CHARLES RICH

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Professional Interests

Artificial Intelligence: knowledge representation, reasoning, planning, learning, engineering applications, intelligent tutoring, autonomous agents, natural language processing.

Interactive Media and Game Development: multi-user virtual environments, serious games, authoring tools, artificial intelligence.

Human-Robot Interaction: collaboration, engagement, gesture, gaze, emotional expression.

Education

Ph.D. 1980 (Artificial Intelligence), Electrical Engineering and Computer Science Dept., Massachusetts Institute of Technology. Thesis: *Inspection Methods in Programming*. Supervisor: G.J. Sussman. Minor: philosophy & psychology of language.

S.M. 1975, Electrical Engineering and Computer Science Dept., Massachusetts Institute of Technology. Thesis: *Initial Report on a Lisp Programmer's Apprentice*. Supervisor: G.J. Sussman.

B.A.Sc. 1973, Department of Engineering Science, University of Toronto. Specialization: Computer Science. Thesis: *Design and Implementation of the Instruction Set for a Computer of Student Construction*.

Employment History

2007–present, *Professor*, Computer Science Dept., and *Associated Faculty*, Interactive Media and Game Development Program, Robotics Engineering Program, Learning Sciences & Technology Program, Worcester Polytechnic Institute

2006–2007, *Associate Director, Research Lab.*, Mitsubishi Electric Research Laboratories

2002–2007, *Distinguished Research Scientist*, Mitsubishi Electric Research Laboratories

1991–2002, *Senior Research Scientist*, Mitsubishi Electric Research Laboratories (founder)

1991–2004, *Research Affiliate*, M.I.T. Artificial Intelligence Laboratory.

1984–1991, *Principal Research Scientist*, M.I.T. Artificial Intelligence Laboratory.

1980–1984, *Research Scientist*, M.I.T. Artificial Intelligence Laboratory.

Honors

Fellow, Association for the Advancement of Artificial Intelligence, 1992:
"For pioneering contributions to research at the intersection of artificial intelligence and software engineering."

Senior Member, Institute of Electrical and Electronic Engineers, 1990.

Postgraduate Scholarship, National Research Council of Canada, 1974-1978.

Admissions Scholarship, Mary H. Beatty Scholarship, U. of Toronto, 1969-1972.

Patents

D. Schwenke, B. Harsham, B. Schmidt-Nielsen, C. Rich and C. Lee. *Push-to-Talk Wireless Telephony*, U.S. Patent filed March, 2005.

C. Rich, N. Lesh, C. Sidner, A. Garland and S. Booth. *System for Configuring and Controlling Home Appliances*, U.S. Patent filed August, 2004.

C. Rich and C. Sidner. *System with Collaborative Interface Agent*, U.S. Patent 5,819,243 issued Oct. 6, 1998.

C. Rich. *Multiple User/Agent Window Control*, U.S. Patent 5,796,396 issued Aug. 18, 1998.

Books

C. Rich and R. C. Waters. *The Programmer's Apprentice*. Addison-Wesley, Reading, MA and ACM Press, Baltimore, MD, 1990.

C. Rich and R. C. Waters, editors. *Readings in Artificial Intelligence and Software Engineering*. Morgan Kaufmann, San Francisco, CA, 1986.

Book Chapters

C. Rich and R. C. Waters. Approaches to automatic programming. In M. C. Yovits, editor, *Advances in Computers, Volume 37*, pages 1–57. Academic Press, Boston, MA, 1993. Also published as MERL Technical Report 92-04.

C. Rich and R. C. Waters. Formalizing reusable software components in the Programmer's Apprentice. In T. Biggerstaff and A. Perlis, editors, *Software Reusability, Volume II*, pages 313–344. Addison-Wesley, Reading, MA, 1989. Also published as MIT AI Memo 954.

C. Rich and R. C. Waters. Artificial intelligence and software engineering. In W.E.L. Grimson and R. S. Patil, editors, *AI in the 1980's and Beyond: An MIT Survey*, pages 109–154. MIT Press, Cambridge, MA, 1987.

C. Green, D. Luckam, R. Balzer, T. Cheatham, and C. Rich. Report on a knowledge-based software assistant. In *C. Rich and R. C. Waters, editors,* Readings in Artificial Intelligence and Software Engineering*, Morgan Kaufmann, San Mateo, CA, 1986*, pages 377–428. Morgan Kaufmann, San Francisco, CA, 1986. From Technical Report 195, Rome Air Development Center, 1983.

C. Rich. Programming apprentices. In P. H. Winston and K. Prendergast, editors, *The AI Business: The Commercial Uses of Artificial Intelligence*, pages 121–132. MIT Press, Cambridge, MA, 1984.

C. Rich and H. E. Shrobe. Design of a Programmer's Apprentice. In Winston and Brown, editors, *Artificial Intelligence: An MIT Perspective*. MIT Press, Cambridge, MA, 1979.

Refereed Journal and Magazine Articles

C. Rich. Building task-based user interfaces with ANSI/CEA-2018. *IEEE Computer*, 42(8):20–27, August 2009.

C. Rich and C. Sidner. Robots and avatars as hosts, advisors, companions and jesters. *AI Magazine*, 30(1):29–42, 2009.

C. Rich and C. Sidner. DiamondHelp: A generic collaborative task guidance system. *AI Magazine*, 28(2), Summer 2007. Special Issue on Mixed-Initiative Assistants.

C. Rich, C. Sidner, N. Lesh, A. Garland, S. Booth, and M. Chimani. DiamondHelp: A new interaction design for networked home appliances. *Personal and Ubiquitous Computing*, 10(2–3):187–190, 2006.

C. L. Sidner, C. Lee, C. Kidd, N. Lesh, and C. Rich. Explorations in engagement for humans and robots. *Artificial Intelligence*, 166(1-2):104–164, 2005.

C. Rich, C. Sidner, and N. Lesh. Collagen: Applying collaborative discourse theory to human-computer interaction. *AI Magazine*, 22(4):15–25, 2001. Special Issue on Intelligent User Interfaces.

N. Lesh, J. Marks, C. Rich, and C. Sidner. "Man-computer symbiosis" revisited: Achieving natural communication and collaboration with computers. *IEICE Transactions Inf. & Syst.*, E87-D(6):1290–1298, June 2004.

C. Rich and C. Sidner. Collagen: A collaboration manager for software interface agents. *User Modeling and User-Adapted Interaction*, 8(3/4):315–350, 1998. Reprinted in S. Haller, S. McRoy and A. Kobsa, editors, *Computational Models of Mixed-Initiative Interaction*, Kluwer Academic, Norwell, MA, 1999, pp. 149–184.

D. Anderson et al. Building multiuser interactive multimedia environments at MERL. *IEEE MultiMedia*, 2(4):77–82, Winter 1995.

