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11

Design strategies

The act of making an architectural decision can perhaps be stripped of its mystique, while some far more viable set of operations is seen to add up to something – not a style, not even a discipline, but some indefinable aggregate of operations which have been intelligent and appropriate and have given a situation its fourth dimension.

Peter Cook, *Architecture Action and Plan*

I would be the voyeur of myself. This strategy I employed for the rest of my captivity. I allowed myself to do and be and say and think and feel all the things that were in me, but at the same time could stand outside observing and attempting to understand.

Brian Keenan, *An Evil Cradling*

Theory and practice

In the last chapter we saw that it is common for designers to carry some set of guiding principles with them through their working lives. This intellectual baggage is most frequently gathered during that career, with each project contributing to it in some way. We saw some examples of sets of guiding principles and many others could have been presented. The intention was simply to suggest that it is not necessary to include revolutionary or fringe ideas about design in order to find considerable variation in approach to the design process. This hopefully acts as a counterbalance to the earlier part of the book when emphasis was laid on the more theoretical writings of design methodologists. If we are to gain any real insight into the complexities of the design process then we must study not only what theoreticians say but also what practitioners do.

The early years of the design methodology movement were characterised by a tendency to look for common features in the design process or at least to classify design strategies. Earlier in this book we examined some maps of the design process which it is assumed will be taken up by all designers. The message from the

practitioners is rather different. They speak less of clearly defined routes and rather more of their own individual interests, approaches and strategies. Our earlier examination of some maps of the design process suggested that, whilst many seemed quite logical, none were really all that useful. The writings of practitioners confirm the view that there is not one route through the design process but many. However, it is not enough to rely entirely on designers' accounts of what they do. If we could accurately describe what goes on in our head when we design, then there would be no need for any books such as this!

Begin at the beginning

We know that the process starts with some sort of problem and finishes with some sort of solution, but how do designers get from the first to the second? We have explored maps of the design process and generally found them wanting, since they are neither accurate nor helpful. So just how do designers begin their work?

We know that design problems are rarely, if ever, fully described at the start of the design process. We have also seen empirical evidence suggesting that designers use what we might call solution rather than problem-focused strategies. That is to say their emphasis is more on reaching a solution rather than on understanding the problem. Our examination of the nature of design problems and solutions perhaps now shows this to be rather more logical than it might have at first seemed. We saw that design problems cannot be comprehensively formulated and that solutions cannot be logically derived from them. However, most design problems are also far too complex for the designer to hold all the factors in mind at once. So where do designers begin and what sort of strategies do they employ to proceed?

The brief

Conventionally a design begins with a brief, which we may imagine a designer is given by a client. However, since design problems cannot be comprehensively stated this begs the question of what is in the brief and what is not! This itself can vary considerably. The brief may be quite complete in a design competition. In, for example, architectural competitions there may be a site, a

schedule of accommodation and a set of requirements all laid out quite explicitly. This is necessary in the case of the competition where the designer is probably allowed little or no contact with the client before submission. In the more normal design process our question is not so easy to answer. A common complaint from designers is that their clients do not involve them early enough in the process. Perhaps clients feel that they must have a clear definition of the problem before they commission a designer, but this is not so. In a study of architects and their clients, most of the architects argued that they preferred to be involved with the project from the very beginning (Lawson and Pilling 1996).

Some clients are experienced at their job, and may even be acting in that capacity professionally. It is also increasingly the case that large clients for buildings may take on their own architects to help them develop a brief which may later be given to quite different architects. However, many clients for design are less experienced at preparing design briefs. The architect and interior designer Eva Jiricna tells how, in her experience, 'we never, ever get a brief from a client which we can start working on' (Lawson 1994). Now this might seem problematic for designers, but when asked about this most of them are quite happy to receive briefs which are very brief indeed! The Malaysian architect Ken Yeang, even prefers to start with what might be called a 'mission statement' of just a few sentences. (Lawson 1994). The view expressed by Michael Wilford describing his work with James Stirling, is reflected by many architects and designers:

> We have found over the years that the ideal brief is probably one or two pages even for the most complex project. Many clients think they have got to produce something that is two inches thick before an architect can even put pen to paper. We prefer it the other way round, we prefer the thinnest possible information so that we can get a grasp on the whole thing and gradually embellish it with detail later.
>
> (Lawson 1994)

Protocol studies

To find out how the design process actually begins to develop the brief and formulate a solution we need to turn to some of the many studies on design process protocols. These protocols have been gathered under a wide range of conditions, but all share in common a rather more controlled environment than the design studio normally provides. The process studied usually has quite a short duration measured in a few hours and often is completed

within one session. Such conditions are, of course, highly artificial so we must be careful how we analyse the findings of such studies.

