Dr Emilie M. Roth

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Overview

Dr. Emilie M. Roth is a cognitive psychologist whose work has involved analysis of human problem-solving and decision-making in real-world environments (e.g., military command and control; intelligence analysis; nuclear power plant emergencies; railroad operations; surgery), and the impact of support systems (e.g., computerized procedures; alarm systems; advanced graphical displays; new forms of automation) on cognitive performance. She has conducted empirical studies of naturalistic decision-making; developed and applied cognitive task analysis and cognitive work analysis techniques for understanding the cognitive demands imposed by work environments; and developed principles for effective decision-support for individuals and teams. Dr. Roth has supported design of first of a kind systems including design and manning of the command center for a next-generation Navy ship; design of a next-generation nuclear power plant control room; and design of work-centered support systems for flight planning and monitoring for an Air Force organization. She is a fellow of the Human Factors and Ergonomics Society and serves as Associate Editor of the journals *Human Factors* and *Journal of Cognitive Engineering and Decision Making*. She recently participated in the National Research Council Committee on Human-System Design Support for Changing Technology and is currently a member of the National Research Council Committee examining lessons learned from the Fukushima nuclear accident for improving safety and security of U.S. nuclear plants.

Education

Ph.D. University of Illinois at Urbana-Champaign, 1980, Cognitive Psychology
M.A. University of Illinois at Urbana-Champaign, 1977, Cognitive Psychology
B.A. Brooklyn College, Brooklyn, N.Y., 1974, Psychology

Professional Positions

June 1997 - present: Owner and Principal Scientist,
Roth Cognitive Engineering

Research and development in areas of human factors and applied cognitive psychology (Cognitive Systems Engineering). Serves as consultant and subcontractor on projects involving cognitive analysis and cognitive engineering.

Customers have included: Aptima, Inc.; BBN Technologies; Brigham and Women's Hospital; Brookhaven National Laboratory; Charles River Analytics, Inc.; Harvard Risk Management Foundation; Idaho National Laboratory; Logicon; ManTech International Corporation; MacroSys Research and Technology; Mitsubishi Heavy Industries; MIT Medical Department (Performance Improvement & Risk Management); Ohio State University Research Foundation; Resilient Cognitive Solutions; Secure Decisions, a division of Applied Visions, Inc.; Volpe National Transportation Center; Westinghouse Electric Company;

Recent and current ongoing projects of Roth Cognitive Engineering include:

- A project to support the design of an integrated human-system interface for automatic exploitation and cross-cueing of multi-intelligence sources (Subcontractor to Charles River Analytics, on DARPA INSIGHT program).
- A project to develop improved macrocognitive modeling and analysis methods to support retrospective incident analysis as well as predictive human reliability analysis for nuclear power plant application (Subcontractor to Idaho National Labs on a project sponsored by the U. S. Nuclear Regulatory Commission).
- A project to develop and evaluate prototype work-centered support systems to support real-time Command and Control staff in military transportation planning and management organizations (Subcontractor to BBN Technologies on projects sponsored by US AFRL, Wright Patterson AFB).
- A project to develop and perform empirical experiments to evaluate alternative visualizations for communicating meta-information (e.g., uncertainty; information age or quality). (Subcontractor to Charles River Analytics, on program sponsored by US AFRL, Wright Patterson AFB).
- A project to support design and licensing of the control room for a next-generation power plant, including conducting simulator-based evaluations of crew performance in simulated power plant emergencies using a next-generation control room simulator (for Mitsubishi Heavy Industries)
- A project to assess the impact of new positive train control technology on the performance of railroad personnel including train dispatchers, train crews, and roadway workers (Subcontractor to MacroSys Research and Technology for the Volpe National Transportation Systems Center)
- A project to perform cognitive task analyses of various railroad positions including dispatchers, locomotive engineers, conductors, and roadway workers (Subcontractor to MacroSys Research and Technology for the Volpe National Transportation Systems Center)
- A project to develop cognitive support concepts and computational approaches to support complex intelligence analysis tasks. (Subcontractor to Charles River Analytics, Inc.)
- A project to improve the safety of medication prescribing/filling/dispensing systems by identifying medication-related errors associated with the interface of electronic systems and humans and using a human factors engineering (HFE) analysis to: identify causes of these errors, design systems to reduce the current error rate, and avoid serious errors in the future (Consultant to Performance Improvement & Risk Management, MIT Medical Department, under an RMF/CRICO grant enhance medication safety in an ambulatory setting by applying human factors methods.
- A project to perform an observational study in the operating room of a large academic hospital in order to identify points of vulnerability and opportunities to improve patient safety through process changes (Sponsored by Harvard Risk Management Foundation).

