakes a building or project would place it, in his imagination, within the walls of Athens and that, surrounding it with the masterpieces that remain or those whose memory has been conserved by history, he would examine them, drawing from them analogies applicable to his own designs. Their silent and ideal witness would still be one of the most authentic kinds of advice he might receive.' (Vidler, 1987, p.163)

It is significant that the proposed test was not a verbal criticism but a visual comparison. The suggestion was in some ways akin to the provision by the emerging museums of the late 18th and early 19th century for special artists' days in which painters could copy, and be inspired by, the masterpieces on display.

Once architects were encouraged to look for verities in the past rather than follow the master to whom they were apprenticed and were, moreover, to replicate the discovered typology, it became increasingly necessary to work on the basis of some theory. This was particularly true in the period of the Enlightenment when reason was seen as the proper foundation of action.

The two theories which held sway were that perfection resided in some earlier period. In the case of 18th-century France it was 5th century B.C. Greece. The second theory was that buildings have particular characteristics depending on their purpose. Stylistically the result was neo-classicism. The basic argument was, however, no different from Pugin's illogical thesis that the Gothic represented true Christian architecture and was therefore to be imitated. He totally discounted the fact Rome, untouched by Gothic, was intimately associated with Christianity and that the Byzantine was linked to the Eastern Church for centuries and indeed pre-dated Gothic.

What was not made clear was how to find the particular appropriate model or how to choose between possibly competing models. Ledoux had built a series of *barriers* around Paris and was taken to task by Quatremère 'for the indiscriminate mingling of antique types, none of which seemed to answer the requirements of monumental gateways ... A correct "type" for imitation, that of the triumphal arch, he implied, would have led to a more suitable architecture for entrances to the city' (Vidler, 1987, p.168).

Both Quatremère and Pugin favoured continuity to innovation. Both had a discernible effect on what was built: in one case neo-classicism, in the other Victorian Gothic:

the Houses of Parliament, law courts, and a proliferation of churches.

The teaching at the Bauhaus was based on quite different assumptions. Students were not encouraged to look for precedents but to create designs from the nature of materials and the technology of production, the constraints of function and the compositional patterns of abstract art. Continuity tended to be derided while innovation was fostered. But that innovation remained within certain limits which represented the approved visual vocabulary so that we can today recognise a Bauhaus style.

Below
Architecture de C.N. Ledoux, Edition de Ramee 1847; plate 27 showing one of the *Propylées de Paris*
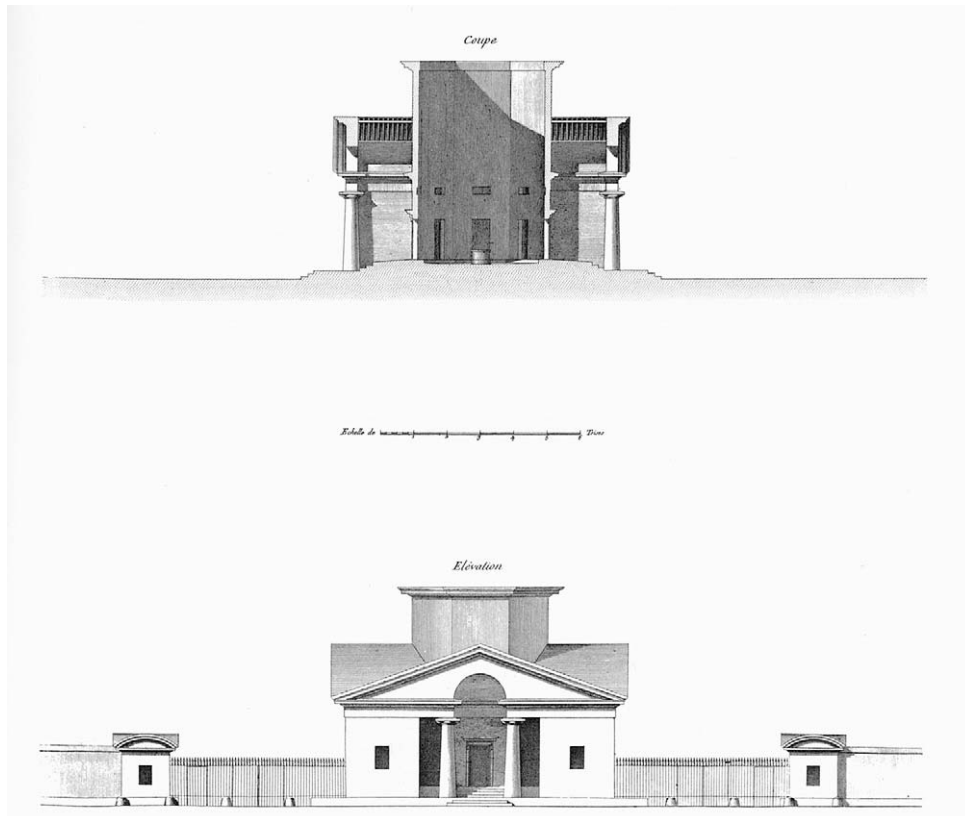
In the prologue to *On the Art of Building in Ten Books* Alberti sets out the claim:

