

## **Abstract:**

This dissertation presents a method for looking at and changing the practice of group engineering design. In traditional design studies, researchers stand outside the process to analyze or criticize. In contrast, the author presents a method for proactive design research—a way of intervening in design practice, of watching (and accounting for) the effects of those changes, and of planning the next intervention. The method encompasses the breadth of engineering design activity and address the ways that design work emerges from interactions among individuals and groups as they establish, maintain, and develop a shared understanding. Four threads emerge from the chronicle of research efforts discussed herein:

- an integrated method for studying and intervening in group engineering design practice,
- a framework for considering the work that gets done in the social activity of design,
- a description of practices used to accomplish the social and technical work of design, and
- a collection of entailments for design education, practice, tools, and research.

Two related projects were undertaken during the course of this research. The first, a longitudinal study of an industrial team working on a photocopier subsystem, emphasized intervention with multi-media services and provided an ethnographic overview of design practice in situ. The second project, a series of half-day, group design exercises focusing on the communications arising in distributed design activity, was used to provide a detailed look at phenomena being observed in the longitudinal study. Videotape recordings of each project were gathered for further study. The understanding that resulted from this detailed analysis has two related parts—a framework for the activity of designing, and a set of practices that participants use to get design work done.

The framework, a perspective for thinking about the content of design work, has two dimensions—facets (the things being worked on) and trajectories (a temporal sense to the work being done). This framework highlights how participants have personal views of the ongoing activity, and how, at any particular time, design activity is doing communicative work on multiple topics.

The complexity revealed by the framework raises the question of how it is that designers actually accomplish this activity. Four practices observed in the activity were identified as crucial:

- negotiating understandings,
- conserving ambiguity,
- tailoring engineering communication for recipients, and
- manipulating mundane representations.

With these practices, designers' activity can be seen, not as something shaped by an externally imposed context, but rather as attending to and creating a recognizable order in the ongoing social interaction.

It is argued that not only do negotiation and interactive organization largely account for design activity, but also that these moment-to-moment practices have substantial implications for design education, tool development, design practice, and design research.