

# JOYCE MA

## EDUCATION

***Ph.D., Learning Sciences, Northwestern University*** **1996-2001**

June 2001

Dissertation Title: *Perceptions of Feedback Systems - Learning an Expert Model through Comparison and Design*

Committee Members: Kenneth D. Forbus (advisor), Dedre Gentner, Bruce L. Sherin

***M.S. and B.S., Electrical Engineering and Computer Science, MIT*** **1985-1990**

June 1990

Dissertation Title: *The Effects of Probe Correction Error on the Planar Near-Field Calibration of a Beacon Tracking Antenna*

Advisor: J.A. Kong

## PROFESSIONAL INTERESTS

- To develop innovative learning environments as informed by cognitive research
- To understand how people make sense of scientific and technical domains

## SELECTED PROFESSIONAL EXPERIENCE

### Visitor Research and Evaluation Department, The Exploratorium

***Senior Researcher*** **2001-Present**

- Design and implement research and evaluation studies. Studies use a variety of methods such as real-time observations, uncued and cued interviews, computer logging, and video recordings to collect qualitative and quantitative data. Studies include
  - Conducting formative evaluation studies on exhibits and public programs to iteratively improve the offerings and the visitors' experience at the Exploratorium.
  - Identifying visitors' preconceptions of and familiarity with topics of interest in front-end studies that inform planning and grant applications.
  - Characterizing new audience(s) for offsite exhibit collections.
  - Determining people's movement and affect in a new section of the Exploratorium. Results are used to inform iterative space design.
- Collaborate with exhibit developers, scientists, artists, and project leads to define and refine our goals and strategies for development projects: Microscope Imaging Station, Mind, and Outdoor Exploratorium.
- Work with project team members to design studies that inform development decisions.
- Act as the visitors' advocate on all project teams.
- Experiment with and develop new tools to collect and analyze data.
- Train and oversee assistant evaluators in data collection and analysis.
- Report on research and evaluation findings to project teams, funding agencies, and research communities.
- Conceive and write research and evaluation grant proposals.
- Prototype new exhibits.

**The Qualitative Reasoning Group, Northwestern University*****Research Assistant******1997-2001***

- Analyzed students' changing mental models of feedback control systems as they worked with the Articulate Virtual Laboratory (AVL), a computer-based learning environment for science and engineering education that allows students to build and simulate systems. Defined experimental set-up. Formulated quantitative and qualitative pre and post measures for student learning. Performed clinical interviews with high school students. Identified a progression of mental models and performed verbal protocol analyses on students' reasoning through systems. Conducted microgenetic analysis of student work on the computer.
- Conducted field studies on how the AVL software and curriculum were used in the classroom. Observed student interactions with the software and with each other in high school classrooms and interviewed teachers about their use of technology in the classroom.
- Prototyped AVL software. Rapid-prototyped GUI in Macromedia Director 6.0, designed and implemented a qualitative tutoring system in LISP, and specified the underlying mathematical models.
- Designed curriculum to teach feedback systems to high school students using AVL software. Curriculum emphasizes learning by doing and problem solving with scaffolding to help students' progress toward building more sophisticated system models.

**Bell Communications Research*****Research Scientist – Applied Research******1995-1996***

- Prototyped element management system for broadband telecommunication systems.

***Member of Technical Staff - Broadband Technologies Group******1990-1995***

- Formulated object-oriented information model for operations communications in broadband access systems for Bell Operating Companies.
- Defined and analyzed alternative backbone architectures for video transport. Identified technical and operational issues for each architecture. Performed cost analyses comparing candidate architectures.
- Led team in assessing intra-office operations communications architectures for Synchronous Optical Network (SONET).
- Mentored employees.

**Hughes Aircraft Company*****Systems Engineer-Space and Communications Group******Summers 1987, 1988, 1989***

- Performed theoretical and simulation analyses on the antenna and communication subsystems for the INTELSAT-VI communication satellite and the Tracking and Data Relay Satellite System (TDRSS).

**TEACHING EXPERIENCE*****Teaching Assistant, Northwestern University******Fall 2000***

Knowledge Representation for the Learning Sciences, a core graduate level class as taught by Prof. Bruce Sherin that introduced Ph.D. and Masters students to the cognitive science perspective(s) on the nature of knowledge and knowledge change as posited in theory and as examined through different methodologies.

**Teaching Assistant, Northwestern University****Winter 1999**

Learning and Understanding - A Cognitive Science Approach, an undergraduate class for students in Learning and Organizational Change that presented an overview of different theories on how people think and learn with a focus on pedagogical tools that foster learning.

**RELATED COMMUNITY ACTIVITIES****National Science Foundation****2006**

- Reviewed research proposals for NSF funding.

**Evanston Township High School****1999**

- Worked with team of teachers and business leaders to restructure high school's electronics curriculum in order to better promote student interest and link students' classroom experiences to their professional futures.