Not surprisingly, most design strategies seem to begin with a brief scanning of the problem as it appears initially. However, it is also common to find that elements of solutions rather than problems begin to emerge very early on in the process. In one of the earliest of these studies, subjects were asked to design a new bathroom, and they invariably began drawing solutions almost immediately (Eastman 1970). One experimental technique used to externalise and reveal design thinking is to use groups of subjects and record their conversations. One such study of architectural students designing a nursery school was video-recorded and then analysed for both words and actions. It was rarely very long in these protocols before the subjects began to use such phrases as 'this suggests' or 'we could try'. It was found here that different aspects of the problem were examined to see what they might suggest in terms of ideas about the solution, rather than analysed in their own right (Agabani 1980).

There are many ways of analysing the data from such design process protocols. A notable contribution to the field has been made by a conference at which all the contributors had analysed the same two video-recorded design protocols. Both were industrial design problems, in one case tackled by an individual who was asked to think aloud and in the other case was worked on by a group (Cross, Christiaans et al. 1996). Some researchers tried to break down the process into sequences, others looked to classify the kinds of cognitive activity they thought to be revealed. Others still tried to link the events on the path to the solution with phases of thinking, while yet others concentrated on the cognitive style of the designers. Finally, researchers concentrated on the inadequacies of the protocols themselves to properly represent real design activity (Lloyd, Lawson et al. 1995). Thus there was sufficient material here to publish a book larger than this one just on two design protocols!

Heuristic strategies

An examination of protocols obtained from such closely observed design sessions reveals that most designers adopt strategies which are heuristic in nature. The essence of this approach is that it is simultaneously educational and solution seeking. Heuristic strategies

do not so much rely upon theoretical first principles as on experience and rules of thumb.

To illustrate this principle let us look at two methods of sizing timber floor joists. In the first, theoretical method, calculations are performed using the known compressive and bending stress capabilities and elasticity of the timber. The calculations give a depth of timber which will not deflect more than 0.003 of the span and will not cause the bending and sheer stresses to exceed the permitted levels. The calculations are based on established theories of structural mechanics and would be performed by structural engineers and required for building regulation approval. The alternative to this precise but laborious procedure is to use our second, rule of thumb or heuristic, method. There are many possible rules such as 'the depth of 50 mm wide joists at 400 mm centres is 25 mm for every half metre of span'. Such a method is by no means precise but will never be very far out. However, not only does the method go straight to the solution, but it is educational in the sense of clearly identifying the critical relationship between depth and span of the joist. The rule of thumb is also much more practical in that timber does not come in an infinite range of depths but is commonly available in multiples of 25 mm.

This rule of thumb provides a good model of the heuristic strategy so commonly employed by designers. A rough idea is quickly developed for the most significant elements of the solution which can then be checked by more precise methods and adjusted as necessary. Such rules as those relating depth and span clearly cover the critical aspect of the problem of sizing a joist. However, in more complex design situations it is by no means so easy to decide what is critical. Indeed what is important or critical is likely to be a matter of opinion. Here designers need rather more sophisticated heuristic strategies.

Three early phases of working on the same problem

To see how this might actually work in practice we shall briefly consider the approach taken by three groups of architecture students towards a competition to design a large new county authority office building. After a fairly short period of work the groups presented their ideas and thoughts so far. Here, then, rather than working on protocols we can analyse the presentations made by the design students at an early interim criticism session with their tutors.

The first group started by describing how they felt that the environmental requirements of the office space were the critical factors (Fig. 11.1). They had done a literature review of all the research they could find on office space and had arrived at a sketch design of a 'typical bay' showing the structural and service systems for providing shelter, power, comfort and light while maintaining a relatively uninterrupted floor space to give flexibility of layout. The building, they thought, could be assembled by replicating these bays as desired and as the site permitted.

By contrast the second group took the view that office space itself was not difficult to design and they had focused their attention on some rather unusual features of the site. (Fig. 11.2) The sub-urban parkland site was located between two major radial roads connected by a footpath. This group had noticed that the competition brief had stressed the importance of not presenting a remote or forbidding image to the ratepayers. They decided to build their office around a covered mall which followed the line of the footpath and thus brought the public right through the building. Taken together with the banks of trees, south-facing slope and considerations of screening noise from the busy roads this enabled our second group to develop proposals for the siting and massing of their building. The next phase, they explained, would be to fit the various departments into the building adjusting the envelope where necessary.

