6 Impromptu Prototyping and Artefacting: Representing Design Ideas through Things at Hand, Actions, and Talk

Gilbert D. Logan and David F. Radcliffe

Introduction

Design offices have always been littered with physical artefacts, including components, prototypes and models, as well as drawings and various paper-based design objects. Radcliffe and Harrison (1994) noted that physical artefacts, including existing products and prototypes, are an important part of the design environment in a small manufacturing company. Product development involves numerous movements across the boundary between physical artefacts and abstract representations, including drawings, sketches and lists. Notwithstanding the evolution of the CAD (computer-aided design) systems and the promise of virtual design tools (e.g., Krovi et al. 1997; Furlong 1997), physical objects continue to have a place in the contemporary design office. However, relatively few empirical studies have focused on the role of artefacts in engineering design.

Tang (1991) found that during group sketching activity, designers used drawing, lists, and gesture to store information, express ideas and mediate interaction. These actions were supported by talk, although Tang treated this as a substrate to the design actions and did not examine the role of talk in respect of the actions. A subsequent study by Radcliffe and Slattery (1993) of the work of a cross-discipline, rehabilitation engineering team observed that they used lists, gesture, mimicry, and physical interventions to express and test design ideas, to explore the context of the task, to mediate interaction, to negotiate closure and to store information. Harrison and Minneman (1996) observed in the Delft Protocol that artefacts serve a variety of functions in the hands of designers. They concluded that "the processes of

interaction with objects have communicative value and alter the dynamics in multi-designer settings."

Analyzing the same group of designers in the Delft Protocol, Radcliffe (1996) noted that, on several occasions where objects were recruited to demonstrate a design proposal, team members augmented their actions with sounds to accentuate the meaning. For example, the sound of spot-welding was used as part of a presentation to convey to team members how an assembly would be made. While no formal analysis was conducted into the relationship between engagement with artefacts and talk, Harrison and Minneman (1996) noted that, as the body of referents increased, the use of pronouns in designers' speech increased. Thus, talk and action with artefacts are intertwined in ways that have not been explored fully.

This chapter presents a fine-grained, empirical study (Logan 1999) of the relationships between design actions, physical objects, and talk in design discussions in a cross-discipline team. We use the term "artefacting" to describe the combination of utterance and physical interaction used to communicate complex messages that have design implications. Physical interactions include gestures, interventions with hands or objects, mimicry in which the body simulates ideas, and the use of physical artefacts at hand during a design act. Some of these artefact interactions involve the construction of artefact assemblies – prototypes through which participants provide physical representation of their ideas and also gain immediate experience of the prototype in the current physical environment. This impromptu prototyping was recognized by Horton (1997) as having the potential to develop a designer's "device in mind" into an overall design intent.

This study is based on a cross-discipline, rehabilitation engineering[1] team at work in a seating clinic. Rehabilitation engineering is often provided as a service to people with a disability in hospital, university, or community health settings to evaluate, prescribe, devise, and provide assistive devices to increase their independence and reduce handicap. A Rehabilitation Engineering Centre (REC) employs rehabilitation (professional) engineers, technicians, physiotherapists and occupational therapists who work in a team to offer unique combinations of knowledge and skill to help solve physical problems experienced by a client. A rehabilitation engineering team usually practices face-to-face with the client and the client's care-providers to: (1) acquire information about the client's physical situation, functional ability, and performance of current assistive devices such as a wheelchair; (2) experiment to understand how functional performance, postural control, etc. is enhanced or exacerbated by various interventions, and (3) devise unique solutions to problems based on the outcome of intervention and the trialling of various items of equipment. Much of the information on which decisions are based is acquired by observation. The cross-discipline team in this study specializes in aiding clients with severe physical disability who experience difficulty with mobility, comfort and control of sitting posture, and pressure sores. Figure 6.1 illustrates a seating clinic in progress. The team undertakes an assessment of the client's needs, then designs and manufactures custom seating and related devices to ameliorate specific problems. The assessment is conducted according to a set of questions and headings that seek to probe for specific and general information. The assessment aims to encourage discussion and experimentation with the client by trying various seating