

Designerly Ways of Knowing

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With 15 Figures

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Preface

This book traces the development of a personal research programme over a period of many years. The starting point for the programme was a realisation that research in design seemed to have no clear goal of what it was trying to achieve. A key insight for me was to realise that if we wanted to develop a robust, independent discipline of design (rather than let design be subsumed within paradigms of science or the arts), then we had to be much more articulate about the particular nature of design activity, design behaviour and design cognition. We had to build a network of arguments and evidence for ‘designerly ways of knowing’.

The research programme has included some empirical, laboratory-based work, but has also included theoretical reflection, and attempts to review and synthesise the work of other researchers. I have reported this work at various times and in various places – in lectures, conference presentations and journal papers. In this book I have brought together a selected series of these reports, trying to trace a coherent thread, and to lay out some of the network of arguments and evidence referred to above. My goal has been to understand how designers think, or the nature of design expertise, trying to establish its particular strengths and weaknesses, and giving credit where it might be due for design cognition as an essential aspect of human intelligence. The versions of the reports and papers now published here have been revised in order to aid coherence and avoid overlap.

Chapter 1, ‘Designerly Ways of Knowing’ was first published as a contribution to a series on ‘Design as a Discipline’ in the journal *Design Studies*, which aimed to establish the theoretical bases for treating design as a coherent discipline of study. The first contribution in the series had been from Bruce Archer, in the very first issue of *Design Studies* in 1979, in which he outlined arguments for a ‘third area’ of education – design. At that time, the subject of ‘design’ was being introduced into secondary schools in the UK for the first time, meaning that it was becoming part of general, not specialist education. Also at that time, my colleagues and I at the new Open University had been facing similar issues concerned with how to develop a form of design education that was relevant for ‘everyone’, and was not necessarily aimed at preparing students for a professional role in design practice. In my contribution to the debate I attempted to develop further an understanding of this ‘third area’ by contrasting it with the other two – sciences

and humanities – and to go on to consider the criteria which design must satisfy to be acceptable as a part of general education. I argued that such an acceptance must imply a reorientation from the instrumental aims of conventional, professionally-orientated design education, towards intrinsic values of design as a valid subject of study for everyone. These intrinsic values, I suggested, must derive from the deep, underlying patterns of how designers think and act, or the ‘designerly ways of knowing’. Because of their common concern with these fundamental ‘ways of knowing’, I suggested that both design research and design education were thereby contributing to the development of design as a discipline. I also suggested that this emerging view that ‘there are designerly ways of knowing’ could form the axiomatic ‘touch-stone theory’ for research within design as a discipline.

The second chapter, ‘The Nature and Nurture of Design Ability’, is based on my inaugural lecture as Professor of Design Studies in the Open University, which I delivered in 1989. The first part of my lecture concentrated on the nature of design ability, for which I drew upon a variety of studies and investigations into design activity and designer behaviour. From a review of these studies, I summarised design ability as comprising abilities of resolving ill-defined problems, adopting solution-focused cognitive strategies, employing abductive or oppositional thinking and using non-verbal modelling media. These abilities are highly developed in skilled designers, but I suggested that they are also possessed to some degree by everyone. I then outlined a case for design ability as a fundamental form of human intelligence, thus seeking to provide a much broader foundation for establishing ‘designerly ways of knowing’. In the second part of my lecture I argued that understanding the nature of design ability is necessary in order to enable design educators to nurture its development in their students. I discussed the nurture of this ability through design education, with particular reference to the problem of providing design education through the distance-learning media of the Open University. In the chapter here, I have revised the second part of the lecture so as to make it less focused on the special concerns of the Open University, and hopefully more relevant to all design educators, although still emphasising that ‘open-ness’ is a key principle for modern design education.

Chapter 3, ‘Natural and Artificial Intelligence in Design’, arose from the challenge of being asked to give the keynote lecture to the international conference on Artificial Intelligence in Design, in 1998. Rather than discussing ‘artificial intelligence’, I chose to concentrate on the ‘natural intelligence’ of design. The lecture addressed what we know about the ‘natural intelligence’ of design ability, and the nature of design activity. My starting point was the observation that the ability to design is widespread amongst all people, but some people appear to be better designers than others. I used quotations and comments from some acknowledged expert designers to reinforce general findings about the nature of design activity that have come from design research. I also referred to and analysed the role of sketching in design in order to exemplify some of the complexity of designing. Finally, I made some comments about the value and relevance of research into artificial intelligence (AI) in design. I suggested that one aim of research in AI in design should be to help inform understanding of the natural intelligence of design ability, to help us better to understand such natural intelligence, or human cognition.