C. Rich. Negotiation in collaborative activity: An implementation experiment. *Knowledge-Based Systems*, 7(4):268–270, December 1994.

C. Rich et al. Demonstration of an interactive multimedia environment. *IEEE Computer*, 27(12):15–22, December 1994.

C. Rich et al. An animated on-line community with artificial agents. *IEEE MultiMedia*, 1(4):32–42, Winter 1994.

C. Rich and R. C. Waters. Knowledge-intensive software engineering tools. *IEEE Trans. Knowledge and Data Engineering*, 4(5):424–430, October 1992. Also published as MERL Technical Report 91-03. Invited paper.

C. Rich and Y. A. Feldman. Seven layers of knowledge representation and reasoning in support of software development. *IEEE Trans. Software Engineering*, 18(6):451–469, June 1992. Special Issue on Knowledge Representation and Reasoning in Software Development. Also published as MERL Technical Report 92-01.

Y. A. Feldman and C. Rich. Pattern-directed invocation with changing equations. *J. Automated Reasoning*, 7:403–433, 1991.

C. Rich and L. M. Wills. Recognizing a program's design: A graph-parsing approach. *IEEE Software*, 7(1):82–89, January 1990. Reprinted in P. H. Winston with S. A. Shellard, editors, *Artificial Intelligence at MIT: Expanding Frontiers*, pages 196–215, MIT Press, Cambridge, MA, 1990, in R. Arnold, editor, *Software Reengineering,* IEEE Computer Society Press, Los Alamitos, CA, 1992, and in P. Hall and R. Hudson, editors, *Reuse and Reverse Engineering*, Unicom Seminars, Uxbridge, England, 1994.

C. Rich and R. C. Waters. The Programmer's Apprentice: A research overview. *IEEE Computer*, 21(11):10–25, November 1988. Reprinted in D. Partridge, editor, *Artificial Intelligence and Software Engineering*, pages 155–182, Ablex, Norwood, NJ, 1991, and in P. H. Winston with S. A. Shellard, editors, *Artificial Intelligence at MIT: Expanding Frontiers*, pages 166–195, MIT Press, Cambridge, MA, 1990.

C. Rich and R. C. Waters. Automatic programming: Myths and prospects. *IEEE Computer*, 21(8):40–51, August 1988. Reprinted by Datapro Management of Applications Software Service, Delran, NJ, (in press) and in translation in Y. Ohno and M. Harada, editors, *Automatic Programming Handbook*, pages 41–55, Ohmsha Ltd., Tokyo, Japan, 1989.

C. Rich and H. E. Shrobe. Initial report on a LISP Programmer's Apprentice. *IEEE Trans. Software Engineering*, 4(6):456–467, November 1978. Reprinted in D. Barstow, E. Sandewall, and H. Shrobe, editors, *Interactive Programming Environments*, pages 443–463, McGraw-Hill, New York, NY, 1984.

Refereed Conference Papers

A. Mohseni-Kabir, S. Chernova, C. Rich, and V. Wu. What's in a primitive? Identifying reusable motion trajectories in narrated demonstrations. In *IEEE Int. Symp. on Robot and Human Interactive Communication (RO-MAN)*, New York, NY, August 2016. (Nominated for Best Paper)

M. Shayganfar, C. Rich, and C. Sidner. An overview of affective motivational collaboration theory. In *AAAI Workshop on Symbiotic Cognitive Systems*, Phoenix, AZ, 2016.

M. Shayganfar, C. Rich, and C. Sidner. An overview of appraisal in human-robot collaboration. In *Autonomous Agents and Multi-Agent Systems*, Singapore, 2016. (Extended Abstract).

M. Shayganfar, C. Rich, and C. Sidner. Impact of affective appraisal on collaborative goal management: My robot shares my worries. In *Proc. ACM/IEEE Int. Conf. on Human-Robot Interaction*, Christchurch, NZ, 2016. (Late Breaking Results).

A. Mohseni-Kabir, S. Chernova, and C. Rich. Identifying reusable primitives in narrated demonstrations. In *Proc ACM/IEEE Int. Conf. on Human-Robot Interaction*, Christchurch, NZ, 2016. (Late Breaking Results).

L. Ould Ouali, C. Rich, and N. Sabouret. Plan recovery in reactive HTNs using symbolic planning. In *Artificial General Intelligence*, Berlin, Germany, July 2015.

C. Sidner et al. A robotic companion for social support of isolated older adults. In *Proc. ACM Conf. on Computer Human Interaction (Video Competition)*, 2015.

A. Mohseni-Kabir, C. Rich, S. Chernova, C. Sidner, and D. Miller. Interactive hierarchical task learning from a single demonstration. In *Proc. ACM/IEEE Int. Conf. on Human-Robot Interaction*, Portland, OR, 2015.

M. Behrooz, C. Rich, and C. Sidner. On the sociability of a game-playing agent: A software framework and empirical study. In *Int. Conf. on Intelligent Virtual Agents*, Boston, MA, 2014.

B. Nooraei, C. Rich, and C. Sidner. A real-time architecture for embodied conversational agents: Beyond turn-taking. In *Proc. 7th Int. Conf. on Advances in Computer-Human Interaction*, Barcelona, Spain, 2014.

A. Mohseni-Kabir, C. Rich, and S. Chernova. Learning partial ordering constraints from a single demonstration. In *Proc. ACM/IEEE Conf. on Human-Robot Interaction*, Bielefeld, Germany, 2014.

C. Sidner, C. Rich, M. Shayganfar, M. Behrooz, T. Bickmore, L. Ring, and Z. Zhang. Robotic and virtual companions for isolated older adults. In *AAAI Fall Symposium on Artificial Intelligence and Human-Robot Interaction*, Washington, DC, 2015.

C. Sidner et al. Demonstration of an always-on companion for isolated older adults. In *4th Annual SIGdial Meeting on Discourse and Dialogue*, Metz, France, 2013.

W. Coon, C. Rich, and C. Sidner. Activity planning for long-term relationships. In *Proc. Int. Conf. on Intelligent Virtual Agents*, Edinburgh, UK, 2013.

M. Shayganfar, C. Rich, and C. Sidner. A design methodology for expressing emotion on robot faces. In *Proc. IEEE Int. Conf. on Intelligent Robots and Systems*, Vilamoura, Portugal, October 2012.

C. Rich and C. L. Sidner. Using collaborative discourse theory to partially automate dialogue tree authoring. In *Proc. Int. Conf. on Intelligent Virtual Agents*, pages 327–340, Santa Cruz, CA, September 2012.

A. Holroyd and C. Rich. Using the behavior markup language for human-robot interaction. In *Proc. ACM/IEEE Conf. on Human-Robot Interaction*, pages 147–148, Boston, MA, March 2012.

