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## Preface

The initial motivator for the development of *DRM, a Design Research Methodology*, and the subsequent writing of this book was our frustration about the lack of a common terminology, benchmarked research methods, and above all, a common research methodology in design. A shared view of the goals and framework for doing design research was missing. Design is a multidisciplinary activity occurring in multiple application areas and involving multiple stakeholders. As a consequence, design research emerges in a variety of disciplines for a variety of applications with a variety of subjects. This makes it particularly difficult to review its literature, relate various pieces of work, find common ground, and validate and share results that are so essential for sustained progress in a research community. Above all, design research needs to be successful not only in an academic sense, but also in a practical sense. How could we help the community develop knowledge that is both academically and practically worthwhile?

Each of us had our individual ideas of how this situation could be improved. Lucienne Blessing, while finishing her thesis that involved studying and improving the design process, developed valuable insights about the importance and relationship of empirical studies in developing and evaluating these improvements. Amaresh Chakrabarti, while finishing his thesis on developing and evaluating computational tools for improving products, had developed valuable insights about integrating and improving the processes of building and evaluating tools. Many discussions took place with various researchers, in particular with Ken Wallace, who had particularly useful thoughts and insights based on his many years of supervising PhD students and involvement in the design research community. As background, several pieces of work were available: the extensive review of design research literature by Finger and Dixon (1989a; 1989b) categorising literature into descriptive, prescriptive and computational studies; the classical research approaches in natural and social sciences of creating and evaluating models and theories of reality; the approaches of research in disciplines such as economics and management studies, where observations are used to develop interventions to improve reality; and last but not least, the many theses and other publications

describing many interesting approaches to tackle the challenges of doing design research.

As the literature showed, different methods can be, and have been, used to address the various issues involved in design research, and many areas of research have developed, focusing on various research questions. Based on our own experience, insights and analyses of these research questions, we aimed at putting the research areas together into one framework. The result is DRM, a generic design research methodology that links the research questions together and provides support to address these in a systematic way.

A preliminary version of DRM was developed as early as 1991 by us and Ken Wallace and published in Blessing *et al.* (1992). At that stage, however, only the major research questions and the DRM framework for addressing these questions were available, along with some examples of how to interpret and use this framework in research. An expanded version, with more examples, was published in 1995 (Blessing *et al.* 1995).

We started applying the framework for structuring the research of our students, which met with some success. However, it was clear that substantial further development had to take place to support each individual stage of the methodology. This was the precursor to a long period of joint research for over ten years. It involved creation, evaluation and improvement of various specific methods through our own research projects and those of our Masters and PhD students, the analysis of a large number of research projects in design, and the feedback from those outside our own research groups. DRM has been taught in a Summer School on Engineering Design Research in Europe since 1999 and as a Graduate level course in the Indian Institute of Science, Bangalore since 2002 (see Chapter 8 for some of the experiences). Several of the students we taught continue to use the methodology in their work. The feedback we received, and still receive, has been invaluable. Together with our own experiences, this has led to a clearer focus and greater substance and validity of DRM.

One of the consistent observations of our students is the lack of material for researchers on design research methodology: also on DRM. The papers and lecture notes we produced have been found helpful, but inadequate for understanding and using DRM in detail. The lack of detailed publications will have been a reason why some aspects and terms were misinterpreted, although the sources of some misinterpretations and even quotes are unclear: in particular the misinterpretation that DRM by emphasising Measurable Success Criteria would focus only on a quantitative approach to design research and devalue qualitative methods; that the DRM process would be linear, narrowly focused on process aspects of design only; that DRM would only be applicable to individual research projects rather than research programmes. As the following paragraphs will explain, these interpretations are in direct contradiction with how we view design research, our own research projects, and what we have taught and written in our publications.

The adjective ‘Measurable’ in Measurable Success Criteria refers to the need to assess whether the criterion has been realised. The criterion as well as the methods used can be qualitative and quantitative. Design research in many instances needs a combination of qualitative and quantitative research in order to be able to answer the research questions. As we pointed out in Blessing *et al.* (1995), “methods from

a variety of disciplines are needed for carrying out various aspects of design research” and our own research and that of our students show a clear combination of qualitative and quantitative research. In 2002 (Blessing and Chakrabarti 2002) we defined a Measurable Criterion as “the measure against which the results of the project will be judged”. Note that we have now returned to using the full term ‘Measurable Success Criteria’ rather than the shortened version ‘Measurable Criteria’, as the latter caused some confusion. The emphasis in the book on qualitative, more inductive approaches to research is not because we consider these approaches more relevant, but because we assume the reader is more familiar with the quantitative research approaches and methods common in engineering.