> '… that the security, dignity and honour of the republic depend greatly on the architect: it is he who is responsible for our delight, entertainment and health while at leisure, and our profit and advantage while at work, and in short, that we live in a dignified manner, free from any danger. In view then of the delight and wonderful grace of his works, and how indispensable they have proved, and in view of the benefit and convenience of his inventions, and their service to posterity, he should no doubt be accorded praise and respect, and be counted among those most deserving of mankind's honour and recognition.'
>
> (Alberti, 1988, p.5)

Architects and architecture, however, need not only honour and recognition but also understanding of the work processes involved. This matters not only in teaching institutions – the Royal Academy of Architecture or the Bauhaus – but also in practice when tackling a project we start with an in-built set of assumptions, virtually impossible to purge, about the appropriate way to pursue the design process. These predispositions strongly influence the way we tackle the design which in turn affects the eventual outcome. Some of the predispositions come from our education, some from our personal characteristics and preferences, some from the current paradigm which tends to ring-fence what is thought to be significant or, at least, appropriate. That understanding is, I believe, in any case also of general interest since architecture affects, as Alberti emphasises, so many facets of our lives.

There is additionally a further and perhaps ultimately more crucial reason: non-verbal thinking extends far beyond architecture yet is sparsely chartered territory. It is important to be aware what non-verbal thinking can and cannot do. There

are, moreover, significant differences between various kinds of non-verbal thought.

Mime, for instance, can tell a story and convey emotions. It does so because it heightens body language which we use everyday, consciously and unconsciously, to convey meanings on its own or to emphasise words. Some body-language is almost universal, some specific to a society. It is our empathy with the mimed actions, our intimate relation to those actions, which makes it possible to tell a story through mime. Architecture is too abstract an art, too separated from bodily actions (with just the possible exception of the caryatids) to be able to mimic human behaviour and emotions. It might be said that a column represents a body supporting a weight; it could equally, however, represent a tree trunk or indeed only represent itself. We can ascribe all kinds of meanings to the straight line, vertical and horizontal, and the intersection between the two, but these meanings will always be ambiguous. The integrity of the lines will, however, remain; three straight lines

Right
El Lissitzky, Street poster
1919–20, *Beat the Whites
with the Red Wedge*
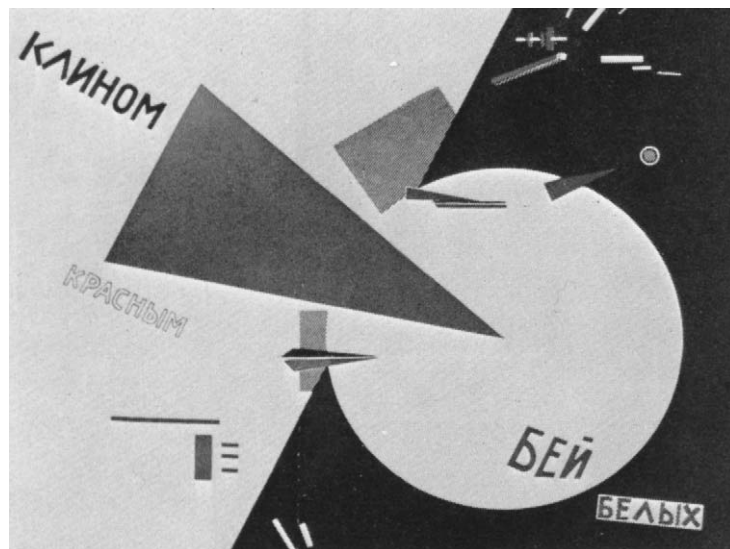
making a 90° triangle had the same properties in the days of Pythagoras as they have now. A triangle may acquire additional and new meanings as in El Lissitzky's street poster of 1919 – 20, 'Beat the Whites with a Red Wedge', where it became a weapon of attack without losing its original attributes. The meaning is dependent on the visual context and in this case, as in so many others, on the adjacent words.

