

We should also add a word of caution here about the division between these various generators of design. The discussion so far has tended to imply the classical situation of a client commissioning a design perhaps on behalf of other users. However, this is by no means the only way design can be done. In fact, as Roy (1993) has pointed out in his study of product designers, much really creative and innovative design is initiated by designers. He studied the design of the innovative Ballbarrow, the Moulton bicycle and the Workmate® work bench. In all these cases the designer started with a personal need or involvement in the application area of the product. The designer James Dyson was fitting a cyclone air filter to his Ballbarrow factory and noticed that it worked all day without clogging. He began to wonder why his domestic vacuum cleaner was not made this way and so began the design of his highly successful revolutionary cleaner which not only maintains constant suction but also removes the need for disposable bags. In fact Dyson found it impossible to convince any British manufacturers to take on the production of his design and had to market it himself. Thus he eventually had to become his own client!

We should also note that clients come in many sizes and shapes and have many different motivations. They may be the future users of the design or may intend to exploit it financially. They may be single individuals or large committees. We shall see in a later chapter that the relationship between designer and client can be very varied, but that this relationship is more often critical to the success of the project than is usually recognised by design commentators. However, we must explore many other issues before getting involved in such a detailed examination of these roles.

The domain of design constraints

Constraints in design result largely from required or desired relationships between various elements. For example, in housing the legislator demands that there is a worktop on either side of the cooker, the client might express a wish for both the kitchen and living-room to open directly on to the dining-room and the architect may think it sensible to try to organise all the spaces around a central structural and service core.

What links all the constraints in this example is their domain of influence. All establish relationships between elements of the object being designed, in this case a house. They are entirely internal to

the problem and we shall therefore call them internal constraints. Consider by contrast the following equally hypothetical, but quite likely, set of constraints. The building regulations closely define the permitted distances of windows from boundaries so as to avoid the risk of a fire spreading to adjacent properties. The client may have a strong preference for a living-room which overlooks the garden and has a sunny aspect. The architect may think it important to continue the existing street façade in terms of line and height. Here the constraints establish a relationship between some element of the house and some feature of the site. They relate the designed object to its context, and in each case one end of the relationship, the site boundary, the sun, the street, is external to the problem. We shall therefore refer to these as external constraints.

Both internal and external constraints may be generated by designers, clients, users and legislators. So far the model of design constraints appears two-dimensional, the dimensions being the generator and the domain of constraints.

Internal constraints

Internal constraints are the more obvious and easily understood in that they traditionally form the basis of the problem as most clients initially tend to express it. Thus, for an architect the internal constraints frequently comprise the majority of the brief. The number and sizes of spaces of various kinds and qualities form the most obvious client-generated internal constraints. The structure or pattern of the problem for the architect lies in the desired relationships between these spaces. These relationships may be in terms of human circulation and the distribution of services, or in the visual and acoustic connections and barriers necessary to house the various communal and private functions of the building. Architects conventionally begin to grapple with these internal constraints very early on in the process by drawing bubble diagrams and flow charts which graphically represent the required relationships. The flow of people into and around a building was a central issue of the Beaux Arts architectural design process, and this was carried into the 'functionalism' of the modern movement.

For the product designer, the internal constraints include the problems of fitting an object together. Some relationships may need to be quite close particularly where mechanics are involved. However, other items which may need linking electrically may