D. Becroft, J. Bassett, A Mejia, C. Rich, and C. Sidner. AIPaint: A sketch-based behavior tree authoring tool. In *Proc. 7th AAAI Artificial Intelligence and Interactive Digital Entertainment Conf.*, Palo Alto, CA, October 2011.

A. Holroyd, C. Rich, C. Sidner, and B. Ponsler. Generating connection events for human-robot collaboration. In *IEEE Int. Symp. on Robot and Human Interactive Communication*, pages 241–246, Atlanta, GA, 2011.

K. O'Brien, J. Sutherland, C. Rich, and C. Sidner. Collaboration with an autonomous humanoid robot: A little gesture goes a long way. In *Proc. ACM/IEEE Conf. on Human-Robot Interaction*, Lausanne, Switzerland, 2011.

C. Ramsley, M. Fugere, R. Pawson, C. Rich, and D. O'Donnell. A simple intensity-based drama manager. In *3rd Int. Conf. on Interactive Digital Storytelling*, Edinburgh, UK, November 2010.

P. Hanson and C. Rich. A non-modal approach to integrating dialogue and action. In *Proc. 6th AAAI Artificial Intelligence and Interactive Digital Entertainment Conf.*, Palo Alto, CA, October 2010.

C. Rich, B. Ponsler, A. Holroyd, and C. Sidner. Recognizing engagement in human-robot interaction. In *Proc. ACM/IEEE Conf. on Human-Robot Interaction*, pages 375–382, Osaka, Japan, March 2010.

B. Ingram, D. Jones, A. Lewis, M. Richards, C. Rich, and L. Schachterle. A code of ethics for robotics engineers. In *Proc. ACM/IEEE Conf. on Human-Robot Interaction*, Osaka, Japan, March 2010.

J. Moffett, C. Rich, and J. Beck. Toward a causal model for automatic game balancing. In *14th Int. Conf. on Computer Games*, Louisville, KY, July 2009. (Second Place Best Paper Award)

C. Rich and C. Sidner. From the Programmer's Apprentice to human-robot interaction: Thirty years of research on human-computer collaboration. In *Proc. 21st National Conf. on Artificial Intelligence*, Boston, MA, July 2006.

C. Rich, C. Sidner, N. Lesh, A. Garland, S. Booth, and M. Chimani. DiamondHelp: A collaborative task guidance framework for complex devices. In *Proc. 20th National Conf. on Artificial Intelligence*, pages 1700–1702, Pittsburg, PA, July 2005.

C. Rich, C. Sidner, N. Lesh, A. Garland, and S. Booth. Collaborative help for networked home products. In *IEEE Int. Conf. on Consumer Electronics*, Las Vegas, NV, January 2005.

D. Devault, C. Rich, and C. L. Sidner. Natural language generation and discourse context: Computing distractor sets from the focus stack. In *17th Int. Florida Artificial Intelligence Research Symp.*, pages 887–892, Miami, FL, May 2004.

C. Rich, N. Lesh, J. Rickel, and A. Garland. A plug-in architecture for generating collaborative agent responses. In *Proc. 1st Int. J. Conf. on Autonomous Agents and Multiagent Systems*, Bologna, Italy, July 2002.

J. Rickel, N. Lesh, C. Rich, C. Sidner, and A. Gertner. Collaborative discourse theory as a foundation for tutorial dialogue. In *6th Int. Conf. on Intelligent Tutoring Systems*, pages 542–551, Biarritz, France, June 2002.

J. Eisenstein and C. Rich. Agents and GUIs from task models. In *Proc. ACM Int. Conf. on Intelligent User Interfaces*, pages 47–54, San Francisco, CA, January 2002.

J. Cassell et al. Non-verbal cues for discourse structure. In *Proc. 39th Annual Meeting of the Assoc. for Computational Linguistics*, pages 106–115, Toulouse, France, 2001.

C. Rich, N. Lesh, and C. Sidner. Human-computer collaboration for universal access. In *First Int. Conf. on Universal Access in Human-Computer Interaction*, New Orleans, LA, August 2001. Invited paper.

J. Rickel, N. Lesh, C. Rich, C. Sidner, and A. Gertner. Building a bridge between intelligent tutoring and collaborative dialogue systems. In *Proc. 10th Int. Conf. on Artificial Intelligence in Education*, pages 592–594, San Antonio, TX, May 2001.

N. Lesh, C. Rich, and C. Sidner. Collaborating with focused and unfocused users under imperfect communication. In *Proc. 9th Int. Conf. on User Modelling*, pages 64–73, Sonthofen, Germany, July 2001. Outstanding Paper Award.

J. Davies, N. Lesh, C. Rich, C. Sidner, A. Gertner, and J. Rickel. Incorporating tutorial strategies into an intelligent assistant. In *Proc. ACM Int. Conf. on Intelligent User Interfaces*, pages 53–56, Santa Fe, NM, January 2001.

A. Garland, K. Ryall, and C. Rich. Learning hierarchical task models by defining and refining examples. In *First Int. Conf. on Knowledge Capture*, Victoria, B.C., Canada, October 2001.

N. Lesh, C. Rich, and C. Sidner. Using plan recognition in human-computer collaboration. In *Proc. 7th Int. Conf. on User Modelling*, pages 23–32, Banff, Canada, June 1999.

D. Gruen, C. Sidner, C. Boettner, and C. Rich. A collaborative assistant for email. In *Proc. ACM Conf. on Computer Human Interaction, Extended Abstracts*, pages 196–197, Pittsburgh, PA, May 1999.

C. Rich and C. Sidner. Collagen: When agents collaborate with people. In *Proc. 1st Int. Conf. on Autonomous Agents*, pages 284–291, Marina del Rey, CA, February 1997. Reprinted in M. Huhns and M. Singh, editors, *Readings in Agents*, Morgan Kaufmann, San Francisco, CA, 1997, pp. 117–124.

C. Rich and C. Sidner. Segmented interaction history in a collaborative interface agent. In *Proc. ACM Int. Conf. on Intelligent User Interfaces*, pages 23–30, Orlando, FL, January 1997.

C. Rich and C. Sidner. Adding a collaborative agent to graphical user interfaces. In *Proc. 9th ACM Symp. on User Interface Software and Technology*, pages 21–30, Seattle, WA, November 1996.

Y. A. Feldman and C. Rich. Principles of knowledge representation and reasoning in the FRAPPE system. In *Proc. 6th Israeli Symp. on Artificial Intelligence*, pages 133–148, Tel Aviv, Israel, December 1989.

Y. A. Feldman and C. Rich. Bread, Frappe, and Cake: The gourmet's guide to automated deduction. In *Proc. 5th Israeli Symp. on Artificial Intelligence, Vision, and Pattern Recognition*, pages 77–93, Tel Aviv, Israel, December 1988.

