We also briefly examined the way computers have started to play a role in design thinking too. However the challenge to really make them assist in the design conversation remains ahead. So far their primary role in design has been at the presentation/production drawing end of the process. Computer models like physical models are labour intensive and slow in production and so far remain rather remote compared with the sketch.

The point here however is that the forms of representation used and the skills in using them are likely to have a huge effect on the design process. It is hard to imagine Santiago Calatrava working without his model-maker or Frank Gehry working without his computer modellers. In both these cases the process is highly dependent on both team-working and specialised and skilled representation methods. One only has to look at the architecture of Calatrava and Gehry to see the effects not only on the process but also on the final product.

3 Working with multiple representations

What distinguishes the modern design process from the vernacular design process that we studied back in Chapter 2 is that designers do not actually make their designs, but rather they make representations of their designs. They make drawings, computer models, textual descriptions, physical models and so on. In a way the whole point of such a process is that it enables change and experimentation at much lower cost than would be incurred by making the designs themselves. Such a process then is based on the reduction of risk to the designer. Unfortunately what we have often seen is that the risk can be transferred to the client who pays for the representations to be made real. The skills of choosing and making representations that minimise this risk and that represent the finished design as accurately as possible to the client and to users may also be ones which are critical in the success of real design processes. These skills and the associated risks are often difficult to replicate in design education which may come in for some justifiable criticism at times for this very reason.

We have also seen that drawings, words, computer models and so on all have their own advantages and disadvantages as means of representing emerging design solutions. Some experienced and expert designers have developed and refined their processes and have become selective in the range of representations they make. For most of us this may be dangerous. It seems likely that a key skill for designers generally is not just the ability to make a variety of representations but to select them appropriately in order best to further understand the problems surrounding the current design solution

state. Again because of the conversational nature of the relationship that designers have with these representations, it seems appropriate to see representing as another central and crucial skill in design.

Moving

1 Creating solution ideas

So central to design is the activity of solution generation that the word 'design' is sometimes only used to relate to this group of activities. What we have seen now is that there are several activities under this general heading of making design moves. First and most obviously, a new move may be made which has not been seen before in this process. A feature of the solution is placed, or given some shape or some relation to some other element or given some characteristics. Second, a move may alter or develop the existing state of the solution. Where do such ideas come from? We shall develop answers to that question under the section entitled Reflecting.

2 Primary generators

We have seen that designers often develop early ideas about solutions long before they have really understood the problem. This is often done through what Jane Darke called the primary generator (Darke 1978). In turn that is often influenced by the guiding principles we discussed in Chapter 10 and to which we shall return in a later section here. Just as a frame can be seen as a window on the problem space, then a primary generator can be seen as a window on the solution space.

3 Interpretive and developmental moves

Not all moves in design are entirely original to the process. Margaret Boden's distinction of 'h' and 'p' creativity is partially helpful here (Boden 1990). We have four possibilities in a design process. An idea may be entirely novel in all of history (h). Actually such events are relatively rare in our developed and sophisticated world. It might be entirely novel as far as the designer or design team are concerned (p), it might be entirely novel as far as this particular process is concerned and finally it might derive from another idea that has already appeared in this process. Design moves then are frequently the result of reflections on the represented inchoate design and are interpretations of them. Goel refers to such a move