- A project to develop concepts for a mixed initiative planning system for command and control of unmanned vehicles (Subcontractor to Charles River Analytics, Inc. and Draper Labs on a Defense Advanced Research Projects Agency (DARPA) program) -- – *Dr. Roth analyzed user requirements and designed and performed a user evaluation.*
- A project to perform a Cognitive Task Analysis to guide the design and manning of the Command Center for the next-generation Navy Ship (Subcontract to: Logicon)
- A project to perform a Cognitive Task Analysis to guide the development and test of advanced visualizations in support of the command post of the future. (Subcontract to: Logica Carnegie Group, DARPA Command Post of the Future program).
- A project that examines the cognitive demands inherent in data overload situations and explores aiding approaches to enable intelligence analysts to cope with data overload situations. (A project in collaboration with Prof. David D. Woods, from Ohio State University that was sponsored by Wright Patterson AFB).
- A project to conduct a simulator study of operator performance in an existing power plant control room (at a Swedish plant) to serve as a baseline for design and validation of an advanced control room (Customer: Westinghouse)

November 1997 – June 1998: Visiting Associate Research Professor
Department of Information Science and Telecommunications
University of Pittsburgh

Member of a research team investigating the application of intelligent software agents to support team performance in complex dynamic diagnostic and planning tasks.

Sept. 1992 - May 1997: Advisory Scientist/Human Sciences Program Manager
Westinghouse Science and Technology Center

Technical leader in a multi-disciplinary group that performs research and development in the areas of applied cognitive psychology, human factors, and human-computer interaction for Westinghouse divisions as well outside customers. (Advisory Scientist is the second highest level on technical ladder at Westinghouse. Appointment entails formal peer review as well as management approval.).

Served as lead human factors specialist in the Westinghouse program to design and license an advanced control room for the Westinghouse AP600 advanced passive light water reactor nuclear power plant.

Conducted R&D in support of design of several Westinghouse person-machine products including a large wall-mounted group view display for broad situation awareness.

Aug. 1989 - Aug. 1992: Human Sciences Program Manager,
Westinghouse Science and Technology Center

Responsible for marketing and developing new programs in the Human Sciences area as well as serving as a technical lead on Human Sciences programs.

Sept. 1988-July 1989: Research Psychologist, Engineering and Public Policy, Carnegie-Mellon University

Member of a multi-disciplinary applied research team performing studies on decision-making, risk perception, and risk communication.

1982 - 1988: Senior Scientist, Information Systems and Human Sciences Research, Westinghouse Research and Development Center

Member of a human factors and applied cognitive psychology group. Conducted research on human problem-solving and decision-making in complex dynamic environments (e.g., simulated nuclear power plant emergencies) and human-computer interaction, with specific focus on human interaction with artificial intelligence systems.

1981 - 1982: Research Analyst, ToxiGenics, Inc.

Internal consultant on statistical and experimental design problems.

1980 - 1981: Visiting Assistant Professor, Department of Psychology, Illinois State University.

Taught courses in cognitive psychology, experimental design and research methods, and statistics.

Professional Service and Society Memberships

Editorial and Advisory Activities

- Associate Editor, *Human Factors*
- Associate Editor, *Journal of Cognitive Engineering and Decision Making*
- Member of the National Research Council Committee examining lessons learned from the Fukushima nuclear accident for improving safety and security of U.S. nuclear plants
- Member of a National Academy of Sciences Committee on Human-System Design Support for Changing Technology (in 2006).
- Member on a Leaders Review Symposium providing guidance on an AHRQ-funded contract, "Implementing and Improving the Integration of Decision Support into Outpatient Clinical Workflow." (2008)
- Member of the National Academies' (National Research Council's) Panel on Soldier Systems. The panel annually visits the Army Research Laboratory's Human Research and Engineering Directorate to assess the quality of that laboratory's scientific and technical programs (2007 –2010)
- Editorial board member, *Le Travail Humain* (through 2011)