C. Rich, R. C. Waters, and H. B. Reubenstein. Toward a Requirements Apprentice. In *Proc. 4th Int. Workshop on Software Specification and Design*, pages 79–86, Monterey, CA, April 1987. Reprinted in R. Thayer and M. Dorfman, editors, *System and Software Requirements Engineering*, IEEE Computer Society Press, Los Alamitos, CA, 1990.

Y. A. Feldman and C. Rich. Reasoning with simplifying assumptions: A methodology and example. In *Proc. 5th National Conf. on Artificial Intelligence*, pages 2–7, Philadelphia, PA, August 1986.

C. Rich. The layered architecture of a system for reasoning about programs. In *Proc. 9th Int. Joint Conf. Artificial Intelligence*, pages 540–546, Los Angeles, CA, 1985.

C. Rich. Knowledge representation languages and predicate calculus: How to have your cake and eat it too. In *Proc. 2nd National Conf. on Artificial Intelligence*, pages 193–196, Pittsburgh, PA, August 1982. Nominated for Publisher's Prize

C. Rich. A formal representation for plans in the Programmer's Apprentice. In *Proc. 7th Int. Joint Conf. Artificial Intelligence*, pages 1044–1052, Vancouver, British Columbia, Canada, August 1981. Reprinted in M. Brodie, J. Mylopoulos, and J. Schmidt, editors, *On Conceptual Modelling*, pages 239–270, Springer-Verlag, New York, NY, 1984, and in C. Rich and R. C. Waters, editors, *Readings in Artificial Intelligence and Software Engineering*, Morgan Kaufmann, San Mateo, CA, 1986.

C. Rich, H. E. Shrobe, and R. C. Waters. An overview of the Programmer's Apprentice. In *Proc. 6th Int. Joint Conf. Artificial Intelligence*, pages 827–828, Tokyo, Japan, August 1979.

Refereed Research Videos

C. Sidner, T. Bickmore, C. Rich, M. Shayganfar, L. Ring, Z. Zhang. "A Robotic Companion for Social Support of Isolated Older Adults," Research Videos, ACM/IEEE Int. Conf. on Human-Robot Interaction, Portland, OR, March 2015.

B. Nooraei, Z. Liu, C. Conley, C. Sidner, C. Rich and T. Bickmore. "Toward an Always-On Relational Agent for Social Support of Isolated Older Adults," Gala Video Festival, Int. Conference on Intelligent Virtual Agents, Reykjavik, Iceland, September 2011.
(See http://tinyurl.com/AlwaysOnVideo)

C. Rich, C. Sidner and C. Lee. "Two Generations of Robots for Human-Robot Interaction Research," AI Video Competition, Conference on Artificial Intelligence, Chicago, IL, July 2008.
(See http://tinyurl.com/TwoGenerations)

Design Competitions

Finalist, INDEX: Award 2005, Copenhagen, Denmark. With C. Sidner, N. Lesh, A. Garland, and S. Booth (for DiamondHelp).

Finalist, 3AD: Third International Conference on Appliance Design 2005, Bristol, UK. With C. Sidner, N. Lesh, A. Garland, and S. Booth (for DiamondHelp).

Refereed Workshop Papers

A. Boteanu, D. Kent, A. Mohseni-Kabir, C. Rich, and S. Chernova. Towards robot adaptability in new situations. In *AAAI Fall Symposium on Artificial Intelligence and Human-Robot Interaction*, Arlington, VA, 2015.

M. Shayganfar, C. Rich, and C. Sidner. An overview of affective motivational collaboration theory. In *AAAI Workshop on Symbiotic Cognitive Systems*, Phoenix, AZ, 2016.

L. Ould Ouali, C. Rich and N. Sabouret, "Réparation de plans dans les HTNs réactifs in utilisant la planfication symbolic," Rencontres des Jeunes Chercheurs en Intelligence Artificielle, Rennes, France, June 2015.

C. Sidner, C. Rich, M. Shayganfar, M. Behrooz, T. Bickmore, L. Ring, and Z. Zhang. A robotic or virtual companion for isolated older adults. In *Int. Workshop on Socially Assistive Robots for the Aging Population*, Bielefeld, Germany, March 2014.

A. Mohseni-Kabir, S. Chernova, and C. Rich. Collaborative learning of hierarchical task networks from demonstration and instruction. In *Workshop on Human-Robot Collaboration for Industrial Manufacturing, Robotics Science and Systems*, Berkeley, CA, July 2014.

A. Mohseni-Kabir, S. Chernova, and C. Rich. Collaborative learning of hierarchical task networks from demonstration and instruction. In *AAAI Fall Symposium on Artificial Intelligence and Human-Robot Interaction*, Arlington, VA, 2014.

M. Shayganfar, C. Rich, and C. L. Sidner. An exploratory study of the role of mood and social relationship in collaboration. In *Int. Workshop on Emotion Representation and Modelling for HCI System*, Sydney, Australia, December 2013.

C. Sidner, T. Bickmore, C. Rich, B. Barry, L. Ring, M. Behrooz, and M. Shayganfar. An always-on companion for isolated older adults. In *Int. Workshop on Techniques Toward Companion Technologies*, Edinburgh, UK, 2013.

C. Rich, C. Sidner, B. Nooraei, and W. Coon. Operating in a hierarchy of time scales for an always-on relational agent. In *Workshop on Real-Time Conversations with Virtual Agents*, Santa Cruz, CA, September 2012.

C. Rich and E. Torres-Jara. "Tactile Support for Human-Robot Collaboration," Workshop on Advances in Tactile Sensing and Touch based Human-Robot Interaction, 7th ACM/IEEE International Conference on Human-Robot Interaction, March 2012.

C. Rich and C. L. Sidner. Collaborative discourse, engagement and always-on relational agents. In D. Bohus et al., editors, *Dialog with Robots, Papers from the 2010 Fall Symposium*. AAAI Press, Menlo Park, CA, November 2010.

C. Rich and C. L. Sidner. Generating, recognizing and communicating intentions in human-computer collaboration. In G. Ferguson, editor, *Intentions in Intelligent Systems, Papers from the 2007 Spring Symposium*. AAAI Press, Menlo Park, CA, March 2007.

C. Rich and C. L. Sidner. Collagen: Middleware for building mixed-initiative problem solving assistants. In G. D. W Aha and G. Gecuci, editors, *Mixed-Initiative Problem Solving Assistants, Papers from the 2005 Fall Symposium, FS-05-07*. AAAI Press, Menlo Park, CA, November 2005.

C. Rich, C. Sidner, N. Lesh, A. Garland, S. Booth, and M. Chimani. DiamondHelp: A collaborative interface framework for networked home appliances. In *5th International Workshop on Smart Appliances and Wearable Computing*, Columbus, OH, June 2005.

A. Garland, N. Lesh, and C. Rich. Responding to and recovering from mistakes during collaboration. In *IJCAI 2003 Workshop on Mixed-Initiative Intelligent Systems*, Acapulco, Mexico, April 2003.