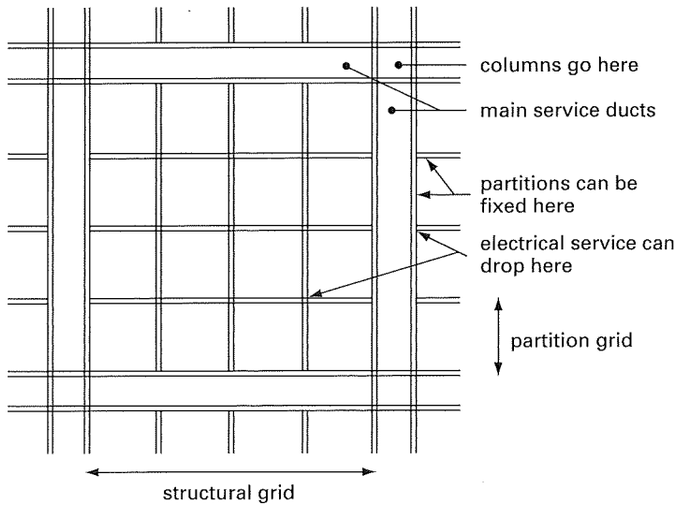

Figure 11.1
A student group present their early work in designing an office building

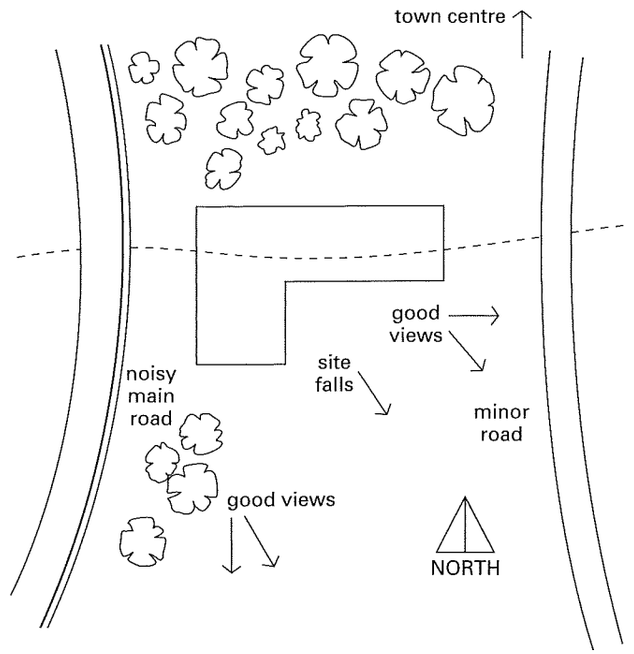

Figure 11.2
The second group seem to be concentrating on quite different problems

The third group had focused more on the visitors rather than just the regular inhabitants of the building (Fig. 11.3). This group were anxious to avoid what they saw as the usual failings of such buildings, that is, presenting large inscrutable façades with unclearly structured interiors in which it is easy to get lost. For them the whole structure of the organisation provided the stimulus to building form. Each section and department were to be clearly articulated using a hierarchy of open spaces linked by well-defined routes to a central entrance court.

It is difficult to decide whether any of these approaches are better than the others and it is certainly not possible to declare any to be either right or wrong. Although at first sight these three approaches may seem rather different, in fact they share basically the same overall strategy. In each case a group of sub-elements of the overall problem have been clustered together and elevated to the role of form generator.

What differentiates the three is simply the kind of constraint which has been used in this focal role. The first and last group concentrated on the way the building should be organised by focusing on internal constraints while the second group looked at the external constraints imposed by the site. The first and second groups looked at constraints generated by two different types of

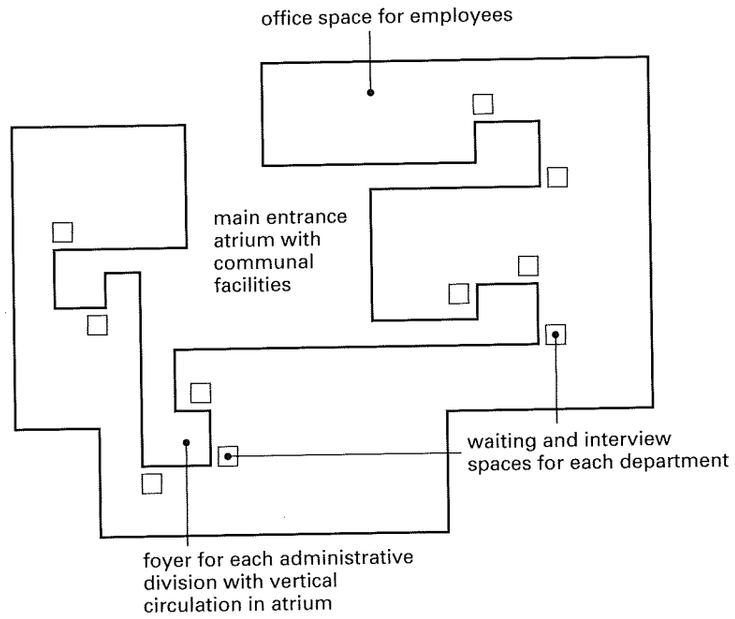

Figure 11.3
The third group add to the variety of approaches possible

user, the employee and the local taxpayer. The first group gave priority to the efficient control of the working conditions and thus recognised mainly radical constraints. By contrast, the second group thought that the quality of the place was more important and they recognised more symbolic constraints. The third group, when questioned, saw no conflict between these and felt that the physical expression of the organisation achieved in their building would not only be easy for the taxpayer to relate to but would also lend a sense of identity and belonging to the employees, thus creating a good social working environment.

