



More than the Sum of the Parts: Shared Representations in Collaborative Design Interaction

This dissertation presents an inquiry into the roles played by persistent, shared external representations in design collaboration. It advances a conception of representations—including drawings, models and prototypes—as active participants in the collective reasoning of design teams. Insights into the accomplishment of essential work in this context are developed through interaction analysis and a novel network formalization for design activity. A synthesis of analyses over different time scales informs a comprehensive notion of representational support for design interaction and a diagnostic for problems that may arise with inadequate support and/or with disparities of access or participation.

Data were collected during working sessions of a leading, “real-time” concurrent design practice at NASA’s Jet Propulsion Laboratory, notable for accelerated performance and the use of technologically-advanced, shared representations. Fine-grained analysis of this activity complements insights obtained from laboratory studies of individual designers, ad-hoc groups, and organizationally-situated ethnographic accounts. A micro-analytic technique is developed to assess dynamic interaction between participants and representations. The resulting, novel formalization of an actor-discourse network makes concepts derived from actor-network theory operational to understand the work accomplished through design interaction. Network visualization and structural metrics highlight patterns associated with productivity in the design process. On this basis, indicators for the quality of design conversation are proposed: these include the degree of participants’ engagement, the development of design discourse, the integration of representations and the consolidation of commitment to action. Specific roles and situational attributes of representations are identified that foster and sustain advances in collective design reasoning.

The dissertation advocates a view of design activity in terms of the temporal evolution of constellations of issues and actors, in which representations act to stabilize and anchor expanding networks of commitment. Directions for further work include technical enhancement to network metrics and visualization, extension of the actor-discourse network formalization and further exploration of theoretical and practical issues pertaining to representational actors in social situations.