J. Cassell, Y. Nakano, T. Bickmore, C. Sidner, and C. Rich. Annotating and generating posture from discourse structure in embodied conversational agents. In *Autonomous Agents Workshop on Representing, Annotating, and Evaluating Non-Verbal and Verbal Communicative Acts to Achieve Contextual Embodied Agents*, Montreal, Canada, May 2001.

J. Rickel, R. Ganeshan, C. Rich, C. Sidner, and L. Lesh. Task-oriented tutorial dialogue: Issues and agents. In *AAAI Symposium on Building Dialogue Systems for Tutorial Applications, Tech. Report FS-00-01*, pages 52–57. AAAI Press, Menlo Park, CA, November 2000.

A. Garland, N. Lesh, C. Rich, and C. L. Sidner. Learning task models for Collagen. In *AAAI Symposium on Learning How To Do Things, Tech. Report FS-00-02*, pages 24–29. AAAI Press, Menlo Park, CA, November 2000.

C. Rich. Evaluating the contribution of discourse theory to an interactive system. In L. Terveen, editor, *Human-Computer Collaboration: Reconciling Theory, Synthesizing Practice, Papers from the 1993 Fall Symposium, FS-93-05*. AAAI Press, Menlo Park, CA, 1993.

C. Rich and R. C. Waters. The Programmer's Apprentice. In *Advance Papers of First Int. Workshop Computer-Aided Software Engineering (CASE '87)*, pages 1036–1039, Cambridge, MA, May 1987. Sponsored by Index Technology Corp.

D. Brotsky and C. Rich. Issues in the design of hybrid knowledge representation and reasoning systems. In *Proc. Workshop on Theoretical Issues in Natural Language Understanding*, Halifax, Canada, May 1985. Reprinted in *Workshop on Principles of Hybrid Reasoning*, Minneapolis, MN, August 1988.

C. Rich and R. C. Waters. Formalizing reusable software components. In *Proc. ITT Workshop on Reusability in Programming*, pages 152–159, Newport, RI, September 1983. Also published as MIT AI Working Paper 251.

C. Rich and R. C. Waters. The disciplined use of simplifying assumptions. *ACM SIGSOFT Software Engineering Notes*, 7(5):150–154, December 1982. Proc. ACM SIGSOFT Second Software Engineering Symp.: Workshop on Rapid Prototyping. Also published as MIT AI Working Paper 220.

C. Rich. Multiple points of view in modeling programs. *ACM SIGPLAN Notices*, 16(1):177–179, January 1981. Proc. Workshop on Data Abstraction, Data Bases and Conceptual Modeling.

Other Publications

C. Rich, A Robot Partner (Tools of the Trade), *Research at WPI*, 2008.

C. Rich. Window sharing with collaborative interface agents. *ACM SIGCHI Bulletin*, 28(1):70–78, January 1996.

C. Rich. Implemented knowledge representation and reasoning systems. *AI Magazine*, 12:34–35, Winter 1991. Spring Symposium Series Report.

C. Rich. CAKE: An implemented hybrid knowledge representation and limited reasoning system. *ACM SIGART Bulletin*, 2(3):120–127, June 1991. Special Issue on Implemented Knowledge Representation and Reasoning Systems.

C. Rich and R. C. Waters. Software Development Technology. In *Artificial Intelligence and 5th Generation Computer Technologies: The Technology and the Commercial Prospects*, pages 179–206. Brattle Research Corp., Boston, MA, 1982.

C. Rich and R. C. Waters. Software development technology. In *The Commercial Prospects for Artificial Intelligence Technologies*. Brattle Research, Inc., Boston, MA, 1981.

C. Rich and R. C. Waters. Computer aided evolutionary design for software engineering. *ACM Sigart Newsletter*, 1(76):14–15, April 1981. Progress Report.

Chair of Major Conferences

Program Cochair, Fifth ACM International Conference on Foundations of Digital Games, Bordeaux, France, June 2011.

General Cochair, Fourteenth ACM International Conference on Intelligent User Interfaces, Hong Kong, China, January 2010.

Program Cochair, Eighth ACM International Conference on Intelligent User Interfaces, Madeira Island, Portugal, January 2004.

Program Cochair, Fifteenth National Conference on Artificial Intelligence, Madison, WI, August 1998.

General Chair, Third International Conference on Principles of Knowledge Representation and Reasoning. Boston, MA, October 1992.

Technical Community Leadership

Cochair, 2006–2008, Consumer Electronics Association, Home Networks Committee (R7) Working Group on Task-Based User Interface (WG12), which defined ANSI/CEA-2018 Task Model Description (CE Task 1.0) standard.

President, 1992–1998, Principles of Knowledge Representation and Reasoning, Inc.

Councilor, 1984–1987, American Association for Artificial Intelligence.

Workshop Chair

Cochair, AAAI Fall Symposium on Learning How to Do Things, North Falmouth, MA, November 2000.

Cochair, Workshop on Using Plans in Intelligent User Interfaces, International Conference on Intelligent User Interfaces, New Orleans, LA, January 2000.

Chair, AAAI Spring Symposium on Implemented Knowledge Representation and Reasoning Systems. Stanford, CA, March 1991.

Invitation-Only Workshop Participant

Building Lifelong Learning Companions, Institute for Creative Technologies, U. Southern California, October 2008

Computing Community Consortium (National Science Foundation), Roadmapping for U.S. Robotics Research, Domestic and Professional Services Robotics Workshop, San Francisco, CA, August 2008.

Madeira Usability and Software Encounters (MUSE II), Madeira, Portugal, June 2008.

Program Committees

International Conference on Robotics and Automation (ICRA): 2015.
International Conference on Social Robotics (ICSR): 2015.

