

vertical posts which will support it. The width of the handrail is narrower than the posts which are needed to support the balustrade. Almost certainly this is an example of Scarpa resolving the size of a rail which fits comfortably in the hand with the structural depth of the post. However the transition is, typically for Scarpa, very carefully detailed. It is characteristic of Scarpa that such a problem would not be dismissed, or even concealed, and that junctions of these kinds were often clearly articulated. Groak explains how Scarpa achieved this kind of detail by drawing (Groak 1992):

In drawing the lines to show where the cut edges would be, he encountered the familiar problem of the draughtsman: how do the lines cross? Do they overlap? Or stop at a point? Scarpa realised that the carpenter would face an analogous problem in cutting the piece of timber (although in fact it is not a complicated task for a skilled craftsman). Eventually he decided that the carpenter should drill a small hole at the intersection of the lines, so that the saw would change tone when it then hit the void and produce a clean cut with no overrun. To complete the detail, he then designed it to have a small brass disk inserted in the circular notch left behind . . .

One can see in this sequence of drawings how Scarpa first draws the lines, then sees the problem and finally solves it. Thus the drawing appears to talk back to the designer enabling a problem to be discovered and a solution created.

However there remains the danger which we saw in Chapter 13 of falling into the 'icon trap'. That is to say the drawing begins to dominate the conversation, sets the agenda and ultimately becomes the designed object replacing the original objective. This trap seems at its most dangerous the further designers are away from the process of making. When a design is highly unlikely to be realised then the drawing inevitably becomes more potent. Sadly this is the case for the vast majority of design projects completed by students during their education. No wonder then that students can develop a conversational style with their drawing that is not entirely constructive.

This is then a matter of the balance of power in the conversation. Herman Hertzberger expressed a concern about allowing the balance to go too far in favour of the drawing (Lawson 1994).

A very crucial question is whether the pencil works after the brain or before. In fact what should be is that you have an idea, you think and then you score by means of words or drawing what you think. But it could also be the other way round that while drawing, your pencil, your hand is finding something, but I think that's a dangerous way. It's good for an artist but it's nonsense for an architect.

One can sympathise with Hertzberger's view here that the design drawing is not in itself an end product in the way a piece of art is. On the other hand research evidence suggests that designers, just like artists, do get inspiration and ideas from their drawings that they did not imagine in advance. Schön and Wiggins (1992) have described this as 'unexpected discovery' and it does appear to be a significant influence in the design process. Suwa and Twersky have studied the way designers work with drawings in a more controlled setting. Their work clearly suggests that designers respond to the geometric properties of drawings as they develop them and from this may 'see' other ideas than those that were in their mind before they began the drawing (Suwa and Twersky 1997). The Scarpa drawing already described here offers an excellent example of this phenomenon. In particular what this research suggests is that these design drawings tend to be of solution features rather than problem states. However it is the formal and figural properties of their own drawings that designers appear to attend to. The work shows that a high level of activity involving such considerations often follows the act of drawing. The drawings then are primarily images of the materiality of what might be, while the designer may also be considering the more abstract sets of needs and wishes. But since the drawings do not actually have to be constructed or manufactured the material constraints on them can be relaxed or tightened at will. It seems then that the drawing does indeed offer the potential to be a 'perceptual interface', as Schön and Wiggins describe it, between function and form (Schön and Wiggins 1992). Goldschmidt has also described this process in conversational terms by calling it the 'dialectics of sketching' (Goldschmidt 1991). She points out how sketches enable a dialogue between 'seeing that' and 'seeing as'. For her 'seeing that' is a way of summarising the process of reflective criticism and 'seeing as' represents the process of making analogies and reinterpretations. In fact it is one of the most flexible and powerful tools for conducting the conversation of negotiation between what is desired and what can be realised.

## Conversations with computers

In the first edition of this book I included a whole chapter on designing with computers. At that time using computers in design was relatively innovatory at least in practice if not in theory. Now there are many books on the subject of computer-aided design