The primary generator

We have seen how the range of possibilities can be restricted by initially focusing attention on a limited selection of constraints and moving quickly towards some ideas about the solution. In essence this is the 'primary generator' idea which we first introduced in Chapter 3, but where does the primary generator come from and how does it work?

Obviously it is highly desirable that the primary generator involves issues likely to be central or critical to the problem. However, what is central and what is critical may turn out to be two

quite different things as we shall see. The student architects designing a building for a county administrative authority used a variety of generators relating to the radical functions, user constraints and external constraints of the site. The first and obvious source of a primary generator, then, is the problem itself. Finding those issues most likely to be central is a matter of common sense and some experience, and these students were all demonstrating a growing sense of judgement in these matters.

What is used as a primary generator is also likely to vary to some extent between the different design fields and problems. Mario Bellini the designer of the Olivetti golf-ball portable typewriter, emphasises the difference between designing static artefacts such as furniture, and mechanical or electrical goods in this respect (Bellini 1977). Obviously, the product designer must learn to adapt the design process to the situation.

We have seen in the last chapter that designers develop their own sets of guiding principles and these often set the direction for the primary generator in any one design project. Thus the architect/engineer Santiago Calatrava with his guiding principles of dynamic equilibrium is likely to use practical constraints about the structure of his building. However, he has himself noted that this is not enough, and that it is the highly specific and local external constraints which often help him to create form:

> I can no longer design just a pillar or an arch, you need a very precise problem, you need a place.
>
> (Lawson 1994)

For the experienced designer, then, the guiding principles when set against the local external constraints may often create the material for the collection of issues which primarily generate the form of the solution. The designer uses this initial attempt at the solution gradually to bring in other considerations, perhaps of a more minor or peripheral nature.

The central idea

These primary generators, however, often do much more than simply get the design process started. Good design often seems to have only a very few major dominating ideas which structure the scheme and around which the minor considerations are organised. Sometimes they can be reduced to only one main idea known to designers by many names but most often called the 'concept' or 'parti'.

In 1994 Jonathan Miller made his Covent Garden debut as an opera director, having also designed the sets. In the programme he wrote that 'the formal artificiality of the work is part of its essential mechanism, for it demonstrates reality without slavishly representing it. It is an argument as opposed to a report – an epigram rather than a memo'. His production of *Così fan tutte* was set in modern times and relied upon costumes exclusively designed by Giorgio Armani. The public is well used to Armani's own restricted palette of plain-coloured fabrics in soft textures and colours largely restricted to fawns, beiges and browns. This simple idea was carried through into the colours and textures of the set, itself very simply arranged using a large backdrop wall with an opening surrounded by a suggestion of a classical architrave. With all the technical and financial power of the Royal Opera behind him, Miller chose this simple and consistent message which effectively conveyed his interpretation of 'demonstrates reality without slavishly representing it'. It was surely the determination with which he resisted any temptation to depart from this one simple single idea which made this production so memorable visually.

The industrial designer James Dyson is famous for a number of innovative domestic products and is perhaps most well known for his revolutionary 'Ballbarrow'. Dyson had experience of using a traditional barrow and found it frequently got stuck in the muddy ground of a garden (Fig. 11.4). He transferred the idea of using a spherical wheel from some previous experience and adapted the shape of the body of the barrow to make it more suitable for mixing cement and for tipping. As Roy (1993) says, throughout the design process was 'an essential generating idea . . . a ball-shaped wheel'. Roy documents this and other cases where the whole design process is driven by one single, relatively simple, but revolutionary idea.

Another dramatic example of this is reported by Nigel and Anita Cross in a fascinating study of the successful racing-car designer Gordon Murray. It was Murray, when working for the Brabham formula one team, who first introduced the idea of refuelling pit stops since adopted by all his competitors. Murray describes how he was thinking logically how to make the car lighter in order to make it faster. The idea of running with a half empty fuel tank became the central driving force behind a huge development programme. At that time pit stops were only used in emergencies and to change tyres. Murray worked out the gains in time from the lighter load and calculated the maximum time he could allow for refuelling whilst still gaining an advantage. From this came the need to design a way of