AAAI Spring Symposium on Turn-taking and Coordination in Human-Machine Interaction: 2015.
International Conference on Human-Robot Interaction (HRI): 2015, 2013, 2012, 2011, 2010, 2009, 2008.
International Symposium on Robot and Human Interactive Communication (RO-MAN): 2012.
International Conference on Intelligent Virtual Agents (IVA): 2012.
Conference on Artificial Intelligence (AAAI): 2012, 2006, 1996, 1992, 1991, 1982.
AI and Interactive Digital Entertainment (AIIDE): 2012, 2011
AAAI Fall Symposium on Dialog with Robots: 2010.
International Conference on User Modeling, Adaptation and Personalisation (UMAP): 2010.
International Conference on Intelligent User Interfaces (IUI): 2010, 2009 (Associate Chair), 2008, 2006, 2003.
International Conference on Autonomic and Autonomous Systems (ICAS): 2010, 2009, 2008.
Intelligent Technologies for Interactive Entertainment (INTETAIN): 2009, 2005.
International Conference on Knowledge Capture (K-CAP): 2009.
European Conference on AI (ECAI), Workshop on Cognitive Collaborative Appliances: 2008.
AAAI Spring Symposium on Intentions in Intelligent Systems: 2007.
ACM Symposium on User Interface and Software Technology (UIST): 2005.
International Conference on Multimodal Interfaces (ICMI): 2005.
International Conference on User Modeling (UM): 2001.
International Conference on Autonomous Agents (AGENTS): 1997.
International Workshop on Agent Theories, Architectures, and Languages (ATAL): 1997, 1995.
IJCAI Workshop on Collaboration, Cooperation and Conflict in Dialogue Systems: 1997.
AAAI Workshop on Agent Modeling: 1996.
Knowledge-Based Software Engineering Conference (KBSE): 1993, 1992, 1991.
Working Conference on Reverse Engineering (WCRE): 1993.
AAAI Fall Symposium on Human-Computer Collaboration: 1993.
International Joint Conference on Artificial Intelligence (IJCAI): 1991, 1989, 1985, 1983, 1981.
International Conference on Tools for Artificial Intelligence (TAI): 1991.
AAAI Spring Symposium on Artificial Intelligence and Software Engineering: 1989.

Editorial and Referee Service

IEEE Transactions on Computational Intelligence and AI in Games, reviewer, 2011, 2015.
Pervasive and Mobile Computing, reviewer, 2012.
Journal of Human-Robot Interaction, reviewer, 2012.
IEEE Transactions on Affective Computing, reviewer, 2012.
IEEE Transactions on Systems, Man, and Cybernetics, reviewer, 2010.
ACM Transactions on Interactive Intelligent Systems, reviewer, 2010.
International Journal of Arts and Technology, reviewer, 2009.
International Journal of Robotics Research, reviewer, 2008.
Communications of the Association for Computing Machinery, reviewer, 2008.
User Modeling and User-Adapted Interaction, Board of Special Reviewers, 1996–.
Journal of Artificial Intelligence Research, referee, 1994–1999.
IEEE MultiMedia, Editorial Board, 1995–1998.

Automated Software Engineering, Editorial Board, 1992–1998
Perspectives in Artificial Intelligence, Editorial Advisory Board, 1988–1995.
IEEE Transactions on Software Engineering, referee, 1985–1995.
ACM Transactions on Software Engineering and Methodology, referee, 1989–1994.
IEEE Transactions on Knowledge and Data Engineering, referee, 1994–1989.
Artificial Intelligence Frontiers, General Editor, 1991–1987.
ACM SIGART Bulletin, Guest Editor, Special Issue on Knowledge Representation and Reasoning, 1991.
IEEE Computer, referee, Special Issue on Knowledge Representation, 1983.

Recent Invited Lectures

Shifting the Responsibility of Learning to the Learner, MIT Enterprise Forum, The Big Game Theory: Gaming Beyond Gamers, Panel, Cambridge, MA, April 2015

Engagement Recognition and Generation in Human-Robot Interaction, Digiteo Research Network, Paris, France, December 2013

Engagement Recognition and Generation in Human-Robot Interaction, University of Augsburg, Computer Science Department, Augsburg, Germany, November 2013

Using Collaborative Discourse Theory to Partially Automate Dialogue Tree Authoring, University of Augsburg, Computer Science Department, Augsburg, Germany, November 2013

Research Road Map, Games and Learning Alliance (GALA) Conference, Panel, Paris, France, October, 2013.

Using Collaborative Discourse Theory to Partially Automate Dialogue Tree Authoring, Computer Science Laboratory for Mechanics and Engineering Sciences, National Center for Scientific Research, Paris, France, September 2013

.

Engagement Recognition and Generation for Human-Robot Interaction, Laboratory for Analysis and Architecture of Systems, National Center for Scientific Research, Toulouse, France, October 2011

The Right Tool for the Job, AI Summit, Game Developers Conference, Panel, San Francisco, CA, February 2010.

Teaching, Learning, Doing and Conversing: How They Fit Together, Building Lifelong Learning Companions, University of Southern California, Institute for Creative Technology, Invitation-Only Workshop, October 2008

From the Programmer's Apprentice to human-robot interaction: Thirty years of research on human-computer collaboration, Brown University, Computer Science Colloqium, January 2008.

Feature-ology, Panel, Consumer Electronics Lab, MIT Media Laboratory, October 2007.

New Technologies for Making Products Easier to Use, Panel, International Consumer Electronics Show, Las Vegas, NV, January 2007.

I Can't Even Program My VCR and They Keep Throwing More Complicated Stuff at Me!, Humans and Technology Symposium, MIT, January 2006, and Computer Science Dept. Colloquium Series, Brandeis University, November 2006.

DiamondHelp: A Collaborative Task Guidance Framework for Complex Devices, Distinguished Lecturer Series, Institute for Creative Technology, U. Southern California, November 2005.

Collagen: Applying Collaborative Discourse Theory to Human-Computer Interaction, Human-Computer Interaction Lecture Series, Carnegie Mellon University, Pittsburg, PA, March 2005.

The Usability Crisis in High-Tech Home Products: An Opportunity for Intelligent User Interfaces?, Panel, International Conference on Intelligent User Interfaces, San Diego, CA, January 2005.

Managing Complexity, Panel, International Consumer Electronics Show, Las Vegas, NV, January 2004.

Applying Collaborative Discourse Theory to Human-Computer Interaction, New Work in Language Processing Speaker Series, MITRE, Bedford, MA, September 2004.

What is a Task Model?, W3C Working Group on Multimodal Interaction Activity, Charles Rich and Candace L. Sidner, March 2004.

From the Programmer's Apprentice to human-robot interaction: Thirty years of research on human-computer collaboration, Brown University, Computer Science Colloqium, January 2008.

Feature-ology, Panel, Consumer Electronics Lab, MIT Media Laboratory, October 2007.

New Technologies for Making Products Easier to Use, Panel, International Consumer Electronics Show, Las Vegas, NV, January 2007.

I Can't Even Program My VCR and They Keep Throwing More Complicated Stuff at Me!, Humans and Technology Symposium, MIT, January 2006, and Computer Science Dept. Colloquium Series, Brandeis University, November 2006.

DiamondHelp: A Collaborative Task Guidance Framework for Complex Devices, Distinguished Lecturer Series, Institute for Creative Technology, U. Southern California, November 2005.

Collagen: Applying Collaborative Discourse Theory to Human-Computer Interaction, Human-Computer Interaction Lecture Series, Carnegie Mellon University, Pittsburg, PA, March 2005.

The Usability Crisis in High-Tech Home Products: An Opportunity for Intelligent User Interfaces?, Panel, International Conference on Intelligent User Interfaces, San Diego, CA, January 2005.

Managing Complexity, Panel, International Consumer Electronics Show, Las Vegas, NV, January 2004.

