

JOYCE MA

EDUCATION

Ph.D., Learning Sciences, Northwestern University

June 2001

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

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

M.S. and B.S., Electrical Engineering and Computer Science, MIT

June 1990

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

Committee Members: J.A. Kong (advisor) and Josephine Stiles

PROFESSIONAL EXPERIENCE

Senior Researcher

2001-Present

Visitor Research and Evaluation Department, Exploratorium

- Formulate, implement and supervise visitor research and evaluation studies for small (\$10K) to large-scale (\$2.5M) projects. Studies use a variety of methods including collecting and analyzing real-time observations, interviews, computer logs, audio and video recordings, and social media datasets. Studies have
 - defined design guidelines for supporting observation, metacognition, and inquiry at exhibits.
 - determined conceptual foci of exhibit collections based on visitors' interests and prior knowledge.
 - improved usability, accessibility and comprehension of exhibits and galleries.
 - informed museum's environmental design and layout.
- Lead research and development teams in adapting scientific tools (e.g., interactive visualizations and bioimaging) for museum visitors (1322828 for \$1.6M, 1514612 for \$299K) and in investigating new technologies (e.g., indoor positioning systems) in visitor studies (1346664 for \$296K).
- Conceive and write winning grant proposals (e.g., DRL-1011084, 1322828, 1514612).
- Collaborate with developers, scientists, artists, and project leads to define project goals and strategies.
- Train, mentor and oversee evaluators in data collection and analysis.
- Report on research and evaluation findings to project teams, funding agencies, and research communities.
- Prototype new visitor experiences and exhibits.

Evaluation Consultant

2001-2010

Oakland Museum of California

- Formulated and executed the formative evaluation plan for *Coming to California*, the complete renovation of the museum's history gallery. Work led to incorporating evaluation into the museum's prototyping process.

Inquirium

- Designed and conducted evaluation for *Take a Stand*, an interactive social immersive exhibit, developed for the *Illinois Holocaust Museum and Education Center* that encourages young visitors to

make decisions and take actions in a simulated world. Work on early exhibit prototypes led to guidelines for facilitating student interactions and sense-making inside the virtual reality exhibit. Subsequent formative evaluation produced suggestions for technology and pedagogy improvements.

- Performed heuristic evaluation for an early desktop prototype of the STEP Literacy Assessment Visualizer, used to track and analyze literacy assessment. STEP is now used in the Chicago Public Schools system.

Research Assistant

1997-2001

The Qualitative Reasoning Group, Northwestern University

- Prototyped Articulate Virtual Laboratory (AVL), a computer-based learning environment for science and engineering education that allows students to build and simulate systems. Rapid-prototyped GUI, designed and implemented a qualitative tutoring system in LISP, and specified the underlying mathematical models.
- Characterized students' changing mental models of feedback control systems as they worked with AVL. Work included defining experimental set-up, formulating quantitative and qualitative pre and post measures for student learning, conducting clinical interviews with students, performing verbal protocol analysis, and conducting microgenetic analysis of student work on the computer.
- 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.
- Conducted field studies on how the AVL software and curriculum were used in the classroom with students and teachers.

Research Scientist

1995-1996

Applied Research, Bell Communications Research

- Prototyped element management system for broadband telecommunication systems.

Member of Technical Staff

1990-1995

Broadband Technologies Group, Bell Communications Research

- Defined and analyzed alternative backbone architectures for video transport. Identified technical and operational issues for each architecture. Performed cost analyses comparing candidate architectures. Results were used to aid clients in making decisions about appropriate architecture to deploy.
- Formulated object-oriented information model for operations communications in broadband access systems.
- Led team in assessing intra-office operations communications architectures.
- Mentored employees.

Systems Engineer

1987-1990

Space and Communications Group, Hughes Aircraft Company

- Conducted theoretical and simulation analyses on the antenna and communication subsystems.
- Analyzed racing strategies for SunRaycer, GM's solar powered car.
- Coordinated engineering changes for communications subsystems.

RELATED COMMUNITY ACTIVITIES

Golden Gate Exhibition Project

2009-2016

- Advised on outdoor exhibits for the Golden Gate Bridge.

Audience Engagement in Citizen Science Investigation**2010-2012**

- Advised on the research design of a citizen science project for Adler Planetarium, Johns Hopkins University, and Southern Illinois University.

