

Distributed Cognition in Healthcare

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Introduction

Jiajie Zhang is a cognitive scientist working in healthcare and a professor of health informatics at University of Texas at Houston. Zhang will be the moderator and discussant for this symposium. He will provide an overview of distributed cognition and its importance in healthcare. Distributed cognition provides a unique framework to describe the dynamics, interactions, processes, and knowledge structures critical to cognitive tasks in healthcare environment. It allows researchers to focus on complex informational, social, organizational, and cognitive issues involved in team interactions with information technologies within a distributed, collaborative environment. The core unit of analysis is the functional system composed of human and artificial agents and their relations which are distributed across time and space dimensions (Cohen *et al.*, in review; Hutchins, 1995; Zhang & Norman, 1994). Distributed cognition can lead to discoveries concerning how interactions between agents are coordinated and how artifacts and tools are really used.

Decision Making in Critical Care

Vimla L. Patel is a cognitive scientist working in healthcare and a professor of biomedical informatics and psychiatry at Columbia University. Patel will present studies of distributed cognition in Emergency Department (ED). ED personnel have to deal with many patients at the same time, constantly prioritizing and dividing their attention between patients, interacting with paper and electronic artifacts and with other people. Human errors in a dynamic environment such as critical care are viewed as products of cognitive activities in people's adaptation to their complex physical, social, and cultural environments. The clinicians' actions reflect the level of expertise and the demands of tasks in making clinical decisions. The empirical results from this study, unlike the popular goal of achieving flawless performance (through development of error-free systems), can be used to enhance and modify the current, more static, taxonomy of medical errors. They can guide development of adaptive systems that anticipate errors, respond to them, or substitute less serious errors that allow subsequent intervention before the errors result in an adverse event.

Distributed Model-based Reasoning

Nancy Nersessian is a professor of cognitive science at George Tech. Nersessian will present a study on the interplay of physical and mental models in the context of prob-

lem solving in a tissue engineering laboratory. The laboratory is analyzed as an *evolving cognitive-cultural system* and simulation models are used as a means of examining problem solving as situated in local interactions and distributed across researchers and artifacts. The analysis couples ethnographic methods with cognitive-historical analysis to examine in a unified manner the evolution of technologies and models, and the enactment of these in the daily problem solving practices of the community (Nersessian, 2005).

Resolution & Bandwidth of Shared Workspace

Yan Xiao is an associate professor in the School of Medicine at University of Maryland. Xiao will present studies of cognitive artifacts in the management of operating rooms (Xiao, 2005). Collaborative work in OR is supported by an infrastructure composed of mostly non-computerized, physical components. The fluidity and ease of restructuring workplaces to support collaborative work may be explained in part by the high resolution and bandwidth of workplaces. Support health care workers, designers of computer supported cooperative work (CSCW) systems should learn how the physical and perceptual properties of workplaces are exploited, and that CSCW systems should be designed to allow maximum freedom of restructuring and reconfiguring as part of workplaces to enhance bandwidth and resolution of representation and communication.

References

- Cohen, T., Blatter, B., Almeida, C., Shortliffe, E. H., & Patel, V. L. (in review). Distributed cognition in the psychiatric emergency department: A cognitive blueprint of collaboration in context.
- Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: MIT Press.
- Nersessian, N. J. (2005). Interpreting scientific and engineering practices: Integrating the cognitive, social, and cultural dimensions. In M. Gorman, R. Tweney & D. Gooding (Eds.), *Scientific and technological thinking* (pp. 17-56). Hillsdale, NJ: Erlbaum.
- Xiao, Y. (2005). Artifacts and collaborative work in healthcare: Methodological, theoretical, and technological implications of the tangible. *Journal of Biomedical Informatics*, 38(1), 26-33.
- Zhang, J., & Norman, D. A. (1994). Representations in distributed cognitive tasks. *Cognitive Science*, 18(1), 87-122.