the way the process can be mapped out as designers are seen to move their attention from one part of the problem to another. Which constraints should form the starting-point of the design process, or does it matter? Which constraints are critical in determining the design form or are key factors for success? Do designers differ in the kinds of constraints they focus on and do different types of design present different balances of types of constraint? These are questions which, as yet, remain unanswered, but the model of design problems provides a structure within which we can explore these and many other issues. This model is not intended to form part of a design method but rather as an aid to the understanding of the nature of design problems, and thus only indirectly to assist in establishing a design process.

This book began with a question. How is it that we can still use the word 'design' to describe such different processes as the creation of motor cars, architecture or advertisements? Reference to the model will show that such situations differ only in the degree of importance attached to various aspects of the problem. We expect that a fashion designer will lay great emphasis on designer-generated formal and symbolic constraints. Architects are expected to take more notice of their clients and users and, because architecture is so public a matter, to respect legislative controls. Sometimes internal constraints will be dominant and sometimes the design may be largely formed by external factors.

Design situations can be seen to vary in terms of the overall degree of freedom and control available to the designer. Where the bulk of the constraints are internal and designer generated we talk of open-ended design. Where, by contrast, clients or legislators make heavy demands or there are many external factors to consider we talk of tightly constrained design. Some designers seem to prefer the open-ended situation while others are more at home with restricted problems. Gordon Murray, the successful designer of Brabham and McLaren racing cars is reported to regard the regulations imposed on Formula One cars as fundamental to the necessity to innovate (Cross 1996b). It seems for this particular designer a highly constrained problem is more interesting than the freer situations which may be more normal in other design fields.

Recognising the nature of the problem and responding with an appropriate design process seems to be one of the most important skills in design. It is very easy to neglect a set of constraints. Modern architects are often criticised for their lack of attention to the symbolic functions of design and for producing architecture which seems aggressive or inhuman. Students of design often

devote too much of their time to unimportant parts of the problem. It is easy for the inexperienced to generate almost impossible practical problems by slavishly following ill-conceived formal ideas which remain unquestioned but could quite easily be modified. One of the major roles of design tutors is to move their students around from one part of the problem to another and the job of the students is to learn to do it for themselves. Here again the model of design problems may be useful acting as a sort of checklist of factors to consider. Almost certainly, the skilled and experienced designer is unlikely to behave so self-consciously, but the novice student needs to learn to develop a balanced design process exploring all the important constraints, whoever generated them, whether they may be internal or external and whatever their function.

Constraints and criteria

As mentioned earlier, Portillo and Dohr have proposed a distinction between constraints and criteria in design which they thought was missing from an earlier version of this book. Their point is certainly an interesting one, although it is also partly semantic. They argue that constraints are seen as restrictive and narrowing down the designer's alternatives whereas criteria are flexible and evaluative:

> Criteria consistently reference design functions and evaluative processes based on purpose while constraints intimate design functions usually characterised as restrictive and more closely aligned with specific solution requirements.
>
> (Portillo and Dohr 1994)

This is a fine point but a fair one. However I have persisted with this model of 'constraints' by which I mean issues which must be taken into account when forming the solution. Taken together these constraints form the design problem and we have seen that they may only become apparent as attempts to create the solution progress. It is rarely the case in my experience that completely clear criteria for success are mapped out in advance of attempts to produce solutions for the kinds of design being discussed here. In the end a good design is one which respects all the constraints to some degree in a balance which is thought acceptable. Of course we must also accept that some people would wish to have set more stringent criteria in some areas than others. Few of us will ever agree entirely about just how good one piece of design is.