What seems to be relevant is that although we frequently and fruitfully think non-verbally, we almost always need words to make precise those thoughts when they require to be communicated. I can produce a drawing showing a design and someone else can produce a different design solving the same problem. We can put these drawings side by side but then need words to argue why one should be preferred to the other. We may then, separately or jointly, return to non-verbal thinking to produce further alternatives. Or to put it another way, I cannot make the above statement as a drawing just as I would find it extremely difficult, if not impossible, to invent and present unambiguously a plan and section of a house in words.

Such a statement may seem a truism. It nevertheless needs making in view of the verbal discussions of architecture which too often neglect the existence of buildings, of buildings as objects resulting from non-verbal thinking.

Critical innovation

The influence of the past is inescapable and a total absence of continuity is therefore inconceivable. We cannot purge ourselves of the effect our surroundings have on us; we simply cannot be blind to the existing world, present and past. In any case the present state embodies the trials of millennia and it would be foolish and wasteful to ignore experience which has accumulated since Adam and Eve.

Even the most radical artist works in some tradition and certainly starts by doing so even if departing from it later in life; the work is part of a changing continuum in which the rate of change may vary but is always there. No one has yet been able to step outside the existing visual – and cultural – environment and suddenly invent a wholly new visual language.

The opposite assumption, namely that there is no innovation, seems equally untenable. Such an absence could be explained by the supposition that there are no new problems or, alternatively, that even new problems can be solved satisfactorily with old solutions. History and our everyday experience, however, deny this as a workable proposition even though some more extreme heritage lobbies act as if it were true.

Part of the difficulty arises from the symbolic content that is enmeshed with all stylistic answers; the connection was the basis of Pugin's fierce polemic as much as Le Corbusier's pronouncements in *Towards a New Architecture*. Style is related to a particular period and becomes synonymous with the cultural indicators of that time. Thomas Jefferson while third President of the United States, for instance, hoped that there would be an indigenous architecture development that would run parallel with that of the new republic. He encouraged Latrobe, the architect of the new Capitol building in Washington D.C., to create an 'American Order'. Latrobe sent him drawings of capitals based on corn, cotton and tobacco plants; a modest innovation on an ancient form that preserved the notion of a continuity with an admired republican Rome.

Innovation also suggests a certain degree of optimism; that not all the answers are already in existence, that in fact new and perhaps more relevant answers can be found. Such optimism is a necessary part of the life blood of any society and includes the manifestations of architectural optimism, for architecture is not just the passive mirror of society but also the moulder of culture. The shift in architectural thinking and expression which occurred in the 1920s and 1930s was consciously intended to bring about a freer, more equitable society. Although the modern movement has many villas for the rich or nearly rich among its creations, it was mass housing which it believed it should revolutionise; it was there that a new and better world would emerge. Though entirely different in form, Le Corbusier's Ville Radieuse and Frank Lloyd Wright's Broadacre City have the same underlying intention.

We also look to innovation to keep our expectant eye alert and for it not to become lethargic; to keep our vision fresh and to prevent the boredom of repetition. We in a sense cease to see what is too familiar. Some of the public and professional success of the Bilbao Guggenheim is surely due to the newness and vigour of Gehry's vision.

