

DESIGN MANAGEMENT IN A DESIGN OFFICE: DEVELOPMENT OF THE KNOWLEDGE BASE

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1 BACKGROUND AND IDENTIFICATION OF PROBLEM/KNOWLEDGE GAP

Within the first paper, we concluded that it is the poor conceptualization of design and design management that has led to the bad consequences. Furthermore, we argue that design management can not decouple from and ignore the fundamentally complex nature of design task (Buchanan, 2001). To shed some light on the design within the context of production science, Koskela and Ballard (2013) have proposed that the two ancient methods, including the method of analysis (proto-theory of design) and rhetoric are separate, yet complementary methods for design conceptualization. Both fall into *techne* (Aristotle, 2001); i.e. that these are productive and creative acts of producing either geometric figure or persuasive speech.

In this second paper in a series of three, we pursue the development of a theoretical knowledge base. This would eventually be the basis for the design science research (DSR) activity, to be presented in the third paper.

2 RESEARCH AIM AND METHODOLOGY

As in the first paper, also here we have adapted the DSR methodology (Kuechler and Vaishnavi, 2011), which Hevner (2007) describes as process of achieving knowledge and understanding of a problem domain by building and application of a designed artefact. Within this study, the focus is on the development of knowledge base, primarily through literature study method. We approach the development of knowledge base through the perspective of production science (Koskela and Ballard, 2012, Koskela, 2000), or in other words *techne* (Meos, 2011). After articulating the basic ideas of the proto-theory of design and design rhetoric, we provide an interpretation and comparison of these concepts within the context of the wider design literature.

3 TWO PILLARS OF DESIGN PRODUCTION

We start with the discussion by Kroes (2002) to justify the selection of proto-theory of design and design rhetoric as relevant prescriptions for design conceptualization. Kroes reasoned that the focus must shift from considering artefacts merely as technical to considering these also as social within the context of intentional human action. It is opportune to propose that the proto-theory of design and design rhetoric represent different but related dimensions of a productive act (*techne*). These concepts provide the explanation for addressing artefacts as technical and social phenomena.

3.1 Comparison of Two Design Conceptualizations

Table 1 summarizes the different dimensions and aspects of the proto-theory of design and rhetoric. The starting point for proto-theory of design is a given design problem, while for rhetoric it is the given context/situation for understanding the particular and probable. If in analytical design problems or design requirements are assumed to be given (Vermaas, 2013), then in rhetoric only

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the design situation is given and requirements, issues and ideas need to be invented. In both design concepts, there are two time periods in design, namely analysis and synthesis in proto-theory, and invention and delivery in rhetoric. Within these two concepts, different modes of reasoning are used, in the proto-theory designers use transformation, regression and decomposition in analysis; and deduction and composition in synthesis. In rhetoric designers use argumentation and abduction (experience and intuition). Analytical design and rhetoric represent necessary and plausible reasoning, respectively, the former based on the universal and certain, and the latter based on the probable and particular. The relation between parts and whole is unproblematic (a whole can be divided into parts, and parts can be put together into the whole) in analytical design, while problematic in rhetoric. Within the latter the focus is on the whole, requiring also assembling partial wholes (Koskela and Ballard, 2013). In the different stages of design, the focus is on one of the four domains, including activity, organ, parts and process (Andreasen et al., 2015).

In terms of collaboration, the proto-theory of design is more focused on the internal argumentation of individual designer. Rhetoric on the other hand lends itself to the service of planning and coordination as design is to large extent co-created by different specialized disciplines developing persuasive means for meeting the ends (Andreasen et al., 2015, Koskela, 2015). The targeted outcome in the proto-theory is the proof that the targeted technical artefact can be constructed with intended functions and behavior, while in rhetoric it is the persuasion of audience and their judgment (validation). As summarized by Buchanan (2001): "If a product is persuasive in the debate about how we should lead our lives, it is so because a designer has achieved a powerful and compelling balance of what is perceived to be useful, desirable and usable."

Table 1. Summary and comparison of the two design conceptualizations.

Characteristics	Proto-Theory of Design	Rhetoric in Design
Starting point	Given design problem	Given situation (common ground, audience, intention and ideas)
Time Periods	Definition and embodiment/construction	Invention and delivery
Stages	Two step abductive reasoning: function to concept to structure/form	Invention (inventio) of issues, ideas and requirements, arrangement (dispositio) and embodiment (elocutio)
Modes of Reasoning	Necessary reasoning (certain and universal)	Plausible reasoning (probable and particular)
Types of Reasoning	Transformation, regression and decomposition in analysis; and deduction and composition in synthesis	Argumentation and abduction (experience and intuition)
Types of Activities	Communication, assembly, testing, verification	Delivery, Validation
Persuasion Strategies (Appeals)	Useful (Logos)	Desirable (Ethos) and usable (Pathos)
Creativity	Finding alternative means or chains of means	In inventing topics and in composition
Whole and parts	Simple, tractable	Complex, intractable
Representation	In the thing (artefact) itself	Physical and digital models
Social Interaction	Internal argumentation	Communication as a means for collaboration
Standardization	Elements, parts and methods	Reuse and transfer of experience and methods
Output	Proof of product (useful)	Persuasion of customer, user and judgement (desirable and usable)

4 CONCLUSIONS

Within this study, we have developed a theoretical base for the design science research (DSR) activity to be carried out within the third paper. The two complementary concepts of the proto-theory of design and design rhetoric provide the necessary prescriptions for understanding the nature of the design task. As a result of the theoretical investigation to develop the knowledge base for design management, several aspects of the design get clarified, including design inferences (modes and types of design reasoning), processes (types and modes of design activities) and strategies. We also most consider that the creative nature of the design process sets extra challenges to managing design.