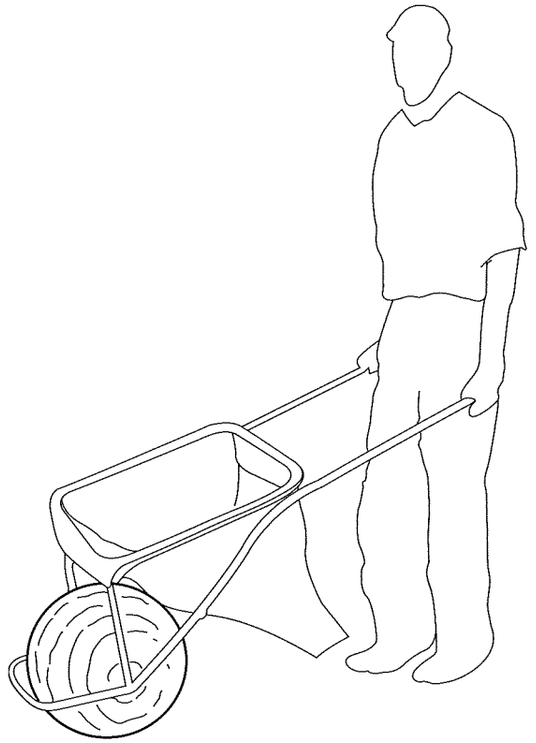

Figure 11.4
According to Robin Roy, James Dyson created his revolutionary 'Ballbarrow' by working throughout the design process with an 'essential generating idea'

injecting the fuel much faster and a way of heating up the new tyres to racing temperature before fitting them. Both have become common and accepted practice.

These examples from very different design fields all offer very good examples of the creative process studied in Chapter 9. A moment of inspiration leading to a central or big idea combined with dogged determination and single-mindedness. Gordon Murray's own description of the pleasure he gets from his job reveals this process:

> That's what is great about race car design, because even though you've had the big idea – the 'light bulb' thing, which is fun – the real fun is actually taking these individual things, that nobody's ever done before, and in no time at all try and think of a way of designing them. And not only think of a way of doing them, but drawing the bits, having them made and testing them.
>
> (Cross 1996b)

This central generative idea may become very important to the designer for whom it sometimes becomes like a 'holy grail'. Characteristically designers become committed to, and work for,

the 'central idea'. The architect Ian Ritchie explains the importance of this to the whole process:

> Unless there is enough power and energy in this generative concept, you will actually not produce a very good result, because there is this three years or so of hard work to go through and the only sustenance, apart from the bonhomie of the people involved, is the quality of this idea, that is the food. It's the thing that nourishes, that keeps you, you know every time you get bored or fed up or whatever, you can go back and get an injection from it, and the strength of that idea is fundamental. It has to carry an enormous amount of energy.
>
> (Lawson 1994b)

Just as a commitment to the idea can be seen to 'nourish' the designer, as Ritchie puts it, so can the search for it in the first place. The central idea does not always appear easily and the search for it may be quite extensive. The architect Richard MacCormac describes this search:

> This is not a sensible way of earning a living, it's completely insane, there has to be this big thing that you're confident you're going to find, you don't know what it is you're looking for and you hang on.
>
> (Lawson 1994b)

The central idea may not always be understood immediately it begins to appear. Richard MacCormac has described this in the development of the design for his acclaimed chapel at Fitzwilliam College in Cambridge. (Fig. 11.5) Very early in the design process the idea was established of the worship space being a round object at the first floor in a square enclosure: 'At some stage the thing became round, I can't quite remember how.' Eventually the upper floor began to float free of the structure supporting it. However, it was not until the design team were considering such detailed problems as the resolution of balcony and staircase handrails that

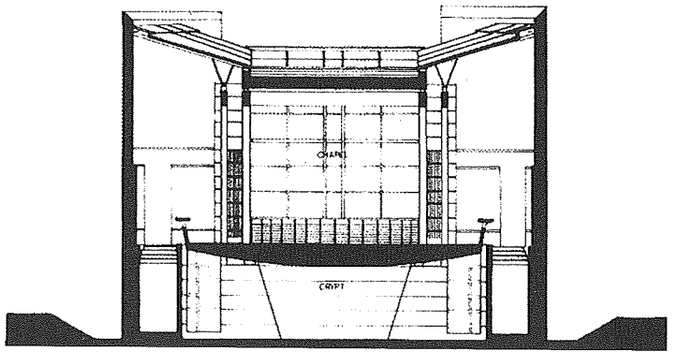

Figure 11.5
Richard MacCormac's chapel at Fitzwilliam College, Cambridge, shown in section with the worship space at the first floor

the team finally understood the idea and made explicit the notion of the congregational space being a 'vessel' (Fig. 11.6). This was then to work its way right through to inform the detailing of the constructional junctions which articulate the upper floor as if it were a boat floating (Fig. 11.7). Richard MacCormac has convincingly argued that this quality of design would have been extremely unlikely to emerge if the designers had changed between the outline and detailed design stages as is now common in some methods of building procurement.