DRM has never been intended to be a linear process, as should be clear from the DRM framework in which arrows link back to earlier stages of DRM. In comparison, the circular process models proposed as a better alternative tend to show a far stronger linear sequence of steps: returning to a stage can only be done in the next round. Similar to other ‘linear’ representations, our representation was chosen to emphasise the need to carry out the research in a systematic way connecting all stages. In particular, the representation is intended to indicate that one should: not start support development unless there is enough understanding and evidence that the need is real and no support currently exists; not evaluate support before carrying out adequate development that ensures that the support can indeed be evaluated for its goals; not only consider improving the support after its evaluation, but also reconsider the understanding upon which the support is based. In our papers, we always emphasised the non-linear, iterative nature of the research process and the fact that some stages may run in parallel.

Contrary to focusing only on process-related aspects of design, DRM is intended to address all facets of the phenomenon of design. As we wrote in Blessing and Chakrabarti (2002), “Design is a complex activity, involving artefacts, people, tools, processes, organisations and the environment in which this takes place. Design research aims at increasing our understanding of the phenomena of design in all its complexity”. “Each of these facets is dealt with in specific disciplines [...]. Each discipline has its specific research methods and, equally important, underlying paradigms and assumptions”. A design research methodology “should help in identifying research areas and projects, and in selecting suitable research methods to address the issues”.

Finally, contrary to being applicable only to individual research projects, DRM is meant to be used both at project and programme levels, as emphasised in the design research types discussed in Chapter 2. “It cannot be expected that each of the stages of the methodology will be executed in depth in every single project [...] a research project may address only one stage because it is part of a larger project” (Blessing and Chakrabarti 2002). DRM, in fact, has already been used as the basic methodological structure of a product platform for computational design tool research for “more loosely related but still potentially complementary projects often steered by different investigators” (Bracewell *et al.* 2001). We have also found the DRM outline used in proposals for research programmes.

This book presents, for the first time, the DRM methodology and associated methods and guidelines in its entirety. Those who were involved in the process or read earlier publications will particularly notice the change in terminology. We

decided to use the opportunity of writing the book to put all the feedback together and reassess the terminology as a whole. This has most clearly affected our overview figures, Figures 2.1 and 2.9, which display most of the key terms. For reasons of continuity we kept the terms used for the three main stages: Descriptive Study I, Prescriptive Study and Descriptive Study II, although we also discussed these extensively. We hope that the new terminology introduced in this book now more clearly expresses the underlying concepts and the messages we wish to convey. However, we realize that there is still much work to be done and continue to welcome suggestions for improvement.

The primary aim of our methodology and its related guidelines is to help engineering and industrial design research to become more relevant, effective and efficient. In addition, we believe that much of the content of the book should be useful for research in other design domains as well. This book is intended to be a practical handbook for teachers, students and researchers in design. The central objective is to help researchers and research groups to rigorously and efficiently plan, implement and communicate their research. This, we hope, should help make design research more creditable to the academic community at large as well as to product development practice and society where our contribution as a useful discipline counts most.

A large number of people have contributed to the development of our ideas and the writing of the book. First and foremost, we acknowledge the sustained encouragement from Ken Wallace, as an initial contributor to DRM, as the Director of and colleague at the Cambridge EDC where much of the theoretical development of DRM took place, and beyond our Cambridge days, as a keen friend and well-wisher who tried to ensure that we did not lose sight and hope in this lengthy exercise.

We also thank Mogens Myrup Andreassen for giving us the opportunity to join and extend the Summer School on Engineering Design Research that he initiated, so that DRM can be taught to, and feedback received from, PhD students across Europe. We are also thankful for his critical comments and encouragement in the many discussions that followed.

We thank our own research and PhD students and those we taught over the years at the Summer School on Engineering Design Research and the Methodology for Design Research course at the Indian Institute of Science, Bangalore, for trying out our framework and the various methods we proposed, as well as their ever so helpful criticism and suggestions for improvement. We specially thank Mattias Bergström, Åsa Ericson, Thomas Flanagan and Judith Jänsch who provided us with careful analyses of DRM compared to other approaches.

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Enjoy your research.

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