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Towards a Design Typology

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Abstract

In the literature many models and theories of design can be found. Part of these models and theories are considered incommensurable, while some of them are complementary or overlapping. However, even if general consensus on these models and theories exists, doubt has been raised on the extent to which these models and theories are valid.

In this paper we will present an approach towards research into identification of the many dimensions involved in characterising design. Such identification would provide us with a basis for a new typology of design, metaphorically called 'Dirty Blackboard'. Our ultimate goal is to use the typology to classify existing models and theories of design with respect to their value and use in specific design situations.

Keywords

Design typology, design process model, knowledge management

1 Introduction

In the literature many models and theories of design can be found as has been pointed out also by several others [Maffin, Alderman, 1994; Cross, Roozenburg, 1992; Love, 2000]. In many of these models and theories design is viewed as a sequence of design activities. Such a sequence may be descriptive or prescriptive, subjective, stressing the creative nature of design, or objective, e.g., viewing design as an information-transformation process. To make the underlying assumptions explicit Love [2000] has developed a meta-theoretical structure. In applying this structure to existing theories, it has been shown that there is no general consensus on design terminology, coherence between approaches is still lacking, while some theories and models are even considered to be incommensurable.

While the meta-theoretical structure supports clarification of terminology and reduction of the number of theoretical concepts, there is not yet a clear view on the validity of the various models and theories of design in specific design situations. In other words the question is what role does each model and theory play in specific circumstances. In this paper we will propose an approach towards research into identification of the many dimensions that can be addressed in characterising design. We will limit ourselves initially to synthesis transformation. Our goal is to identify what knowledge, skills, experience, etc. are used and reused in these transformations. This identification is a first step into developing a method for classifying and selecting design models and theories in specific design situations as well as managing the knowledge involved.

The outline of this paper is as follows. In section 2, we will present a rough outline of the dimensions that can be taken into account in viewing the design process. We will stress that design is a process that is performed in a context, which influences and is influenced by the design process. We introduce the metaphor 'Dirty Blackboard' to indicate the contextual nature of design. These dimensions will be further refined in our research, the methodology of which is presented in section 3. Our research will lead to a typology of design that can be used to classify

and select models and theories of design with respect to their value and use in specific design situations. We will use the metaphor 'Dirty Blackboard' as a name for the typology.

2 Dimensions of designing

When we limit ourselves to synthesis transformations, we can find several dimensions in the literature, which influence the synthesis process. These dimensions are often analytic concepts, which are highly interrelated and interdependent in the real world. We will discuss the dimensions in a top-down manner. For each dimension several aspects will be discussed as a refinement of the dimension.

The first dimension to be discussed concerns the characteristics of the design task. Much literature can be found on this dimension, not only in the design field [Pahl,Beitz,1995; Frost,1994; Ullman,1992; Rückert,1997], but also in organisation and management literature (see e.g., [Kerssen-van Drongelen,1999; Clark,Wheelwright,1993]). Aspects often mentioned are complexity of the task and newness to the market or to the organisation. These aspects are used to determine the level of uncertainty involved in the task by e.g., clustering the design tasks with respect to their innovation character, identifying the knowledge needed to perform the task, determining the degree of change the organisation needs to perform, as well as to what extent existing technology and product parts can be reused. Other aspects used to characterise the task are the origin of the task, like market, customer, or subtask, and the production type.

The design task can be viewed on three levels, which are the organisation, group, and individual level. First of all, the organisation and organisational network level determine which design task is undertaken in accordance with the organisational strategy. Collaboration with other organisations, such as clients, suppliers, or co-designers is established at this level. Moreover, the history of the organisation or organisational collaboration, the political and cultural context influence the design task [Bucciarelli,1994]. Second, the group level comprises the disciplines and functions involved in the design task. The nature of the task determines which groups need to be involved. For example, for a design task in which an extension to an existing product family is developed, the production function needs to be involved in the design task to prevent manufacturing failures as much as possible. In addition, at the group level, procedures, methods, technologies, tools can be identified that may be used in the design tasks. Behaviour of the team composed of the different functions and disciplines is also an aspect to be considered at the group level. Finally, the individual level not only addresses the knowledge, skills, and experience of the people that are performing the design task, but also their motivation, attitude, willingness, and ability to collaborate with others within or outside the own discipline or function.

The second dimension addresses the design task. Concerning this task we can identify two aspects. The first aspect is the object that is designed. This object can be located at three levels again. As such, the object may range from the (network of) organisations in which the eventual product is designed to the product itself and its constituent parts [Andreasen,Hein,1987] as well as all upstream and downstream processes involved in the life cycle of the product [Clark,Wheelwright,1993].

Design at the organisational level involves the essential contingencies as formulated by Mintzberg [1979] and summarised by Kerssens-van Drongelen [1999] in the context of product development organisations. The specific configuration of organisational elements, like strategies and goals, processes, people, means, and organisational arrangements determines the co-ordination needs of the product and process design task. In the Esprit Working Group IIMB (Integration in Manufacturing and Beyond) several dimensions of design co-ordination have been identified [Duffy, 2001].

context of new requirements is already a huge task. As already indicated above, we are interested in the extent to which context (history, collaboration, culture, politics) influences the acquisition and application of new knowledge, skills, etc. The blackboard is not clean at the start of a design task, but is filled with already known solutions, concepts, etc. Our assumption is that the dimensions discussed above influence the degree to which the blackboard is 'dirty' from the start of a design task.

In the next section we will discuss our approach towards research into building knowledge on the dimensions discussed above. This knowledge will help us to build a typology of design that will explain the role of the 'Dirty Blackboard', the metaphor that will be used as a name of the typology.

3 Research methodology

A thorough literature study will be performed to formally specify the dimensions identified above. The initial model presented above provides a structure for classifying the research presented in the literature. After that, empirical research will be performed to build knowledge on each of these dimensions for specific (classes of) design situations. This research will be partly quantitative to identify what dimension play a role in different classes of situations. To answer the question why certain dimension play a role and when requires a qualitative case study approach [Miles,Huberman,1994; Yin,1994].

Results of our study will be used to develop a design typology, called 'Dirty Blackboard' to indicate the contextual nature of design. This typology will support selection and application of models and theories suited for specific design situations. In addition, this approach will support and improve knowledge management in design.

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