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Design Typology and Design Organisation

The aim is the creation of a design typology, which can serve as identification of design types and design research contributions. A typology has been proposed earlier and here clarified. It consists of 4 sub-typologies, from which the design operation typology (showing 6 main views) is elaborated and illustrated by examples. A basic feature is to view both the designs and the design machinery (organisation) as design objects and to focus upon this machinery's ability to possess experience and learning ability. Future work shall justify this conceptual stage proposal.

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Application of Methods from Social Sciences in Design Research

In many engineering publications on approaches to support design activity, there is little evidence of use of valid empirical data. Proposals often rely on single findings, on assumptions or on experience which are hardly articulated or adequately documented. In the last decade a tradition of empirical design research has developed, using methods from social sciences to investigate design processes and design behaviour. The use of these methods requires their adaptation to the specific problems and demands that are characteristic for the field of design. This paper delivers some fundamental considerations referring to our own experiences in the field of empirical design research.

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Cleaning up Design Methods - Describing Methods Completely and Standardised

To improve the design process, it is aimed to optimise the description of design methods and the access to them for effective use in design projects and for better support of learning and teaching. The Process-oriented Method Model (PoMM) has been designed for a standardised description of design methods. The description-modules of the PoMM are organised into process modules and access modules. The process modules are designed in a process-oriented way and the contents have a direct influence to application. The access modules are designed for a flexible and detailed search and for linking to other design methods. The PoMM is suited as checklist for describing design methods and as guideline for teaching and applying them.

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Design Education in the Information Age

We examine changes in design practice during the industrial and information ages from an evolutionary systems perspective. We conclude that: design practice and education have scarcely tapped the holistic sciences yet; despite their importance; new forms of practice are emerging as design becomes more embedded in society; design becomes important to other disciplines; collaborative design will increasingly prevail due to growing design complexity and user involvement; technological developments like virtuality and pervasiveness will strongly affect design education; rapid sociocultural change will require lifelong learning in design. Such developments entail revolutionary rather than incremental change in design education.

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Modular Products and Product Modularity - Implications for the Management of Innovation and for New Product Development

"Modular products" have become a hot topic in industry, even though the concept of modularity being used is wider than the one traditionally used by the engineering design literature. The paper discusses the problem of designing product architecture when a number of heterogeneous criteria, both technical and non-technical, are taken into account. Specifically, the paper shows that the design of product architecture can and should occur by considering a wide range of criteria and especially the stream of innovations that will presumably affect the product within the planning horizon. To this purpose, the paper outlines a method for product architecture design which is currently being tested in industry.

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Building the Design Observatory: a Core Instrument for Design Research

The "observe-analyse-intervene" method allows a complex system to be perturbed to deepen understanding and reveal hidden assumptions. Historically we have collected analogue audio and video data of design team activity to operationalise this method. The use of this type of data has a number of limitations. We sought to overcome these limitations by creating a facility that would support digital data collection and analysis. The goal of the first phase of this project was to implement a core functionality that was informed by the needs of all involved researchers, was functioning in three months, and cost less than US \$10000 to build. In this paper we discuss the design, creation, and performance of this facility, the Design Observatory.

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Assessing Design Activity: Issues and Actions

An international collaborative research and development program documents a single framework to resolve inconsistencies between good teaching principles, accreditation requirements and the various expectations of design faculty and students, employers and the community.

The research program led to development of a Transitional Criteria Framework (TRF) that accommodates multiple value systems and integrates criteria for assessment, evaluation, accreditation and accountability within a single system.

The TRF provides opportunities and challenges for all the design professions for improving the recognition and standing their programs, by enabling design faculty to demonstrate design education quality, to the spectrum of stakeholders.

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Informal Information in Engineering Design - a Classification

To achieve success companies must minimise time to market and possess the ability to make fully informed decisions at the early phase of the design process. Such decisions may include the choice of component and suppliers, for which electronic catalogues are becoming the norm.

In utilising these techniques, the designer demands the capability to identify, evaluate and select mechanical components both quantitatively and qualitatively. It is in the area of qualitative decisions that the use of what the authors call "Informal Information" is of crucial importance and must be incorporated.

This paper provides an overview of the use of electronic information in the design of mechanical systems, including the limitations of current technology. The importance of Informal Information is discussed and a number of levels and classifications are further developed.