If, as it would seem, both continuity and innovation are involved in some way in the design process, then is there a description of design which gives weight to both and in reasonable measure? It has been suggested in an earlier section that typology favours continuity and that determinism implies constant innovation because of the alleged uniqueness of each problem. The Pattern Language also puts great emphasis on past experience rather than novel solutions while the idea of undifferentiated space and the Khanian division into served and servant spaces are more concerned with design solutions than process. It is the sequence P_1 to P_2 with the intermediate stages of tentative solution and error elimination which embodies within it both continuity and innovation; continuity through the fact that P_1 arises from an understanding of the past and

past. It was in fact this recognition of history without facile imitation of its earlier forms that marked their major contribution. Scarpa said that in Venice he was at the junction of Europe and the Orient being influenced particularly by Hoffmann and the Vienna Secession and by the architecture of Japan, as well as by Frank Lloyd Wright, himself indebted to Japanese art and architecture. Kahn's architecture, on the other hand, might appropriately be described as 'doric': an architecture of simplicity, mass and seriousness that stemmed from a deep understanding of the characteristics of Graeco-Roman building.

Individuality of varying degrees has been evident in all artistic creation. We ascribe a work of art to a particular artist because of tell-tale signs in the work. This is true even when the output of contemporaries appears to be quite close.

Recently, for example, Frank Gehry and Daniel Libeskind are contemporaries who both pursue a non-orthogonal architecture for the same building type – the museum – yet create answers that show their personal signature. This an age-old phenomenon which it would not be worth mentioning were it not that critics in some sectors of the public often clamour for a more anonymous architecture, for a conscious and thus unattainable vernacular.

The sequence of P_1 to P_2 stems from Karl Popper's attempt to define the nature of science and to describe the characteristics of significant research. The controversial outcome was the line of demarcation between science and non-science where science is always potentially falsifiable. This went against the accepted position that scientific theories represented ultimate truths. In Popper's view they were only the best and

most rigorously corroborated statements at a particular time.
The line of demarcation in no way implies a value judgement; both sides were important. Popper made this abundantly clear: 'Man has created new worlds – of language, of music, of poetry, of science; and the most important of these is the world of moral demands, for equality, for freedom, and for helping the weak' (Popper, 1944/66). Art – and thus architecture – might also have been included on that list.

Clearly architecture as a totality is not falsifiable. We cannot establish that the structure of a building, its function, its services, its appearance, its symbolism and the variety of other aspects can all be falsified together and thus invalidate the building as a whole. Architecture is firmly on the non-science side of the line. All past efforts to claim that it was a science have failed.

Yet, and perhaps paradoxically, the claim is being made that the sequence of scientific research and the sequence of the design process show many similarities. I would, in fact, argue that it represents the closest parallel that we can find. Nor am I alone in such a belief. Ernst Gombrich in his 1956 Mellon lectures on 'the visible world and the Language of Art' (which became the book *Art and Illusion*) said:

> 'The description of the way science works is eminently applicable to the story of visual discoveries in art. Our formula of schema and correction, in fact, illustrates the very procedure. You must have a starting point, a standard of comparison, in order to begin that process of making and matching and re-making which finally becomes embodied in the finished image. The artist cannot start from scratch but he can criticise his forerunners.'
> (Gombrich, 1960/77, p.272)

Gombrich was primarily discussing the work of painters and his examples came from painting and drawing. His statement is, however, equally relevant to architecture.

The congruence between the scientific search and the design process may not be related to any similarity between science and architecture but stem from the fact that both are research processes. Both are arguably looking for an explanation of some future event; an event which does not occur randomly.

Gombrich concludes his statement that the artist 'can criticise his forerunners'. Indeed he must. Partly, in order to refrain from simply creating novelty for its own sake. This has, as a rule, a low value in terms of building stepping stones to the future. Mainly, though, to create experiments which satisfy the needs of the present, physically and emotionally, and which are experiments which can be continued into the future. This is not to claim an evolutionary sequence; architecture does not 'improve' 'or develop', it simply is an experiment at a particular time. If it survives it is judged with historical hindsight to have been an appropriate hypothesis.

Gothic, for instance, turned out to be a daring and robust innovation when it originated in the Ile-de-France in the 12th century. It lasted for nearly four hundred years, spreading to Germany, England and later Spain, and somewhat weakly in Italy. It was revived in the 19th century. Post-modernism, on the other hand, was a brief escapade at the end of the 20th century that seems to have left few discernible traces. The error elimination step occurs also, it seems, at a much longer time cycle than that of an individual design project.

