way (Yeang) and so on. In turn this causes those designers to lay relative emphasis on certain slices of the design constraint model we developed in Chapter 6. However this cannot be done unless they also develop skills in relation to these ideas. So for example Yeang has developed a set of procedures to calculate energy consumption and forms of solutions that minimise it. Le Corbusier developed his proportion tool; Calatrava has extraordinarily well-developed sketching and modelling techniques to enable him to produce complex three-dimensional forms and so on. As we see above, this in turns leads these designers to collect precedent that helps them to produce solutions that embody the values they espouse. Thus the process can be seen as a virtuous self-reinforcing cycle across many design projects. Occasionally we also see designers making significant shifts in their value systems, guiding principles and precedent collecting and thus going through phases of producing significantly and recognisably different design solutions.

Epilogue

Many years of research and thinking have gone into this book. The first edition was published almost exactly a quarter of a century ago. When it was first published, design research was a mere babe in arms. It is now a rich and quite sophisticated field but full of contradictions and argument. Perhaps we might feel it has reached those perilous argumentative adolescent years. It is certainly not yet a mature adult. Hopefully this book has shown that just as there are many ways of designing so there are many ways of describing design. Some of those ways have been given more attention in this book than others and inevitably that to some extent reflects the personal position of the author. However research continues to emerge that brings yet new paradigms to bear on the problem.

Only recently Stumpf and McDonnell (2002) suggested we should understand the way designers work in teams by applying ideas from the fields of dialectics and rhetoric. By contrast John Gero and his colleagues offer a model of more or less the same phenomenon explained using the ideas of computer software agents (Gero and Kannengiesser 2004). A trawl through the literature can thus often reveal several alternative interpretations of many of the features of the design process that have been discussed in this book. Some authors will advance their ideas in the forms of 'models' often accompanied by diagrams, others may be in the form of lists, and

others simply in prose. The extent to which these ideas actually help you to understand design better is probably more to do with your personal cognitive style, interests and preferences rather than due to some absolute correctness in the model. Some researchers argue persuasively and elegantly that different paradigms are fundamentally at odds with each other (Dorst 1997). On the other hand the more you analyse all these views of design the more you can see parallels in what they have to say about actual practice.

Even after all this effort I remain tormented by a continuing concern. It is that when I read another book or article or listen to a conference paper about the design process I can usually tell whether the author is actually a designer or not. It remains the case that the design process can be learned chiefly through practice and is very difficult to teach well. It is extremely difficult to understand design without actually doing it. For all our empirical science and lofty philosophy we still seem remarkably dependent on our own experience to interpret and make sense of more systematically acquired data. Nigel Cross' wonderful phrase 'designerly ways of knowing' both beautifully encapsulates this problem and stands as a symbol for the tantalising nature of our knowledge about the subject (Cross 1982). Frank Lloyd Wright was greatly influenced by the upbringing he received from his mother who, he was later to explain, believed that he would become a great architect even before he was born. She developed her own system of education for him based on the ideas of Friedrich Froebel. It seems however she believed that his great talent would disappear should he be foolish enough to enquire into its nature. Obviously this book shows that I do not take such a position. To return to the theme of the very first chapter, design is a form of thinking, and thinking is a skill. Skills can be acquired and developed. Those who have a high degree of expertise in such skills often appear willing to learn even more and yet seem capable of performing with little conscious effort. Just how one should approach the nurturing of design skills throughout a design career is something that remains hotly disputed and highly personal. Understanding more about *How Designers Think* is one important step on that journey.

References

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