ABSTRACT

Product success is a major goal of designing and design research. Designing involves developing systems. A system interacts with its environment to satisfy its requirements. Therefore, designing should involve developing the concept of both the system and its surrounding. Depending on how the concept of the system changes will impinge on the concept of the environment, and vice-versa; design must co-evolve the concepts of both the system and its environment to adapt them to each other.

A comprehensive review of literature on designing to explore the use of system-environment view in designing revealed that while the concept of systems is used by many design models, implicitly or explicitly, the concept of environment is rarely used as an evolvable construct in designing.

Activities, outcomes, requirement-solution and system-environment views play a significant role in product success. Thus, it is important to explicitly address these views in designing. Further, integration of these views is important for explaining various complex characteristics of designing such as requirement-solution co-evolution and system-environment co-evolution. Integration of views is important also for mapping the steps in design models using these views, so as to be able to characterize design models, or benchmark one design model against another.

Literature has been reviewed to identify the constructs in these views that are essential for representing the design process. Srinivasan and Chakrabarti [2010] had earlier developed a model of designing by integrating three of these views: activities, outcomes, and requirement-solution. However, this model did not incorporate the system-environment view. In this thesis, a system-environment view is developed, with both the system and environment as explicit and evolvable constructs in designing. The thesis then proposed an extended, integrated model of designing which combines the constructs of the identified views of activities, outcomes, requirement-solution and system-environment.
The proposed model is empirically validated using protocols from six design sessions; these sessions had been undertaken well before the proposed model was developed. Validation involved checking whether or not instances of all the constructs in the model are naturally present in these design sessions, and whether or not every event in these design sessions could be described using the constructs of the proposed model.

Further, the explanatory power of the proposed model is illustrated by explaining how system-environment co-evolution and requirement-solution co-evolution occur during the design sessions captured in the protocols. Also, a standard prescriptive approach to designing – Pahl and Beitz approach – is used to demonstrate how a design model can be mapped using the constructs of the proposed model – the first step to characterizing or benchmarking design models.