It is highly crucial to architecture that criticism can and does occur at various stages, that it is one of the necessary steps of the process. It is probably even more crucial in fields outside architecture and none more so than in politics. The worst excesses of the last hundred years have been staged because of a belief in an unchallengeable and uncritical correctness. The essence of dictatorship is the suppression of criticism; democracy is – or should be – the possibility and encouragement of criticism. Or to make a possibly exaggerated claim, the way we design – the way we recognise problems, produce tentative hypotheses, that are in need of criticism and which, for the time being, become the best surviving answers – might be taken as a model for our political conduct. If the present era is the age of democracy, then it is by corollary also the age of criticism.

Afterword

Carlo Scarpa has frequently been called 'architetto poeta';
Martin Heidegger claimed that 'all art . . . is essentially poetry'. It
seems that we tend to equate poetry, a form of verbal communi-
cation, with the highest achievement of art and particularly with
its emotional content. This may be a historical legacy that goes
back to Homer.

        In the last half a dozen decades – in certainly less than a
century – there has been a new emphasis on visual communica-
tion and especially on visual communication across distance.
Until relatively recently the illustrated book or journal was the
only distributor of visual information. All this has changed dra-
matically; we may now absorb more organised information
visually than ever before. Architecture has benefited from this
change. Through its dissemination in visual media, architec-
ture is becoming a more popular, a more discussed, topic.
Perhaps as a result also a more relevant topic.

        But architecture is itself a visual medium and thus a par-
ticipant in the current visual revolution. Electronic means of
visualisation, computer aided design, and the subsequent turn-
ing of these visualisations directly into processes of manufac-
ture (computer aided manufacture) have dramatically altered
the procedure and well nigh erased the craftsmanship of draw-
ing as a daily occurrence. Virtual reality speeds up the rate of
change and may continue to do so. Electronic visualisation will
also extend the range of the possible as it did in the case of the
Bilbao Guggenheim or the London Millennium Dome. We may
know intellectually that such buildings relied heavily on com-
puter aided design but I do not believe that we know perceptual-
ly; we do not say this was drawn by computer and this by hand
when we look at architecture.

        I would therefore claim that the design process in archi-
tecture and many other fields is in its essence, and particularly
its sequence, unchanged. Architecture not only envelops us
protectively but is always also part of a culture, of a past that has
a present and a future. It is interwoven with our history and has

180 been part of its warp and weft for thousands of years. In view of this it may also hold lessons outside its own realm.

Notes

Books, like architecture, have antecedents. A number of the   **181**
topics which are discussed in this volume were explored in ear-
lier and different incarnations. Chief among these antecedents
would be Karl Popper's writings which underpinned the argu-
ments in my book *From Idea to Building* (Brawne, 1992). A highly
compressed summary described it as 'a critical view of the
assumptions which influence initial design decisions and of the
process of development from inception to inhabited building,
together with an analysis of the general implications of the
design process'.

   The existence of both continuity and change was the
subject of my talk at a symposium organised by P.G. Raman
at the Department of Architecture, University of Edinburgh, in
November 1997. The propositions put forward were illustrated
by the work of Geoffrey Bawa in Sri Lanka, whose architecture
I had described in several articles in the *Architectural Review*.
Ideas about the aesthetics of the plan and the nature of archi-
tectural drawings were developed at another seminar at the
University of Edinburgh and eventually published in *Spazio e
societa/Space & society*, 44, 1988.

   The relevance of Popper's ideas to education were
discussed by me at a symposium at the University of
Portsmouth in February 1994. The proceedings were later
published in *Educating Architects* (1995) edited by Martin Pearce
and Maggie Toy.

   Many of the topics which appear in this essay were also
the subject of lectures I have given in various places and in par-
ticular at the University of Cambridge and the University of Bath,
in both of which I taught for many years. Teaching was, however,
always carried on in parallel with architectural practice. I believe
strongly that teaching needs, as in other disciplines, to be com-
bined with research. Design, and controlling the translation of
design into architecture, is the core of architectural research;
design and architecture cannot be divorced. This was a subject
I discussed in *Architectural Research Quarterly*, Winter, 1995.

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