Applying Collaborative Discourse Theory to Human-Computer Interaction, New Work in Language Processing Speaker Series, MITRE, Bedford, MA, September 2004.

What is a Task Model?, W3C Working Group on Multimodal Interaction Activity, Charles Rich and Candace L. Sidner, March 2004.

Building Collaborative Agents, MIT Artificial Intelligence Laboratory, Cambridge, MA, November 2002.

Applying Collaborative Discourse Theory to Human-Computer Interaction, MIT Laboratory for Computer Science, Cambridge, MA, June 2002.

Applying Collaborative Discourse Theory to Human-Computer Interaction, Distinguished Speakers Series, Lockheed Martin Advanced Technology Laboratories, Camden, NJ, January 2002.

Collagen: A Tool for Task-Oriented Natural Language in Intelligent Characters for Immersive Training, Institute for Creative Technologies, U. Southern California, Marina del Rey, CA, January 2001.

Applying Collaborative Discourse Theory to Human-Computer Interaction, Cognitive Science Colloquium, Georgia Institute of Technology, March 2000.

Other Professional Activities

Reviewer
, AAAI Fall Symposium on Artificial Intelligence and Human-RobotInteraction, Washington, DC, October 2015.

Member*, Review Panel, National Science Foundation, 2008, 2012, 2015*

Cochair*, Senior Members Track, Conference on Artificial Intelligence (AAAI), Vancouver, Canada, July 2007.*

Member*, INCITS Universal Remote Console Committee (V2), 2005–2006.*

Reviewer*, National Science Foundation, Division of Mathematical and Computer Sciences, 1981–1999.*

Software Demonstrations Cochair*, First International Conference on Autonomous Agents, Marina del Rey, CA, February 1997*

Steering Committee*, Knowledge-Based Software Engineering Conferences, 1991–1993.*

Member*, International Advisory Board, Information Technology Institute, National Computer Board of Singapore, 1990–1992.*

Reviewer*, Air Force Office of Scientific Research, Mathematics Directorate, 1983–1984.*

Advisory Council*, Second International Workshop on Computer-Aided Software Engineering (CASE '88). Boston, MA, July 1988.*

Site Visit Team*, NSF Science and Technology Centers Program, Carnegie Mellon University, June 1988.*

Expert Systems: An Introduction*, Tutorial Program preceding the First International Conference on Expert Database Systems, Charleston, SC, April 1986.*

A Tutorial on Expert Systems*, Tutorial Program preceding the 9th Int. Joint Conference on Artificial Intelligence, Los Angeles, CA, August 1985 (with B. Buchanan).*

Reviewer, *Northeastern University, Advisory Committee for the Research and Scholarship Development Fund, 1983.*

Tutorial Chair, *Third National Conference on Artificial Intelligence. Washington, DC, August 1983.*

A Tutorial on Expert Systems, *Tutorial Program preceding the Third National Conference on Artificial Intelligence, Washington, DC, August 1983 (with R. Davis).*

Selection Committee, *1983 Prize for Exceptional Contributions to the Field of Program Verification.*

Tutorial Chair, *Second National Conference on Artificial Intelligence. Pittsburgh, PA, August 1982.*

A Tutorial on Expert Systems, *Tutorial Program preceding the Second National Conference on Artificial Intelligence, Pittsburgh, PA, August 1982 (with R. Davis).*

Research Grants and Contracts (WPI)

Office of Naval Research. Collaborative Robot Learning from Demonstration Using Hierarchical Task Networks and Attributive Motion Planning. *$877,042. June 2013–June 2016. (Principal Investigator)*

National Science Foundation. Always-On Relational Agents for Social Support of Isolated Older Adults. *$1,084,361. September 2010–August 2014. (Co-Principal Investigator)*

National Science Foundation. Engagement and Collaboration in Human-Robot Interaction. *$450,000. September 2008–August 2011. (Principal Investigator)*

Research Grants and Contracts (MIT)

National Science Foundation. Intelligent Assistance for Program Recognition, Design, Optimization, and Debugging. *$208,000. October 1989–September 1991. (Co-Principal Investigator)*

Siemens Corporation. The Programmer's Apprentice. *$215,000. January 1989–December 1991. (Co-Principal Investigator)*

Defense Advanced Research Projects Agency. The Programmer's Apprentice. *$343,000. July 1988–June 1989. (Co-Principal Investigator)*

International Business Machines Corporation, Systems Integration Division. IBM and the Programmer's Apprentice. *$15,000. November 1988–October 1989. (Co-Principal Investigator)*

Microelectronics and Computer Technology Corp. Research in Program Recognition and Program Design. *$40,000. December 1988. (Co-Principal Investigator)*

Siemens Research and Technology Laboratory. Siemens and the Programmer's Apprentice. *$100,000. October 1987–September 1988. (Co-Principal Investigator)*

NYNEX Corporation. NYNEX and the Programmer's Apprentice. *$100,000. July 1987–June 1989. (Co-Principal Investigator)*

National Science Foundation. Toward a Requirements Apprentice: On the Boundary Between Informal and Formal Specifications. *$410,000. March 1987–February 1990. (Co-Principal Investigator)*

International Business Machines Corporation, Federal Systems Division. IBM FSD and the Programmer's Apprentice. *$199,333. June 1985–May 1987. (Co-Principal Investigator)*

International Business Machines Corporation, Palo Alto Scientific Center. IBM and the Programmer's Apprentice. *$346,000. December 1982–April 1985. (Co-Principal Investigator)*

National Science Foundation. Abstraction, Inspection and Debugging in Programming. *$406,000. February 1982–January 1985. (Co-Principal Investigator)*

Defense Advanced Research Projects Agency. The Programmer's Apprentice. *$750,000. October 1982–June 1988. (Co-Principal Investigator)*

National Science Foundation and Defense Advanced Research Projects Agency. Computer Aided Evolutionary Design for Software Engineering. *$420,000. December 1979–April 1982. (Co-Principal Investigator)*

Doctoral Students (WPI)

D. Rai, Game-like Interventions in Computer Tutors: An Empirical, Incremental and Iterative Approach. *Computer Science, Ph.D. Thesis, Expected 2014. (Reader)*

D. Yoo, Building Web Based Programming Environments for Functional Programming. *Computer Science, Ph.D. Thesis, March 2013. (Reader)*

Masters Students (WPI)

S. Xu, A Natural User Interface for Virtual Object Modeling for Immersive Gaming. *Interactive Media and Game Development, Master's Thesis, August 2013. (Reader)*

Y. Qiu, Leveraging Influential Factors into Bayesian Knowledge Tracing. *Computer Science, Master's Thesis, December 2012. (Reader)*

B. Nooraei, A Real-Time Architecture for Conversational Agents. *Computer Science, Master's Thesis, August 2012. (Co-Advisor)*

