

Chapter 2.19

Socio–Cognitive Engineering

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INTRODUCTION

Socio-cognitive engineering is a framework for the systematic design of socio-technical systems (people and their interaction with technology), based on the study and analysis of how people think, learn, perceive, work, and interact. The framework has been applied to the design of a broad range of human-centered technologies, including a Writer's Assistant (Sharples, Goodlet, & Pemberton, 1992), a training system for neuro-radiologists (Sharples et al., 2000), and a mobile learning device for children (Sharples, Corlett, & Westmancott, 2002). It has been adopted by the European MOBIlearn project (www.mobilelearn.org) to develop mobile technology for learning. It also has been taught to undergraduate and postgraduate students to guide their interactive systems projects. An overview of the framework can be found in Sharples et al. (2002).

BACKGROUND

The approach of socio-cognitive engineering is similar to user-centered design (Norman & Draper, 1986) in that it builds on studies of po-

tential users of the technology and involves them in the design process. But users are not always reliable informants. They may idealize their methods, describing ways in which they would like to or have been told to work, rather than their actual practices. Although users may be able to describe their own styles and strategies of working, they may not be aware of how other people can perform a task differently and possibly more effectively. Surveys of user preferences can result in new technology that is simply an accumulation of features rather than an integrated system.

Thus, socio-cognitive engineering is critical for the reliability for user reports. It extends beyond individual users to form a composite picture of the human knowledge and activity, including cognitive processes and social interactions, styles and strategies of working, and language and patterns of communication. The term *actor* is used rather than *user* to indicate that the design may involve people who are stakeholders in the new technology but are not direct users of it.

The framework extends previous work in soft systems (Checkland & Scholes, 1990), socio-technical and cooperative design (Greenbaum & Kyng, 1991; Mumford, 1995; Sachs, 1995), and the application of ethnography to system design

(see Rogers & Bellotti [1997] for a review). It incorporates existing methods of knowledge engineering, task analysis, and object-oriented design, but integrates them into a coherent methodology that places equal emphasis on software, task, knowledge, and organizational engineering.

The framework also clearly distinguishes studying everyday activities using existing technology from studying how the activity changes with proposed technology. It emphasizes the dialectic between people and artefacts; using artefacts changes people's activities, which, in turn, leads to new needs and opportunities for design.

FRAMEWORK

Figure 1 gives a picture of the flow and main products of the design process. It is in two main parts: a phase of *activity analysis* to interpret how people work and interact with their current tools and technologies, and a phase of *systems design* to build and implement new interactive technology. The bridge between the two is the relationship between the Task Model and the Design Concept. Each phase comprises *stages* of analysis and design that are implemented through

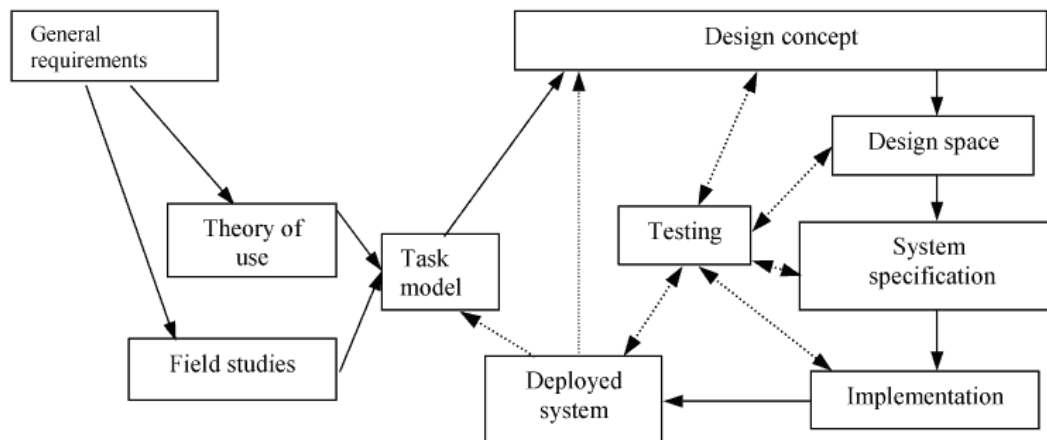
specific *methods*. The framework does not prescribe which methods to use; the choice depends on the type and scale of the project.

It is important to note that the process is not a simple sequence but involves a dialogue between the stages. Earlier decisions and outcomes may need to be revised in order to take account of later findings. When the system is deployed, it will enable and support new activities, requiring another cycle of analysis, revision of the Task Model, and further opportunities for design.

The elements of socio-cognitive engineering are as follows:

- **Project:** The diagram shows the process of design, implementation, and deployment for a single project.
- **Actors:** Different types of people may be involved in or affected by the design and deployment, including (depending on the scale of the project) design, marketing and technical support teams, direct users of the system, and other people affected by it (e.g., administrative staff).
- **Roles:** The actors take on roles (e.g., team leader), which may change during the project.

Figure 1. Overview of the flow and main products of the design process



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