Foreword

This book contains the proceedings of the sixth meeting in the series of 'Design Thinking Research Symposia'. The series was started at Delft University of Technology, The Netherlands, in 1991, with what was initially expected to be a one-off international meeting on 'Research in Design Thinking'. But the content and format of that meeting were felt by the participants to be so good as to warrant more of the same. So a second meeting was also held in Delft, in 1994, focused on the use of protocol analysis as a research tool for analysing design activity. The third meeting was held at the Istanbul Technical University, Turkey, in 1996, on the topic of descriptive models of design, and the fourth meeting was held at the Massachusetts Institute of Technology, Boston, USA, in 1999, on the topic of design representation. It was there that the organisers introduced the term 'Design Thinking Research Symposium' as the generic title for the series. The fifth meeting was again in Delft, in 2001, on the topic of design in context.

The series of meetings has produced a substantial set of publications in books and journals (see the Previous Symposia Publications list at the end of this Foreword), with significant research results, and has helped to foster an international community of scholars and researchers focused on design cognition. Twelve years on from 1991, it is perhaps difficult to recall just how little 'research in design thinking' was going on then, compared with today. It is encouraging to see, in these proceedings, how much the field has grown and developed.

For this sixth meeting, at the University of Technology, Sydney, Australia, we return to somewhere near the focus of the original meeting in Delft in 1991. The focus of this meeting is on the nature and the nurture of expert performance in design. The topic is important for several reasons. Firstly, there is an educational relevance, since the aim of design education is to develop the knowledge and skills of expert design behaviour. Secondly, there is a relevance to the development of tools and techniques to support expert behaviour, including computational support technologies, artificial intelligence and knowledge-based systems. Thirdly, there is a socio-economic relevance in terms of managing, exploiting and developing expert behaviour, given the importance of design as an added-value economic factor and as a key factor in quality of life.

Despite this importance, the topic of expertise has received only limited attention so far in the 'research in design thinking' community, with some

interview work on outstanding or exceptional designers, and some empirical work on differences between novice and expert designers. (There is, of course, a history of more developed work on understanding expertise in some other fields and contexts.)

The intention in planning this sixth symposium was to bring together a relatively small, international group of active researchers for a workshop meeting to review the state of the art and to report recent work. Throughout this series of symposia, this workshop format has been found to be a successful way of synthesising the contributions of an international community, of reporting current work, and of identifying and promoting necessary further research.

In the Call for Papers, we identified relevant topics for the workshop as including: cognitive style, situated cognition, reflective practice, expert vs. novice behaviour, strategic knowledge, tacit knowledge, knowledge-based systems, knowledge support systems, and computational representations of expertise and knowledge working. This intention to encompass both the 'natural' and the 'artificial' cognition research approaches to understanding design thinking also reflects one of the original intentions in the first meeting in the series. In selecting papers from those submitted, we were biased towards those reporting empirical work or formal, explicit modelling. In the event, the 'artificial' end of the research spectrum is less represented in the proceedings than the 'natural'. This is simply a reflection of the number and quality of the different types of papers we received.

Twenty papers were selected and are included here as the proceedings. We have grouped them loosely by the main topics that they share. The first group focuses especially on Design Expertise as it manifests itself in high quality professional practice. Beilharz's paper is an exploration of the interdisciplinary design 'rules' that underlie the compositions of high-level experts in both architecture and music. (This interdisciplinarity is a feature of the 'research in design thinking' symposia, which include studies across any of the domains of design practice.) The papers by Cross and Lawson share a common interest in understanding the strategic thinking of outstanding or exceptional designers – in engineering and product design for Cross, and in architecture for Lawson. Professional practice in engineering design is the common domain for the following sub-set of this first group of papers, by Badke-Schaub, Carkett and Petre – all three of them being observational studies of real-world practice.

The Design Thinking group begins with two papers comparing expert and novice performance in design, and both address the use of analogies in creative design thinking. Ball, Ormerod and Morley focus again on the domain of engineering design, whilst Casakin's study is in the domain of architectural design. Two papers, by Dorst and Restrepo and Christiaans, then address issues of the nature of design problems and how designers attempt to structure these notoriously ill-structured problems. Both papers have product design as their primary domain focus. Solovyova's paper delves deep into the psychology of design thinking, in an

investigation of its emotional content, in the context of architectural design.

Design education is an area where much ad-hoc experimentation and hypothesising seems to go on, but remains poorly understood and sadly uninformed by more careful study and investigation. The set of papers in the Expertise Development group are small beacons of enlightenment in this area. The two papers by co-authors Adams, Atman, Cardella and Turns provide a mix of theoretical reflection on, and empirical studies of, the practice and improvement of education in engineering design. Goldschmidt's paper addresses in a formal way the mysterious processes of education that go on in the typical 'design studio' in architecture. McDonnell, Lloyd and Valkenburg report an experiment in introducing a new approach in product design education. Popovic also focuses on product design education, modelling the development of expertise in terms of strategic knowledge.

The group of papers on Modelling Expertise comprises those selected to represent computational and formalised modelling of expertise. Amitani and Hori report their work in support systems for knowledge management, using exhibition design as their example domain. Edmonds and Candy report on studies of technology experts working collaboratively with artists. The paper by Gero and Kannengiesser offers a model of expertise relevant to the increasingly prevalent phenomenon of temporary (and often 'virtual' or distributed) design teams. Finally (last, but not least), Nath reports the development of a computer program that acquires some of the strategic knowledge for solving simple problems in architectural design.

Overall, we believe that this collection of papers makes another significant step forward in understanding one of the highest cognitive abilities of human beings, that of designing artefacts, products and systems. In focusing on expertise, it also contributes to knowledge and understanding in the wider context of skilled, high-level performance in human cognition.

Acknowledgements

Previous Symposia Publications

The published output from previous symposia in this series includes:

1. Cross, N., Dorst, K. and Roozenburg, N. (eds.) (1992) Research in Design Thinking, Delft University Press, Delft, The Netherlands.

2. Cross, N., Christiaans, H., and Dorst, K. (eds.) (1996) Analysing Design Activity, John Wiley & Sons, Chichester, UK.

3. Akin, Ö. (ed.) (1997) 'Descriptive Models of Design', special issue of Design Studies, vol. 18, no. 4.

Akin, Ö. (ed.) (1998) 'Models of Design', special issue of Automation in Construction, vol. 7, no. 2/3.

4. Goldschmidt, G. and Porter, W. (eds.) (2004) Design Representation, Springer Verlag, London.

5. Lloyd, P. and Christiaans, H. (eds.) (2001) Designing in Context, Delft University Press, Delft, The Netherlands.