

**DANIEL J. EPSTEIN DEPARTMENT OF  
INDUSTRIAL AND SYSTEMS ENGINEERING**

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**EPSTEIN INSTITUTE SEMINAR • ISE 651 SEMINAR**

***Analyzing Human–Automation Interaction and  
Human-human Communication Using  
Formal Task Analytic Models***

**Dr. Ellen Bass**

**Professor, College of Computing and Informatics  
and College of Nursing and Health Professions,  
Drexel University, Philadelphia, PA**

**ABSTRACT**

Complex systems are composed of humans and automation interacting with dynamic flexibility in the allocation of authority and autonomy. Breakdowns in complex systems often occur as a result of system elements interacting in ways unanticipated by designers. The analysis of such systems requires methods for verifying and validating that the range of roles and responsibilities potentially assignable to the humans and automation does not lead to unsafe situations. The use of human task behavior models as part of a larger, formal system model should allow the ramifications of normative and erroneous behaviors to be verified in relation to other aspects of the system. To support the development of formal models of human operator behavior, we have developed a task analytic modeling formalism, the Enhanced Operator Function Model with Communication (EOFMC). It is an Extensible Markup Language-based, platform- and analysis-independent languages with formal syntax and semantics. We have developed associated automated processes for translating instantiated models into the model checking language Symbolic Analysis Laboratory. Both normative and erroneous human behavior models are produced in order to verify procedure related (omissions, jumps, repetitions, and intrusions), strategic knowledge related (slips) erroneous human behaviors, and communication errors. The system model can then be verified using model checking in order to identify potentially hazardous situations related to the interaction of the environment, human behavior, and human–automation interaction. These methods have already been applied to medical device design and transportation applications and they hold promise for other domains.

**TUESDAY, OCTOBER 1, 2013  
GRACE FORD SALVATORI (GFS) ROOM 101  
3:30 – 4:50 PM**

## SPEAKER BIO



Ellen Bass is a Professor in the College of Computing and Informatics and in the College of Nursing and Health Professions at Drexel University. Her research focuses on understanding and modeling how human operators perform in real-time complex systems in order to inform the systems engineering process: operational concept definition, requirements for decision support and human-computer interaction, procedures the operators will follow, and training requirements. She develops analytical frameworks, measures, and methods that quantify total system performance including end users, their tools, features of the task environment and schedule. Bass has published over 200 publications on cognitive systems engineering topics.

Bass is a member of the Board on Human-Systems Integration (BOHSI) in the Division of Behavioral and Social Sciences and Education (DBASSE) of the National Academy of Sciences. Bass is the Editor-in-Chief for the journal *IEEE Transactions on Human-machine Systems*. She serves on several editorial boards. She is the Chair of the Cognitive Engineering and Decision Making (CEDM) Technical Group of the Human Factors and Ergonomics Society (HFES).

For over thirty years, Bass has been involved in systems engineering research and design with relevant experience in cognitive modeling, cognitive systems engineering, human factors, simulation and formal methods. Bass served on the faculty at the University of Virginia from 2002 to 2012 and then joined the Drexel faculty in 2013. Before then, Bass was a systems engineer at IBM, SAIC, Search Technology and Georgia Tech. She earned a Ph.D. in Systems Engineering at the Georgia Institute of Technology.