Reviewing Activities

- Human Factors
- IEEE, Systems, Man and Cybernetics
- Cognition, Technology and Work
- Applied Ergonomics
- Ergonomics
- JAMA
- International Journal of Human-Computer Studies
- Organizational Studies
- Computer Supported Cooperative Work Conference
- Le Travail Humain
- Quality and Safety in Healthcare
- Grant Reviewer for Department of National Defence/NSERC , Canada

Society Memberships

- Fellow, Human Factors and Ergonomics Society (Fall, 2010)
- Ergonomics Society
- New England Chapter of the Human Factors and Ergonomics Society
- American Psychological Society
- Cognitive Science Society
- IEEE
- Association for Computing Machinery

Invited Presentations

- Invited speaker, 12th Human Factors Inter-University Workshop, University of Buffalo, November 5, 2011.
- Invited speaker, Human and Automation Lab, MIT , March 3, 2011
- Invited speaker Tufts University Human Factors – November 24, 2009
- Invited speaker Department of Industrial and Systems Engineering University at Buffalo, State University of New York, Buffalo, February, 2006
- Invited speaker MIT Humans and Technology Symposium, January 25, 2006
- Invited speaker at the Human Factors & Ergonomics Student Chapter (HFES) at MIT (1/3/2003 and 2005)
- Invited speaker, Krasnow Institute for Advanced Study, George Mason University, March 31, 1997

External Member of Dissertation Committee

- Catherine Burns, Interface Integration for Large-Scale Systems, Department of Mechanical and Industrial Engineering, University of Toronto, 1998
- Jiao Ma, Investigating Human Factors Issues in Data Mining Processes, Department of Industrial Engineering, University of New York, at Buffalo, 2004
- Xilin Li, Evaluating ecologically-inspired displays for complex systems: Hydropower system case study, The University of Queensland, Australia, 2008

Publications and Patents

Patents and Patent Disclosures

Rusnica, L. A., Kerch, S. P., Thomas, V. M., Kenney, S., Brockhoff, C. S., Morris, B. C., Roth, E. M., & Sugibayashi, N. 'Process overview display for use by personnel in operations/command and control centers to increase situation awareness and enhance crew coordination.', U. S. Patent # 5,859,885, Jan. 12, 1999.

Lipner, M. H., Kerch, S. P., Roth, E. M. & Rusnica, L. A. 'An improved navigational aid for the execution of complex plant process facility operating procedures.', Patent disclosure, Oct. 27, 1995.

Elm, W. C., Roth, E. M., and Woods, D. D. 'Expert advice display processing system', U. S. Patent # 5,167,010, Nov. 24, 1992.

Bernard, T. E., Roth, E. M., Mohan, E. R., Sherwin, G. W. & Zomp, J. M. 'Evoked potential autorefractometry system', U. S. Patent # 4,697,598, Oct. 6, 1987.

Journal Publications

Hu YY, Peyre SE, Arriaga A, Roth EM, Corso KA, Greenberg CC. War Stories: A Qualitative Analysis of Narrative Teaching Strategies in the Operating Room. The American Journal of Surgery (2012); 203(1); 63-8.

Hu YY, Arriaga AF, Roth EM, Peyre SE, Swanson RS, Osteen RT, Schmitt P, Bader AM, Zinner MJ, Greenberg CC. (2012) Protecting Patients from an Unsafe System: The Etiology & Recovery of Intra-Operative Deviations in Care. Annals of Surgery. Vol 256 (2), 203-210.

Hu YY, Arriaga AF, Peyre SE, Corso KA, Roth EM, Greenberg CC. Deconstructing Intraoperative Communication Errors. Journal of Surgical Research (2012); May 4; *Epub Ahead of press.*

Bisantz, A. M., Cao, D., Jenkins, M., Pennathur, P., Farry, M., Roth, E., Pfautz, J. and Potter, S. (2011). Comparing uncertainty visualizations for a dynamic decision-making task. *Journal of Cognitive Engineering and Decision-Making*, volume 5, number 3, 255-276.,

Roth, E. M., Pfautz, J. D., Mahoney, S. M., Powell, G. M., Carlson, E. C., Guarino, S. L., Fichtl, T. C., and Potter, S. S. (2010) Framing and contextualizing information requests: problem formulation as part of the intelligence analysis process. *Journal of Cognitive Engineering and Decision Making,* volume 4, number 3, Fall 2010, pp. 210 – 239.