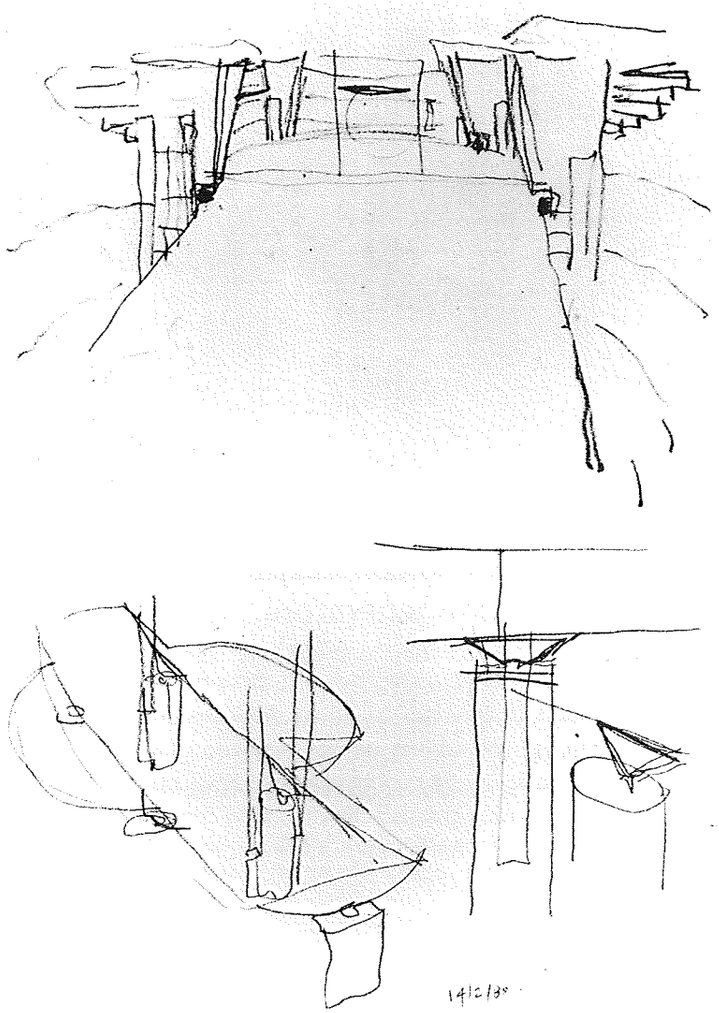

Figure 11.6
Two of Richard MacCormac's sketches as he explored the idea of the worship space as a 'vessel'

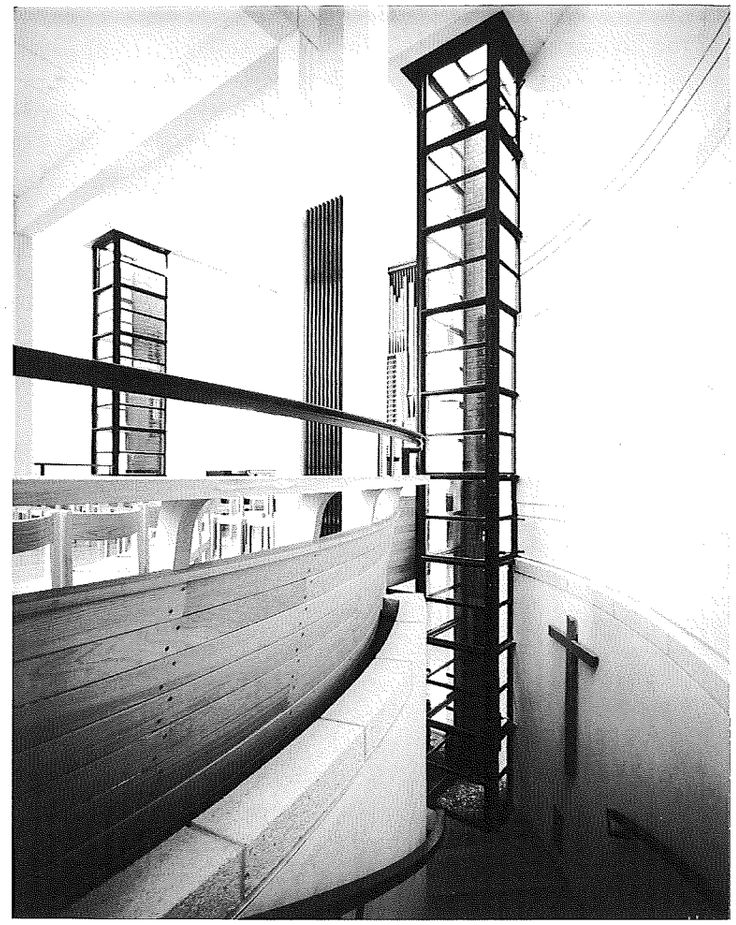

Figure 11.7
The worship space showing the influence of the 'vessel' idea coming right through into the choice of materials and junction details

Sources of primary generators

In the examples considered so far those constraints have been mainly radical in function, that is to say, they are considerations of the primary purpose of the object being designed. The architectural student groups designing a county administrative building focused their attention on providing satisfactory working conditions and internal communications. In general there seem to be three main sources for primary generators or central design ideas. First, and most obviously as we have seen, the programme itself in terms of the radical constraints involved. Second, we might reasonably expect any particularly important external constraints to impact significantly on the designer's thoughts. The design of the Severins Bridge across the

Rhine in Cologne, which was illustrated in Chapter 6, is a very good example of a central design idea emerging from external constraints. Third, we may expect designers to bring their own continuing programme or 'guiding principles' (see Chapter 10) to bear on the specific project. This deserves further illustration here.

