Chapter 2.1
A Use-Centered Strategy for Designing E-Collaboration Systems

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INTRODUCTION

The ubiquity of collaboration cannot be overstated. Derived from the Latin *collaborare*, which means "work with" or through, collaboration is the process wherein agents work together through transaction. Collaboration entails the existence of a *team* if a common goal or purpose underlies the transaction. A *virtual* team exists when collaboration takes place (to a varying degree) through technology across time, space, and (often) organizational boundaries; also known as *e*-collaboration. As a general definition, we follow the lead of Kock and colleagues (Kock, Davison, Ocker, & Wazlawick, 2001; Kock & Nosek, 2005), and state that e-collaboration is "collaboration among individuals engaged in a common task using electronic technologies" (Kock et al., 2001, p. 1). This is a very broad definition and includes such historical means of e-collaboration as the U.S. Department of Defense's ARPANET and early group decision support systems (GDSSs) such as Lotus Notes (Kock & Nosek, 2005). Few would argue the contemporary impact computers, the Internet, and network architectures (e.g., local area networks; LANs) have had on collaboration and

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teams (Schwartz, Divitini, & Brasethvik, 2000). Current instantiations of e-collaborative systems include the Internet (which includes various e-collaborative subsystems such as Internet relay-chat, bulletin boards, and weblogs), videoconferencing, and virtual workstations. The opportunities created by this new wave of e-collaboration and virtual teamwork have, in turn, dramatically transformed military forces (e.g., network-centric warfare; Cebrowski, 1998), business (e.g., B2B collaboration; Rosenberg, 2003), infrastructure (e.g., traffic flow regulation; Jermann, 2001), and other areas of society (e.g., collaborative music development; Weinberg, 2005).

The fact that e-collaboration wires together so many organizations highlights the idea that there is some advantage in having work virtually distributed across multiple decision makers. Thus, researchers are beginning to frame questions around the nature of e-collaboration and virtual teams. Important dimensions of this phenomenon include the organizational dynamics (e.g., Rochlin, 1997), the technological capabilities (e.g., Iacovou, Benbasat, & Dexter, 1995), and the human factors (e.g., Proctor & Vu, 2005). However, the focus of this article will be on the work domain or problem space as a significant context for understanding the interactions among the lower order dimensions. The central premise is that all work, including teamwork, is situated (e.g., Hutchins, 1995; Suchman, 1987). That is, success depends on adaptation to the demands of the problem (i.e., the work, the situation, the ecology). Therefore, modeling the work domain constraints becomes an essential factor for predicting how the organizational structures, information technologies, and human abilities will interact to determine the overall success and stability of the team. In sum, we would like to make the case for a Cognitive Systems Engineering (CSE) (e,g., Rasmussen, Pejtersen, & Goodstein, 1994; Vicente, 1999) or Ecological (e.g., Flach & Dominguez, 1995; Flach, Hancock, Caird, & Vicente, 1995) approach to questions about e-collaboration or virtual teams.

Below we highlight a military example of the use-focused design and development of an e-collaborative system called Knowledge Web. This is followed by an explication of the role of Cognitive Systems Engineering: a use-centered approach for the design of e-collaborative systems.

KNOWLEDGE WEB

There are several common problems/operational issues the U.S. Navy has faced due to the escalation of e-collaboration. First, when information is most needed, it is rarely in an easily accessible location, in the requisite form, or available at the right time. Often, the data is organized and presented based on where it is coming from rather than where and how it is needed. Also, there exist multiple hardware stovepipes that hinder information access and impede the speed of command. An additional, related problem is that there is great difficulty identifying what information is valuable to whom, and when that information is most crucial. Thus, there is little idea of who uses what information, what form the information should take, why collaboration across organizational departments is rare, and why staff presentations are limited by prescribed slide presentations. When reviewing the ecology through which these problems manifest, a common theme emerges: Naval commands are sharing knowledge in distributed, asynchronous (i.e., temporally staggered) environments with multi-echelon and coalition environments to contend with (Oonk, Rogers, Moore, & Morrison, 2002). These findings allowed the Navy to propose a concept of operations for command centers that focuses on shared relevant knowledge (i.e., information that is *meaningful* vs. shared data), shared awareness, and speed of command. Thus, the Knowledge Web was born.

Knowledge Web (or K-Web) is an advanced development project that delineates a clear concept of operations for using the Web to improve the

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