Hoffman, R. R., Deal, S. V., Potter, S. and Roth, E. (2010). The practitioner's Cycles, Part 2: Solving Envisioned World Problems. *IEEE Intelligent Systems*, 25 (3), 6-11.

Bisantz, A. M. , Stone, R. T. , Pfautz, J., Fouse, A., Farry, M., Roth, E., Nagy, A., & Thomas, G. (2009). Visual representations of meta-information. *Journal of Cognitive Engineering and Decision Making*, 3 (1), 67-91.

Roth, E. M. and Pew, R. W. (2008). Integrating cognitive engineering in the systems engineering process: Opportunities, Challenges, and Emerging Approaches. Introduction to the Special Issue. *Journal of Cognitive Engineering and Decision Making*, 2 (3), 161-164.

Roth, E. M. (2008). Uncovering the Requirements of Cognitive Work. *Human Factors*, 50 (3), 475-480. (Golden Anniversary Special Section on Discoveries and Developments). http://www.ingentaconnect.com/content/hfes/hf/2008/00000050/00000003/art00022

Evenson, S., Muller, M. and Roth, E. M. (2008). Capturing the context of use to inform system design. *Journal of Cognitive Engineering and Decision Making*, 2 (3), 181-203.

Saleem JJ, Patterson ES, Militello L, Anders S, Falciglia M, Wissman J, Roth EM, Asch S. (2007). Impact of clinical reminder redesign on learnability, efficiency, usability, and workload for nursing personnel. *J Am Med Inform Assoc.*, 14, 632-640.

Endsley, M. R., Hoffman, R., Kaber, D. and Roth, E. (2007). Cognitive engineering and decision making: An overview and future course. *Journal of Cognitive Engineering and Decision Making*, 1(1), 1-21.

Roth, E., M., Scott, R., Deutsch, S., Kuper, S., Schmidt, V., Stilson, M. And Wampler, J. (2006). Evolvable work-centered support systems for command and control: Creating systems users can adapt to meet changing demands. *Ergonomics*, vol. 49, #7, 688-705.

Roth, E. M., Multer, J., and Raslear, T. (2006). Shared situation awareness as a contributor to high reliability performance in railroad operations. *Organization Studies*, 27(7), 967-987.

Pfautz, J. and Roth, E. M. (2006). Using cognitive engineering for system design and evaluation: A visualization aid for stability and support operations. *International Journal of Industrial Ergonomics*, 36 (5), 389-407.

Patterson, E.S., Woods, D.D., Roth, E.M., Cook, R.I., Wears, R.L. (2006). Three key levers for achieving resilience in medication delivery with information technology. *Journal of Patient Safety*. 2(1). 33-38.

Greenberg, C. C., Roth, E. M., Sheridan, T. B., Gandhi, T. K., Gustafson, M. L., Zinner, M. J., and Dierks, M. M. (2006). Making the operating room of the future safer. *The American Surgeon,* 72 (11), 1102-1108.

Christian, C. K., Gustafson, M. L., Roth, E. M., Sheridan, T. B., Gandhi, T. K., Dwyer, K., Zinner, M. J., and Dierks, M. M. (2006). A prospective study of patient safety in the operating room. *Surgery*, vol. 139, #2, pp 159-173.

Scott, R., Roth, E. M., Deutsch, S. E., Malchiodi, E., Kazmierczak, T., Eggleston, R. and Kuper, S. R., Whitaker, R. (2005). Work-Centered Support Systems: A Human-Centered Approach to Intelligent System Design. *IEEE Intelligent Systems*, vol. 20, issue 2, pp. 73-81.