As we saw in the last chapter many architects have some guiding principles based around practical constraints. One area particularly popular during the modern movement was that of structure, with the notion of 'structural honesty' forming an important part of many architects' guiding principles. Bill Howell (1970) described how his practice of Howell, Killick, Partridge and Amis developed a philosophy of building they called 'vertebrate architecture' in which 'the interior volume is defined and articulated by actual, visible structure'. Howell showed how this led to a design process in which architect and engineer worked in close dialogue to develop the anatomy of each building. At first glance this approach seems rather wilful and, indeed, Howell (1970) admits that 'we do it, because we like it'. This suggests a design process which is guided by a general set of principles about the role of structure, and in which the primary generator is likely to be the structural form of the building. The sequence of drawings shown here, drawn during the design process for Howell's University Centre building in Cambridge, rather tend to confirm this (Fig. 11.8). Of course, such a design process cannot exclude all other considerations, it is just that they are organised around the primary generative ideas. Howell describes exactly such a process in his own words:

> While thinking about structural economy, the relationship of internal partitioning to downstanding beams, the relationship of cladding to the structure, and so on, you are taking decisions which affect the relationship of the anatomy of the building to its site and to its neighbours.
> (Howell 1970)

Of course this strategy is not in some way 'right' or 'wrong'. It simply worked for this particular designer and created an architecture of a certain kind which has been much admired (Fig. 11.9). By way of illustrating this we might consider how Arthur Erikson, who has a very different set of guiding principles about structure, describes his design process for his Museum of Anthropology in Vancouver:

> As with all my buildings, the structure was not even considered until the main premises of the design, the shape of the spaces and the form of the building, had been determined . . . It is only when the idea is fully rounded and fleshed out, that structure should come into play and bring its discipline to give shape and substance to the amorphic form. In that sense it is afterthink.
> (Suckle 1980)

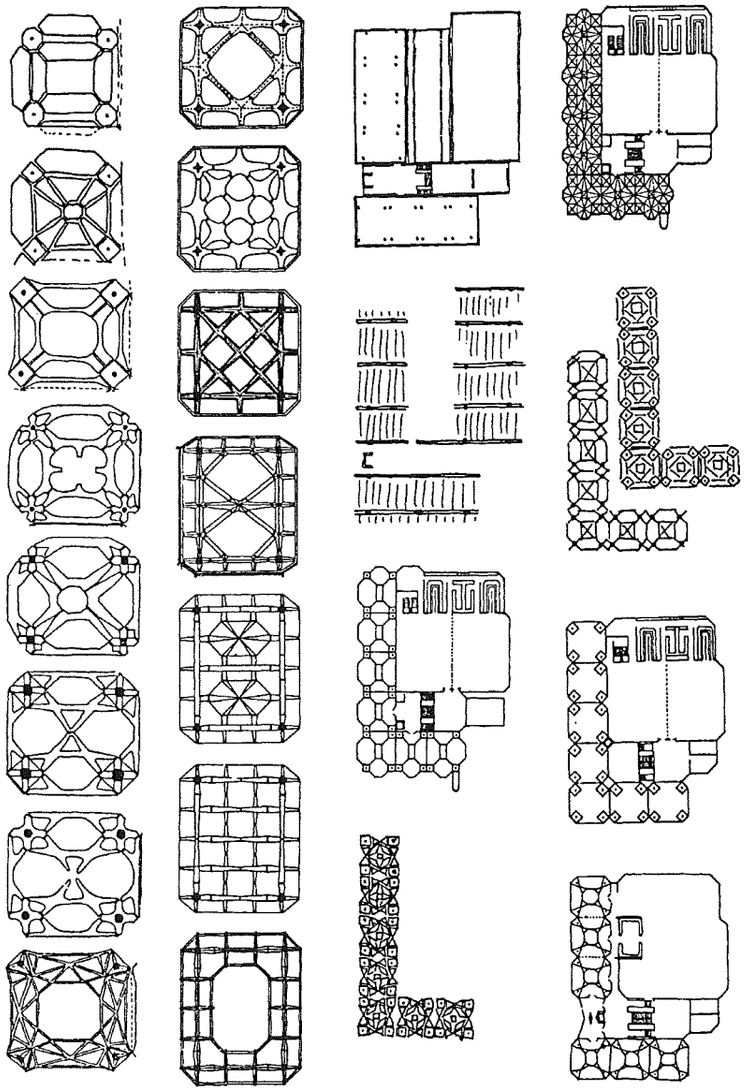

Figure 11.8
Bill Howell called his approach to design 'vertebrate architecture', with the form generated mainly from the structure. This sequence of drawings shows the process operating

