Figure 7.8 Idea sketches for the Yamazaki Collection (Robert Welch).

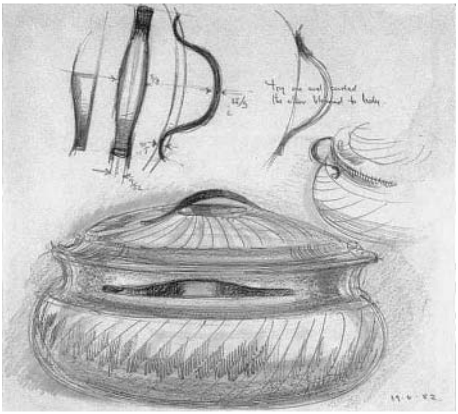

Figure 7.9 Sketch for handles (Robert Welch).

Figure 7.10 The finished Yamazaki Serving Collection (Robert Welch).

stage have a semi-hallucinatory quality as they float on top of one another as if one could see through objects superimposed. Similar hallucinatory superimpositions are found in palaeolithic cave paintings.

Although the sketch shown in Figure 7.9 is of a later stage of design thinking, there are still signs of descriptive-to-depictive translation. The note reads, "Try one end curled the other blended to body," indicating uncertainty about which of two possible types of handle to use. The tapering double-curve form was the one actually chosen and accepted, as Figure 7.10 demonstrates.

Some Implications

In this chapter I have argued that our brains evolved in an environment quite unlike today's, in which survival depended more on the ability to make quick decisions than to reflect on the long-term future. Due to this circumstance, the working memory capacities that are needed for both descriptive and depictive or visual thought are maladapted to a post-industrial culture. Our culture provides us with learned supportive behaviours to compensate for both these maladaptations. However, cultural assistance for symbolic thought is much more advanced and better understood than that for depictive thought. In general education, techniques for visualizing are the poor relations of those for symbol processing.

In a classic book, the Russian psychologist Alexander Luria documented the mind and problems of a man who had an exceptionally detailed and long-lasting visual memory, but who was unable to think with or use abstract symbols (Luria 1968). Luria outlines a number of problems of the kind that we are taught to solve with algebra that his "mnemonist" solved quickly in his head with mental images. When I tried these myself, I was astonished to find how much easier they were to solve by the imagery method than by the method I was taught. To give one example, a man and his wife go into the forest to collect mushrooms. He says to her, "If you gave me seven mushrooms I would have twice as many as you." She says to him, "And if you gave me seven mushrooms we would each have the same number." How many mushrooms did they each collect? Using the method I was taught, my working memory runs into problems. My "inner voice" runs like this: "Let H = the number collected by the husband. Let W = the number collected by the wife. Now let me see . . . $H + 7 = 2(W - 7)$ and $W + 7 = H - 7$. Er . . . Hm . . . Give me paper and pencil!" However, if instead of using symbols, I use the "inner eye" and picture to myself the husband and wife with little piles of mushrooms spread on the forest floor, the problem is strangely easy to solve without paper and pencil. I write "strangely" because the images are more complex than the symbols. Try it. The reason it is easier is that the visualizing parts of our brains are older and better adapted for handling concrete images than those for using abstract symbols. Luria remarks of his mnemonist, "His graphic images kept him from falling into the sort of errors other people can make who use formal methods to solve problems." Why was I never taught this?

It is possible that some system designers will argue that the low capacity of visual working memory and the increasing power of machine visualizing systems will eliminate the need to sketch in the early, as well as the late stages of design. Is it not better to replace our hazy mental imagery with very