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Radical Innovation and Design Research

This paper contains a general description of our Radical Innovation Initiative for Tampere University of Technology (TUT) called Project RID. It is a programme for the development of innovation systems in industrial corporations. The description consists of the following parts: (1) Aims and objectives, (2) Project RID: A development programme for innovation competence, (3) Knowledge surveys, (4) Knowledge assessments, (5) Knowledge acquisition and use in action, (6) The current state of programme and the near-term activities, and (7) Concluding remarks. This paper is our first public presentation of Project RID for a broad audience of design, innovation and R&D people.

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Using Bayesian Models in Preliminary Design

Our objective is to develop a methodology to create surrogate models that enable designers to explore the interactions among design parameters at levels of detail and accuracy that correspond to the current state of design knowledge. We do not assume any specific form of the response; but we do assume that the designer is able to evaluate the system response for a set of design parameters using analysis, computation models, or physical experiments. Our goal is to create models that allow the incorporation of new information as the design progresses. As the design is refined, and new points in the design space are sampled, the scope of the model can be reduced and its accuracy increased without discarding the earlier information.

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Six Ingredients of Collaborative Virtual Design Environments

Collaborative virtual design environments (CVDEs) represent the fourth generation of CAD/E systems. These distributed design support systems are based on a still penetrating new paradigm. Consequently, the standard architecture, functionality, and implementation are not yet agreed upon. The authors have analyzed these issues and have identified six ingredients for a successful implementation of CVDEs. The ingredients are (a) enhancement of the kernel CAD/E functionality, (b) advanced interaction and multi-site imaging, (c) networking and multi-channel communication, (d) collaboration support and virtual presence, (e) knowledge asset management, and (f) interface to virtual enterprise. The authors summarize the results of their investigation into the current and emerging technologies that enable the implementation of the six ingredients in industry, and indicate some of the open issues for further research.

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Product Architecture and the Propagation of Engineering Change

The majority of design activities involve adapting a known solution to meet new requirements. Therefore understanding the issue of engineering changes is of vital importance if companies are to deliver product development projects on time and to budget. Making a change to a product is, in most cases, a relatively simple process. However, unexpected propagation of changes can occur. What may initially appear as a simple procedure can dramatically turn into an expensive redesign that requires alterations to a wide range of components. This paper investigates how product architecture influences change propagation and uses a redesign case study to highlight the complexity of this issue as faced by designers during product development.

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Flexible Adaptation of Methods within the Design Process

The focus of this paper is based on an engineer's view on working methods in design and development. Authors have described basic methods like TOTE, elementary methods like 'compare', methods like 'brainstorming' and methodologies like QFD. The proposed model includes the process, the purpose of the elements of the method, the analysis of useful and harmful elements, strengths and weaknesses, threats and opportunities. The result is a better understanding for the user and a basis for adaptation to the situation. The quality check specifies the usability. A web-based tool called CiDaD (Competence in Design and Development) will give optimal support to users.

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On Knowledge Level Theories and the Knowledge Management of Designing

The design and engineering of new products faces new and difficult challenges due to the globalisation of markets and the rapid development of new technologies. To be competitive, companies must become Intelligent Enterprises. How intelligent an enterprise is, thus depends upon how well it manages its knowledge. This paper presents a definition of knowledge based upon Newell's Knowledge Level, and introduces a Knowledge Level theory of designing. How this theory can offer a theoretical basis for supporting the effective knowledge management of designing is then outlined.

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Approaches of Knowledge-Based Design

Knowledge-based design is a concept for the computer-aided provision and application of different representations of knowledge along the product development process. In this paper, after proposing a knowledge taxonomy, possible applications of knowledge-based design and the resulting benefits are discussed as well as open questions and research needs.

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A Different View on PDM and its Future Potentials

Objective of the paper is to re-conceive the nature and development potentials of PDM-systems, based on a new approach to design theory called "property-driven development/design" (PDD). PDD is a new modelling approach for products and product development processes which focuses on a clear distinction between characteristics and properties of a product.

The authors claim that a formalised representation distinguishing between properties and characteristics, which also includes formalised interdependencies and external conditions, may significantly improve the capability to control and speed up development/design activities by making it more transparent. Based on these considerations the paper introduces a concept for an advanced kind of EDM/PDM system.