The primary generator and crucial constraints

At this point we should examine the importance of the concept of constraints. It may not always be obvious that what is important to a client or a user is not always critical during the design process. In Agabani's (1980) study of the way architectural students perceive design problems one experiment required pairs of students to design a children's nursery. After reading the brief and watching a

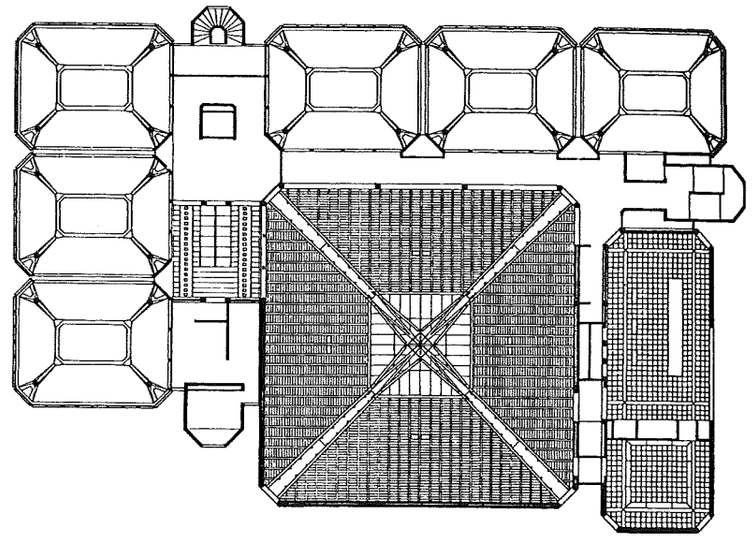

Figure 11.9
The final design of this building by Bill Howell shows the influence of his process

video-recording of the site the students were themselves recorded as they discussed the problem. The very first recorded comment from one pair of subjects was to the effect that: 'the most important thing is that we are going to have children playing outside' (Agabani 1980). Now while playing outside is certainly a requirement for nursery design it hardly seems to be 'the most important thing'. However, the same designer continued: 'so which way round do you put all the playing areas so that they can wander around?' (Agabani 1980). This can now be seen as an assessment not of what is most important to the client or user but what is critical to the designer. In this case, orientation of major spaces towards the protected and sunny side of the site followed by a consideration of vehicular access was quite fundamental in organising the overall form. In this sense these constraints are seen by the designer as crucial in determining form and, therefore, worthy of becoming primary generators. Making sound judgements on such things must surely be a matter of experience and perhaps one of the central skills of good designers.

The life of the primary generator

So far we have seen how both empirical research and the anecdotal evidence gathered from practising designers suggest that the early phases of design are often characterised by what we might call

analysis through synthesis. The problem is studied not in minute detail but in a fairly rough way as the designer tries to identify not the most important (to the client) issues, but the most crucial in determining form. Once a solution idea can be formulated, however nebulous it may be, it can be checked against other more detailed problems. In the experimental studies mentioned earlier both Eastman's and Agabani's results show the combined use of evolutionary and revolutionary modifications of early solutions. In the evolutionary phase the designer is really following his or her nose, gradually modifying the embryonic design as it is tested to see if it satisfies constraints and is found wanting. Eventually, unless the design proves totally successful, one of two things happens to halt this evolutionary phase. Either the general form of the solution reveals itself incapable of solving enough problems, or so many modifications have to be made that the idea behind the solution is lost and abandoned. In either case the designer is likely to choose the revolutionary step of starting a completely new train of thought.

This is the point where creativity is required rather than ingenuity. The train of thought is broken and no longer sequential. Some effort has to be made to look for a new set of problems or a new angle. In fact the whole primary generator may be scrapped in favour of a new focus. I have overheard many conversations between design students discussing their progress, where one will tell the other that they 'have just started again'. Such a thing is impossible, the design process can only begin once, and lessons learned, attitudes developed and understanding acquired cannot be denied. In this context, then, 'starting again' means looking for a new set of generative ideas around which to build the next onslaught on the problem. This brings us as close as we can get, so far, to the centre of design thinking, for the way in which the designer chooses to shift attention from one part of the problem to another is central to the design strategy. In experimental studies we have observed many variations. Some designers only shift attention when they come to a dead end, while others seem to deal with several ideas in parallel and we discuss this further in the next chapter.

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