Vicente, K. J., Mumaw, R. J., and Roth, E. M. (2004). Operator Monitoring in Complex Dynamic Work Environment: A Qualitative Cognitive Model Based on Field Observations. *Theoretical Issues in Ergonomic Science, **5**(5), 359-384.*

Roth, E. M., Christian, C. K., Gustafson, M., Sheridan, T. B., Dwyer, K., Gandhi, T. K., Zinner, M. J., and Dierks, M. M. (2004). Using field observations as a tool for discovery: Analyzing cognitive and collaborative demands in the operating room. *Cognition, Technology and Work, 6, 148 – 157.*

Patterson, E.S., Roth, E.M., Woods, D.D., Chow, R., Gomes, J.O. (2004). Handoff strategies in settings with high consequences for failure: lessons for health care operations. *International Journal for Quality in Health Care, 16(2)*, 1-8.

Dierks, M. M., Christian, C., K., Roth, E. M. and Sheridan, T. B. (2004). Healthcare safety: The impact of disabling 'safety" protocols. *IEEE Transactions on Systems, Man and Cybernetics. Part A: Systems and Humans. Special Issue on Using Field Studies to Understand Healthcare Technical Work*. 34 (6), 693-698.

Burns, C. M., Bisantz, A. M., and Roth, E. M. (2004). Lessons from a Comparison of Work Domain Models: Representational Choices and Their Implications. *Human Factors*, **46** (4), Winter 2004, pp 711-727.

Wreathall, J., Bley, D., Roth, E., Multer, J. and Raslear, T. (2003). Using an integrated process of data and modeling in Human Reliability Analysis. *Reliability Engineering and System Safety,* special issue on HRA Data Issues and Errors of Commission, 83, 221-228.

Bisantz, A. M., Roth, E. M., Brickman, B., Gosbee, L., Hettinger, L. and McKinney, J. (2003). Integrating Cognitive Analyses in a Large Scale System Design Process. *International Journal of Human Computer Studies,* 58, 177-206.

Woods, D. D., Patterson, E. S., and Roth, E. M. (2002). Can we ever escape from data overload? A cognitive systems diagnosis. *Cognition, Technology and Work*, *4* (1), 22-36.

Vicente, K. J., Roth, E. M., Mumaw, R. J. (2001). How do operators monitor a complex, dynamic work domain? The impact of control room technology. *International Journal of Human Computer Studies*, **54**, 831-856. Available online at: http://www.idealibrary.com

Patterson, E. S., Roth, E. M. and Woods, D. D. (2001). Predicting vulnerability in computer-supported inferential analysis under data overload. *Cognition, Technology and Work, 3, 224 – 237.*

Mumaw, R. J., Roth, E. M., Vicente, K. J. & Burns, C. M. (2000). There is more to monitoring a nuclear power plant than meets the eye. *Human Factors*, vol 42, # 1, 36-55.

Roth, E. M. (1998) Book Review of 'Human Factors in Nuclear Safety' (Neville Stanton, Ed.), *Ergonomics in Design*, Vol. 6, No. 3, p. 33.

Woods, D. D., Pople, H. E., & Roth, E. M. (1992). Cognitive Environment Simulation: A tool for modeling intention formation for human reliability analysis. *Nuclear Engineering and Design*, 134, 371-380.

Roth, E. M., Woods, D. D. & Pople, H. E. (1992). Cognitive Simulation as a tool for cognitive tasks analysis. *Ergonomics*, special issue on Cognitive Engineering, vol. 35, no. 10, 1163-1198.

Roth, E. M., Morgan, M. G., Fischhoff, B. , Lave, L., & Bostrom, A. (1990). What do we know about making risk comparisons? *Risk Analysis*., vol 10, no. 3., 375-387, 1990. Reprinted in Lofstedt, R. and Frewer, L. (Eds) *Risk and Modern Society.* London, UK: Earthscan Publications Ltd, 1998.

Woods, D. D., Roth, E. M. & Pople, H. Jr. (1988). Modeling human intention formation for human reliability assessment. *Reliability Engineering & System Safety*, *22*, 169-200.

Woods, D. D. & Roth, E. M. (1988). Aiding human performance: II. From cognitive analysis to support systems. *Le Travail Humain*, *51* (2), 139-171.

Woods, D. D. & Roth, E. M. (1988). Cognitive Engineering: Human Problem Solving with Tools. *Human Factors*, *30* (4), 415-430 (a).

