

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. 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. 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'.

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 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 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. 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). 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. 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. 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. 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. 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. 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'. 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 the team finally understood the idea and made explicit the notion of the congregational space being a 'vessel' (Fig. 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. In the first, theoretical method, calculations are performed using the known compressive and bending stress capabilities and elasticity of the timber. 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. 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 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. 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. 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. The calculations are based on established theories of structural mechanics and would be performed by structural engineers and required for building regulation approval. 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. 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'. 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. 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. 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. 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. (Fig. 11.2) The suburban parkland site was located between two major radial roads connected by a footpath. This group were anxious to avoid what they saw as the usual failings of such buildings, that is, presenting large inscrutable facades with unclearly structured interiors in which it is easy to get lost. 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. (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 industrial designer James Dyson is famous for a number of innovative domestic products and is perhaps most well known for his revolutionary 'Ballbarrow'. The architectural student groups designing a county administrative building focused their attention on providing satisfactory working conditions and internal communications. 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. 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. 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). (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. 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. 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). Finally, researchers concentrated on the inadequacies of the protocols themselves to properly represent real design activity (Lloyd, Lawson et al. 1995). To illustrate this principle let us look at two methods of sizing timber floor joists. 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. Such rules as those relating depth and span clearly cover the critical aspect of the problem of sizing a joist. 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. 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. 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 group gave priority to the efficient control of the working conditions and thus recognised mainly radical constraints. 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. His production of *Così fan tutte* was set in modern times and relied upon costumes exclusively designed by Giorgio Armani. 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 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. 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. 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. 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. 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. The primary generator and crucial constraints At this point we should examine the importance of the concept of constraints. 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. 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. 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. They speak less of clearly defined routes and rather more of their own individual interests, approaches and strategies. We saw that design problems cannot be comprehensively formulated and that solutions cannot be logically derived from them. In, for example, architectural competitions there may be a site, a schedule of accommodation and a set of requirements all laid out quite explicitly. 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). The Malaysian architect Ken Yeang, even prefers to start with what might be called a 'mission statement' of just a few sentences. 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'. Some researchers tried to break down the process into sequences, others looked to classify the kinds of cognitive activity they thought to be revealed. Thus there was sufficient material here to publish a book larger than this one just on two design protocols! Heuristic strategies do not so much rely upon theoretical first principles as on experience and rules of thumb. 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'. 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. The first group started by describing how they felt that the environmental requirements of the office space were the critical factors (Fig. The building, they thought, could be assembled by replicating these bays as desired and as the site permitted. This group had noticed that the competition brief had stressed the importance of not presenting a remote or forbidding image to the ratepayers. In each case a group of sub-elements of the overall problem have been clustered together and elevated to the role of form generator. The first and second groups looked at constraints generated by two different types of user, the employee and the local taxpayer. What is used as a primary generator is also likely to vary to some extent between the different design fields and problems. 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. 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. Dyson had experience of using a traditional barrow and found it frequently got stuck in the

muddy ground of a garden (Fig. 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. This itself can vary ... (considerably. (Lawson 1994). 11.1). 11.3). 11.4)... 11.6). 11.7). 11.8). 11.9