Evanston Township High School**1999**

- Worked with team of teachers and business leaders to restructure high school's electronics curriculum 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

HONORS

- AAAS's International Science and Engineering Visualization Challenge Winner (2008)
- Visitor Studies Association's April Award Recipient for Most Promising Newcomer (2002)
- Northwestern University's Cognitive Science Fellow (1999)
- Hughes Aircraft Company Graduate Fellow (1989-1990)
- Tau Beta Pi Member (1988 induction)

SELECTED PAPERS AND PRESENTATIONS

On Informal Learning

- Ma, J. (2016, July). *Using sequence analysis to understand visitor behavior*. Presented at the 2016 Visitor Studies Conference, Boston, Massachusetts.
- Hsueh, C., Jacqueline Chu, Ma, K., Ma, J., & Frazier, J. (2016). Fostering Comparisons: Designing an Interactive Exhibit that Visualizes Marine Animal Behaviors. In *IEEE Pacific Visualization Symposium* (pp. 259–263).
- Ma, J., Sindorf, L., Liao, I., & Frazier, J. (2015). Using a Tangible versus a Multi-touch Graphical User Interface to Support Data Exploration at a Museum Exhibit. In *Proceedings of the Ninth International Conference on Tangible, Embedded and Embodied Interaction* (pp. 33–40).
- Ma, J. (2014, July). *Using an indoor positioning system to automate visitor tracking*. Presented at the 2014 Visitor Studies Conference, Albuquerque, New Mexico.
- Ma, J. (2013). *Engaging Museum Visitors with Scientific Data through Visualization: A Comparison of Three Strategies*. Paper presented at the annual meeting of the 2013 American Educational Research Association, San Francisco, California.
- Ma, J., Liao, I., Ma, K. L., & Frazier, J. (2012). Living Liquid: Design and Evaluation of an Exploratory Visualization Tool for Museum Visitors. *IEEE Transactions on Visualization and Computer Graphics*, 18(12), 2799-2808.
- Ma, J. (2012). Listening for Self-Reflective Talk in Visitors' Conversations: A Case Study of the Exploratorium's Mind Collection. *Visitor Studies*, 15(2), 136-156.
- Ma, J. (2011, July). *Mining User-Generated Flickr Data for Front-End Evaluation*. Presented at the 2011 Visitor Studies Conference, Chicago, Illinois.
- Ma, J. (2011, July). *Rapid Iterative Testing and Evaluation in Formative Evaluation at the Exploratorium*. Presented at the 2011 Visitor Studies Conference, Chicago, Illinois.
- Ma, J. & Hido, N. (2010, November). *Science Learning in Designed Settings*. Presented at the National Communication Association 96th Annual Convention, San Francisco, CA.
- Ma, J. (2010). Front-end studies on visual representations of the nanoscale. *Ecsite Newsletter*, 84, 4-5.
- Brown, M., Loh, B., & Ma, J. (2010, July). *Take a Stand: Creating an immersive social experience with people tracking, 3D game technology, and interactive storytelling*. Presented at the 9th International Conference of the Learning Sciences, Chicago, IL.
- Ma, J. & Dancu, T. (2010). Evaluating Outdoor Exploratorium Exhibits. *Outdoor Exploratorium - experiments in noticing and understanding*. San Francisco, Exploratorium.
- Ma, J. (2008, October). *Self-Reflection in the Exploratorium's Mind collection*. Presented at the 2008 ASTC Annual Conference, Philadelphia, PA.
- Ma, J. (2007, July). *New tools for tracking and timing*. Presented at the 2007 Visitor Studies Conference, Ottawa, Ontario, Canada.
- Hsi, S., Ma, J., Van Allen, A., Sikes, K., & Alexander, M. (2007). From 'Guerrilla' Methods to Structured Evaluations: Examples of Formative Web Design from the Exploratorium's Evidence and Mind Projects, in J. Trant and D. Bearman (eds.). *Museums and the Web 2007: Proceedings*, Toronto: Archives & Museum Informatics, published March 1, 2007 Consulted September 26, 2010.
<http://www.archimuse.com/mw2007/papers/hsi/hsi.html>

Ma, J. (2005, October). *Formative evaluation: Informing the iterative development of interactive microscopes*. Presented at the 2005 ASTC Annual Conference, Richmond, VA.

Ma, J. (2005, October). *Front-end evaluation: Getting at behavior*. Presented at the 2005 ASTC Annual Conference, Richmond, VA.

Yu, K., Frazier, J., Libsch, J., Ma J., Wong, J., & Carlson, C. (2004, December). *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.

Yu, K., Ma, J., Urashka, M., & Carlson, C. (2003, December). *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.

Yu, K., Urashka, M., Ma, J., & Carlson, C. (2002, December). *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.

Ma, J. (2002, August). *Task analysis in formative evaluation – A case study*. Presented at the Visitor Studies Conference, Cody, WY.

On Learning Environments and Student Understanding

Ma, J. (2001). Perceptions of feedback systems: Learning an expert model through comparison and design. Unpublished doctoral dissertation, Northwestern University, Evanston, IL.

Ma, J. (2000, April). *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, November). *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, April). *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, November). *A computer-based learning environment for teaching high-school students feedback control through design*. Paper presented at the Frontiers in Education Conference, Tempe, AZ.