

## A model of designing as the intersection between uncertainty perception, information processing, and coevolution - DTU Orbit (09/11/2017)

### A model of designing as the intersection between uncertainty perception, information processing, and coevolution

A number of fundamental perspectives on designing have been described in the literature, in particular problem/solution coevolution and information use. However, these different perspectives have to-date been modelled separately, making holistic description of design activity difficult. This paper takes the first steps towards linking these disparate perspectives in a model of designing that synthesises coevolution and information processing. How designers act has been shown to play an important role in the process of New Product Development (NPD) (See e.g. Badke-Schaub and Frankenberger, 2012). Modelling design activity in NPD is typically done in one of three ways; object-, subject- or process oriented. First, it can be modelled by focusing on the object of design: the product. Second, it can be modelled by describing the social interaction and knowledge exchange between actors. Third, design activity can be modelled by describing the steps and phases that entails a specific design activity (Bedny & Harris, 2005). In all aspects and stages of the NPD process, uncertainty plays a key role both within the project itself as well as in relation to the project environment (Huang, Liu & Ho, 2015). In order to resolve uncertainty, both individuals and teams need to engage in decision making. In the case of decision making in a team, there is also greater scope for uncertainty, since personality and cognitive style influence decision making (Dewberry, Juanchich & Narendran, 2013) and every person has a different perception of uncertainty. This difference can for example lead to a lack of agreement on the best solution. In NPD projects information is used to minimize the uncertainties inherent to innovation (Stockstrom & Herstatt, 2008; Huang, Liu & Ho, 2015), however, it is important to accept that there are uncertainties that can not be minimized and are inherent to the project itself (Ullman, 2009). Thus, in NPD, the designer's activity is impacted by a wide range of variables. First, uncertainty is significant both inside and outside the project (as in the market for example), and is perceived and acted upon by the designer. Uncertainty perception can be connected to personal characteristics and cultural background, as well as experience and domain specific knowledge. The designer may perceive uncertainty arising from the design of the artefact, from the market, from consumer use, from prototyping, and others. Second, the designer's perceived uncertainty is the motivation to start a process of collecting, exchanging, and integrating knowledge. This has been formalised in Information-Processing Theory and more generally described by authors such as Aurisicchio et al. (2013) who describe design as an information transformation process. Here the aim of the activity is to reduce the perceived uncertainty through identifying and integrating external information and knowledge within the design team. For example, when perceiving uncertainty the designer might seek new information online, process this information, and share with their team in order to assess e.g. opinion, after that they process this knowledge and information together with their interpretation, giving a context to it and finally analysing if the new knowledge is helpful. Third, the designer's perceived uncertainty might also be the motivation to start a process of synthesizing information and ideas into new design propositions through the process of simulation. That is, design work is characterised by an iterative process between problem and solution space, also termed design coevolution (Poon and Maher, 1997; Dorst and Cross, 2001). This describes how problem and solution coevolve over time and have a mutual effect on one another, helping the designer to resolve high levels of uncertainty (Christensen & Ball, 2013). Thus in resolving NPD projects two fundamental processes are the manipulation and evolution of the problem and solution spaces (Christensen & Ball, 2013), and the transformation of information (Aurisicchio et al., 2013). However, prior research has traditionally modelled these perspectives separately; making holistic description of designer activity difficult. Thus, the aim of this paper is to propose a model that links design coevolution and information processing via uncertainty perception. This brings us to the following question: How are coevolution, information processing, and perception of uncertainty connected? The paper is structured in the following way. First, it presents the definitions and literature review of Uncertainty Perception, Information Processing, and Coevolution highlighting connections between them. The proposed model is then presented and explained. The paper closes with conclusions, limitations, and suggestions for further studies, including testing of the model itself.

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