**Northwestern University****1998-99**

- Coordinated the Institute for the Learning Sciences (ILS) Friday Forum Speaker Series (1998-99) that invited researchers in cognitive science, computer science, artificial intelligence, and educational theory to discuss their work with the Northwestern community.
- Organized graduate student orientation.

**Liberty Science Center****1996**

- As Invention Floor Guide, explained hands-on exhibits, helped visitors build with Invention Floor material and motivated participation.

**Asian American for Affirmative Action Tutoring Outreach****1993- 1996**

- Co-founded, ran and tutored in community outreach program

**Big Sister Volunteer, Cambridge Big Brother / Big Sister Program****1987****PAPERS AND PRESENTATIONS****On Informal Learning**

Ma, J. (2008). Self-Reflection in the Exploratorium's Mind Collection. Presented at the 2008 ASTC Annual Conference, Philadelphia, PA, October 18-21.

Ma, J. (2007). New Tools for Tracking and Timing. Presented at the 2007 Visitor Studies Conference, Ottawa, Ontario, Canada, July 17-21.

Hsi, S., Ma, J., Van Allen, A., Sikes, K., & Alexander, M. (2007). From Guerrilla Methods to Structured Evaluations: Examples of Formative Web Design. Presented at the 2007 Museums and the Web Conference, San Francisco, CA, April 11-14.

Ma, J. (2005). Front-End Evaluation: Getting at Behavior. Presented at the 2005 ASTC Annual Conference, Richmond, VA, October 15-18.

Yu, K., Frazier, J., Libsch, J., Ma J., Wong, J., & Carlson, C. (2004). The Microscope Imaging Station: A Dissemination Tool for Biomedical and Biological Research. Presented at the 44th Annual Meeting of the American Society for Cell Biology, Washington D.C., December 4-8.

Yu, K., Ma, J., Urashka, M., & Carlson, C. (2003). Out of the Ivory Tower: Adapting a research grade microscope for use by the general public. Presented at the 43rd Annual Meeting of the American Society for Cell Biology, San Francisco, CA, December 7-13.

Yu, K., Urashka, M., Ma, J., & Carlson, C. (2002). An Experimental Project: Development of a Microscope Imaging Station. Presented at the 42nd Annual Meeting of the American Society for Cell Biology, San Francisco, CA, December 14-18.

Ma, J. (2002) Task Analysis in Formative Evaluation – A Case Study. Presented at the Visitor Studies Conference, Cody, WY, August 13-17.

### **On Learning Environments and Student Understanding**

Ma, J., *Perceptions of Feedback Systems: Learning an Expert Model through Comparison and Design*, PhD Dissertation, Northwestern University, 2001.

Ma, J. (2000). Using Analogies Guided by Relational Terms to Learn about Dynamic Systems. Paper presented at the National Association for Research on Science Teaching Conference, New Orleans, LA.

Ma, J. (1999). A Case Study of Student Reasoning About Feedback Control In a Computer-Based Learning Environment. Paper presented at the Frontiers in Education Conference, San Juan, PR.

Ma, J., Baher, J.L., & Ureel, L. C. (1999). Supporting Student Design Work in Articulate Virtual Laboratories. Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Canada.

Ma, J. (1998). A Computer-Based Learning Environment for Teaching High-School Students Feedback Control through Design. Paper presented at the Frontiers in Education Conference, Tempe, AZ.

### **On Telecommunications**

Ma, J. (1995). *Object-Oriented Information Model for Hybrid Fiber Coax Systems* (Bellcore Internal Memorandum IM-514). Red Bank, NJ: Bell Communications Research.

Kutz, R., Milton, J., and Ma, J. (1995). *SONET Architectures for Video Transport* (Bellcore Technical Memorandum TM-24893). Red Bank, NJ: Bell Communications Research.

Ma, J. (1995). *Transmission of Asymmetric Video on SONET - Realizing SONET Overhead Functions* (Bellcore Technical Memorandum TM-24652). Red Bank, NJ: Bell Communications Research.

Ma, J., Kane-Esrig, Y., Kimmins, J., Reid, R.L., Siceloff, W., and Su, P. (1993). *Intra-Office Network for SONET Operations Communications – LANs* (Bellcore Technical Memorandum TM-TSV-023441). Red Bank, NJ: Bell Communications Research.

Ma, J. (1995). "Network Operations Economics for Virtual Central Offices," Bellcore Technical Memorandum, TM-NWT-021537). Red Bank, NJ: Bell Communications Research.

Ma, J. (1991). *Transport Surveillance of TDMA-Based, Point-to-Multipoint Fiber In The Loop Systems* (Bellcore Technical Memorandum TM-NWT-018700). Red Bank, NJ: Bell Communications Research.

### **On Antenna Systems and Satellite Communications**

Ma, J. (1990). *The Effects of Probe Correction Error on the Planar Near-Field Calibration of a Beacon Tracking Antenna*, Unpublished Bachelor of Science and Master of Science thesis, Massachusetts Institute of Technology, Cambridge, MA.