Roth, E. M. & Woods, D. D. (1988). Aiding human performance: I. Cognitive analysis. *Le Travail Humain*, *51* (1), 39-64.

Roth, E. M., Bennett, K. & Woods, D. D. (1987). Human interaction with an 'intelligent' machine. *International Journal of Man-Machine Studies*, *27*, 479-525. (Reprinted in G. Mancini, D. D. Woods, & E. Hollnagel (Eds), Cognitive Engineering in Complex Dynamic Worlds, Academic Press, 1988.)

Roth, E. M. & Shoben, E. (1983). The effect of context on the structure of categories. *Cognitive Psychology*, 15 (3), 346-378.

Roth, E. M. & Mervis, C. B. (1983). Fuzzy set theory and class inclusion relation in semantic categories. *Journal of Verbal Learning and Verbal Behavior,* 22, 509-525.

Mervis, C. B. & Roth, E. M. (1981). The internal structure of basic and non-basic color categories. *Language*, 57, 384-405.

Roth, E. M. (1979). Facilitating insight in a reasoning task. *British Journal of Psychology*, *70*, 265-271.

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Roth, E. M. and Bisantz, A. M. (in preparation). Cognitive work analysis. In J. D. Lee and A. Kirlik (Eds). *The Oxford Handbook of Cognitive Engineering. Volume 2: Methods, Models and Technologies*. New York: Oxford University Press, Inc.

Roth, E. M. and Eggleston, R. G. (2010). Forging new evaluation paradigms: Beyond statistical generalization. In Patterson ES, Miller J. (Eds.) *Macrocognition Metrics and Scenarios: Design and Evaluation for Real-World Teams*. Ashgate Publishing. ISBN 978-0-7546-7578-5. (pp. 203-219).

Patterson, E. S., Roth, E. M., Woods, D. D. (2010). Facets of complexity in situated work. In Patterson ES, Miller J. (Eds.) *Macrocognition Metrics and Scenarios: Design and Evaluation for Real-World Teams*. Ashgate Publishing. ISBN 978-0-7546-7578-5. (pp. 221- 251).

Roth, E. M. (2009). Understanding Cognitive Strategies for Shared Situation Awareness Across a Distributed System: An Example of Strategies Analysis. In Ann M. Bisantz and C. M. Burns (Eds) *Applications of Cognitive Work Analysis*. Boca Raton, FL: CRC Press, Taylor & Francis Group. 129 - 147

Bisantz, A. and Roth, E. M. (2008). Analysis of Cognitive Work. In Deborah A. Boehm-Davis (Ed.) *Reviews of Human Factors and Ergonomics Volume 3*. Santa Monica, CA: Human Factors and Ergonomics Society. 1-43.

Roth, E. M. and Patterson, E. S. (2005). Using observational study as a tool for discovery: Uncovering cognitive and collaborative demands and adaptive strategies**.** In Montgomery, H., Lipshitz, R., & Brehmer, B. (Eds.) *How professionals make decisions*. (pp. 379 – 393) Mahwah, NJ: Lawrence Erlbaum Associates.

O'Hara, J. M. and Roth, E. M. (2005). Operational concepts, teamwork, and technology in commercial nuclear power stations. In Clint Bowers, Eduardo Salas and Florian Jentsch (Eds) *Creating High-*

Tech Teams: Practical guidance on work performance and technology. (pp. 139-159).Washington, D. C.: American Psychological Association.

Elm, W. C., Roth, E. M., Potter, S. S., Gualtieri, J. W. and Easter, J. R. (2005). Applied Cognitive Work Analysis (ACWA). In Neville Stanton, Alan Hedge, Karel Brookhuis, Eduardo Salas and Hal Hendrick (Eds.) *Handbook of Human Factors and Ergonomics Methods*. (pp. 36-1 – 36-9) Boca Raton, FL: CRC Press.

Elm, W.C., Potter, S.S., Gualtieri, J.W., Roth, E.M., & Easter, J.R. (2003). Applied Cognitive Work Analysis: A pragmatic Methodology for Designing Revolutionary Cognitive Affordances. In E. Hollnagel (Ed) *Handbook for Cognitive Task Design*. (pp. 357- 382). London: Lawrence Erlbaum Associates, Inc.