A key aspect of human cognition in the context of design is creative thinking. The next two chapters report some studies of creative cognition in design.

In Chapter 4, 'The Creative Leap', I report an attempt to analyse how creative thinking happens in design, through one case study which was captured in a protocol study experiment. The 'creative leap', in which a novel concept emerges – perhaps quite suddenly – as a potential design solution, is widely regarded as a characteristic feature of creative design. The investigation reported here is based on an example of a 'creative leap' which occurred during a recorded laboratory study of the activity of a small design team. The characteristics and context of this 'creative leap' are reconstructed from the recorded material, and I use the commonly accepted procedures underlying generic descriptive models of creative design to try to provide further insight into the example. I also make some observations of potential implications for computer modelling of creative design. I conclude that the perceptual act underlying creative insight in design is not so much a 'leap', but more akin to 'bridging' between problem space and solution space. This fits with the oppositional nature of design thinking, in that the bridging concept embodies satisfactory relationships between problem and solution.

Chapter 5, 'Creative Strategies', continues the line of investigation into creative cognition in design. Three studies of innovative design in engineering and product design are reported. As well as the small team design project reported in Chapter 4, my colleagues and I had been able to capture in the same series of experiments the think-aloud protocols of an outstanding engineering designer, Victor Scheinman. I have also been fortunate enough to be able to conduct some in-depth interviews with a couple of other truly outstanding designers – the product designer Kenneth Grange and the Formula One racing car designer Gordon Murray. In this chapter I present an example of each of these outstanding designers' approaches to a particular design problem that they faced. I have tried to draw comparisons between the three examples, and there do appear to be some striking similarities in their adoption of a strategic design approach, despite the very different project examples. I develop a general descriptive model from the examples, showing how strategic knowledge in creative design is exercised at three levels: low level articulated knowledge of first principles, an intermediate level of tacit personal and situated knowledge applied within the particular problem and its context, and high level implicit and explicit knowledge of problem goals and criteria. All three outstanding designers seem to exercise this strategic knowledge in similar ways in creating novel design proposals.

The studies of Victor Scheinman and the three-person design team in the previous two chapters drew upon the experimental method of protocol analysis, which has become the most widely used technique for investigating design cognition. Chapter 6, 'Understanding Design Cognition', reviews a number of protocol and other such empirical studies of design activity, and summarises results relevant to understanding the nature of design cognition from an interdisciplinary, domain-independent overview. The results are presented grouped into three major aspects of design cognition – the formulation of problems, the generation of solutions, and the utilisation of design process strategies. I draw parallels and comparisons between results, and I find many similarities of design cognition across domains of professional practice. Perhaps the most interesting conclusion is

that it seems that the ‘intuitive’ behaviour of experienced designers is often highly appropriate to the special nature of design tasks, although appearing to be ‘unprincipled’ in theory.

The final chapter returns to the starting theme of ‘Design as a Discipline’. It begins by unravelling some of the history of concern with relationships between design and science. In the original conference paper I was seeking to develop a view of design as a discipline based upon a science of design, but not a ‘design science’. As in Chapter 1, I argue that the underlying axiom of this discipline is that there are forms of knowledge peculiar to the awareness and ability of a designer. In the latter part of the chapter I outline the ways in which this discipline of design, and the understanding of designerly ways of knowing, can be pursued through design research. I identify three sources of design knowledge as research loci: people, processes and products. These are the foundation stones for understanding designerly ways of knowing.

In selecting this particular set of speeches, papers and reports, I have tried to construct some of the argument, and to assemble some of the evidence that supports the concept of ‘designerly ways of knowing’. I believe that this concept can now be justified, and that – thanks to the work of several other design researchers besides myself – we now have a much clearer view of what constitutes the particular nature of design cognition.

The span of time covered by the papers that formed the original versions of the seven chapters here is some twenty years. One might have hoped that much more would have been achieved over such a long period. But the discipline of design is still quite young, and it still has a relatively small research base. I hope that this book might serve to record the coming of age of the discipline, to cement the discipline’s foundations, and to suggest ways forward for a new and rapidly growing generation of design researchers.

Nigel Cross

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