Roth, E. M., Patterson, E.S. & Mumaw, R. J. (2002). Cognitive Engineering: Issues in User-Centered System Design. In J. J. Marciniak (Ed.), *Encyclopedia of Software Engineering*, 2nd Edition (pp 163 – 179). New York: Wiley-Interscience, John Wiley & Sons.

Potter, S. S., Elm, W. C., Roth, E. M., Gualtieri, and J., Easter, J., (2002). Bridging the Gap between Cognitive Analysis and Effective Decision Aiding. In M. D. McNeese and M. A. Vidulich (Eds) *State of the Art Report (SOAR): Cognitive Systems Engineering in Military Aviation Environments: Avoiding Cogminutia Fragmentosa!* Wright-Patterson AFB, OH: Human Systems Information Analysis Center. (pp 137- 168). Available online at: http://iac.dtic.mil/hsiac/.

Roth, E. M., Lin, L., Kerch, S., Kenney, S. J., & Sugibayashi, N. (2001) Designing a first-of-a kind group view display for team decision making: a case study. In Salas, E. & Klein, G. (Eds) *Linking Expertise and Naturalistic Decision Making* (pp. 113-135*)*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Potter, S. S., Roth, E. M., Woods, D. D. & Elm, W. (2000). Bootstrapping multiple converging cognitive task analysis techniques for system design. In J. M. Schraagen, S. F. Chipman & V. L. Shalin (Eds.) *Cognitive Task Analysis* (pp. 317-340). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Roth, E. M., Malin, J. T. , & Schreckenghost, D. L. (1997). Paradigms for Intelligent Interface Design. In M. Helander, T. Landauer & P. Prabhu (Eds.) *Handbook of Human-Computer Interaction* (2nd edition), Amsterdam: North-Holland. (pp. 1177-1201).

Roth, E. M. (1997). Analyzing Decision-Making in Process Control: Multi-disciplinary approaches to understanding and aiding human performance in complex tasks. In C. Zsambok and G. Klein (Eds.) *Naturalistic Decision-Making,* Lawrence Erlbaum Associates.

Roth, E. M. (1997). Analysis of Decision-Making in Nuclear Power Plant Emergencies: An investigation of aided decision-making. In C. Zsambok and G. Klein (Eds.) *Naturalistic Decision-Making,* Lawrence Erlbaum Associates.

Woods, D. D. & Roth, E. M. (1995). Symbolic AI-Based Computer Simulations as Tools for Investigating the Dynamics of Joint Cognitive Systems. In J-M. Hoc, P. C. Cacciabue, B. and E. Hollnagel, editors, *Simulation of Cognition in Dynamic Environments*, Hillsdale, NJ: Lawrence Erlbaum Associates.

Roth, E. M. & Mumaw, R. J. (1994). Cognitive Engineering: Issues in User-Centered System Design. In J. J. Marciniak (Ed.), *Encyclopedia of Software Engineering*. New York: Wiley-Interscience, John Wiley & Sons, 110-123.

Stubler, W. F., Roth, E. M., & Mumaw, R. J. (1993). Integrating Verification and Validation with the Design of Complex Man-Machine Systems. In Wise, J. A., Hopkin, V. D., & Stager, P. (Eds), *Verification and Validation of Complex Systems*: Human Factors Issues (Proceedings of the

NATO Advanced Study Institute: Verification and Validation of Complex and Integrated Human-Machine Systems). NATO ASI Series, Berlin: Springer-Verlag, 159-172.

Roth, E. M., Woods, D. D., & Pople, H. Jr. (1991). Cognitive Environment Simulation: A tool for modeling operator cognitive performance during emergencies. In George Apostolakis (Ed.) *Probabilistic Safety Assessment and Management :(Volume 2)*. New York: Elsevier Science Publishing Co., Inc., pp. 959-964. (Proceedings of the International Conference on Probabilistic Safety Assessment and Management held February 4-7, 1991 in Beverly Hills, Ca.)

Woods, D. D., Roth, E. M. & Bennett, K. B. (1990). Explorations in Joint Human-Machine Cognitive Systems. In W. Zachary & S. Robertson (Eds.), *Cognition, Computing and Cooperation.* Norwood, NJ: Ablex Publishing, 123-158.

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Conference Proceedings

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