W. Coon, A Computational Model for Building Relationships between Humans and Virtual Agents. *Computer Science, Master's Thesis, August 2012. (Co-Advisor)*

J. Wang, Isometric versus Elastic Surfboard Interfaces for 3D Travel in Virtual Reality. *Computer Science, Master's Thesis, June 2011. (Reader)*

A. Holroyd, Engagement Generation in Human-Robot Interaction. *Computer Science, Masters Thesis, May 2011. (Advisor)*

D. Rai, Optimizing Engagement and Learning in a Math Learning Environment with Game-Like Elements. *Computer Science, Master's Thesis, February 2010. (Reader)*

B. Ponsler. Engagement Recognition in Human-Robot Interaction. *Computer Science, Masters Thesis, December 2010. (Advisor)*

J. Moffett. Applying Causal Models to Dynamic Difficulty Adjustment in Video Games. *Computer Science, Master's Thesis, May 2010. (Co-Advisor)*

P. Hanson. A Unified Representation for Dialogue and Action in Computer Games: Bridging the Gap Between Talkers and Fighters. *Computer Science, Masters Thesis, May 2010. (Advisor)*

Undergraduate Students (WPI)

W. Stockinger, M. Tomson, M. Pelissari, C. Ogren, M. Grossfeld and N. Silva. Lifespan. *Computer Science and Interactive Media and Game Development, Major Qualifying Project, May 2013. (Co-Advisor)*

L. LeMenager, A. Porras, E. Saccoccio and C. Zebrose. Relic. *Computer Science and Interactive Media and Game Development, Major Qualifying Project, May 2013. (Co-Advisor)*

T. Jenkel, R. Kelly, and P. Shepanski. Robot Autonomy and Interactive Learning., *Robotics Engineeering, Major Qualifying Project, May 2013. (Co-Advisor)*

P. Malmsten. Object Discovery with a Microsoft Kinect. *Computer Science, Major Qualifying Project, December 2012. (Co-Advisor)*

R. Bass, B. Kaplan, J. Lay, G. Leto, A. Mazzucotelli and B. Myers. Lilium: Exploring Collaborative Artificial Intelligence. *Computer Science and Interactive Media and Game Development, Major Qualifying Project, May 2012. Winner of Provost's Award. (Co-Advisor)*

H. Fletcher, Z. Garbowitz, T. Sanford and A. Tiley. Shattered Sky: An Exploration in Rising Drama. *Computer Science and Interactive Media and Game Development, Major Qualifying Project, May 2012. (Co-Advisor)*

J. Bassett, D. Becroft and A. Mejia. AIPaint: A Sketch-Based Behavior Tree Authoring Tool. *Computer Science and Interactive Media and Game Development, Major Qualifying Project, May 2011. (Co-Advisor)*

M. Fugere, R. Pawson and C. Ramsley. Winds End: An Experiment in Interactive Story Generation. *Interactive Media and Game Development, Major Qualifying Project, March 2010. (Co-Advisor)*

K. OBrien and J. Sutherland. The Effect of Gesture on Collaboration with an Autonomous Robot. *Computer Science and Robotics Engineering, Major Qualifying Project, May 2010. (Advisor)*

J. Thompson. Food Fight: Promoting Self-Care Behaviors for the Management of Diabetes Through a Game. *Computer Science and Interactive Media and Game Development, Major Qualifying Project sponsored by Glymetrix, Inc., May 2010. (Co-Advisor)*

B. Ingram, D. Jones, A. Lewis and M. Richards. A Code of Ethics for Robotics Engineers, *Interactive Qualifying Project, March 2010. (Co-Advisor)*

A. Holroyd, B. Ponsler and P. Koakiettaveechai. Hand-Eye Coordination in a Humanoid Robot, *Computer Science and Robotics Engineering, Major Qualifying Project, March 2009. Winner of Provost's Award. (Advisor)*

D. McCannell and C. Ivory. Forerunner. *Computer Science and Interactive Media and Game Development, Major Qualifying Project, March 2009. (Co-Advisor)*

Doctoral Students (MIT)

L. M. Wills. Automated program recognition by graph parsing. Technical Report 1385, MIT Artificial Intelligence Lab., March 1992. PhD thesis. (Supervisor)

R. J. Hall. Program improvement by automatic redistribution of intermediate results. Technical Report 1251, MIT Artificial Intelligence Lab., February 1991. PhD thesis. (Supervisor)

P. Wu. A knowledge-based program for selecting problem solving paradigms. *PhD thesis, MIT Dept. of Elec. Eng. and Comp. Sci., August 1993. (Reader)*

H. B. Reubenstein. Automated acquisition of evolving informal descriptions. Technical Report 1205, MIT Artificial Intelligence Lab., June 1990. PhD thesis. (Reader)

J. Hartman. Automatic Control Understanding for Natural Programs. *PhD thesis, Univ. of Texas at Austin, Computer Sciences Dept., 1990. (Reader)*

K. E. Huff. Plan-Based Intelligent Assistance: An Approach to Supporting the Software Development Process. *PhD thesis, Univ. of MA, Computer and Info. Sciences Dept., Amherst, MA, 1989. (Reader)*

J. Van Baalen. Toward a theory of representation design. *Phd thesis, MIT Dept. of Elec. Eng. and Comp. Sci., December 1988. (Reader)*

R. G. Simmons. Combining associational and causal reasoning to solve interpretation and planning problems. *PhD thesis, MIT Dept. of Elec. Eng. and Comp. Sci., May 1988. (Reader)*

Masters Students (MIT)

E. J. Wagner, Woodstein: A web interface agent for debugging e-commerce. *M.S. thesis, MIT Arts and Media Technology, Sept. 2003 (Reader)*

J. C. Tang. The design and analysis of a general purpose configuration system. Master's thesis, MIT Dept. of Elec. Eng. and Comp. Sci., August 1989. (Supervisor)

J. Wertheimer. Derivation of a rule system pattern matcher. Technical Report 1109, MIT Artificial Intelligence Lab., March 1989. Master's thesis. (Supervisor)

R. I. Kuper. Dependency-directed localization of software bugs. Technical Report 1053, MIT Artificial Intelligence Lab., May 1989. Master's thesis. (Supervisor)

J. K. Bartholomew. A WYSIWYG program generator for interactive displays. Master's thesis, MIT Dept. of Elec. Eng. and Comp. Sci., May 1988. (Supervisor)

W. H. Santos. Improving control in rule-based systems by symbolic analysis of data patterns. Master's thesis, MIT Dept. of Elec. Eng. and Comp. Sci., May 1988. (Supervisor)

M. R. Crystal. Uses of time intervals to model digital behavior. Master's thesis, MIT Dept. of Elec. Eng. and Comp. Sci., May 1987. (Supervisor)

L. M. Wills. Automated program recognition. Technical Report 904, MIT Artificial Intelligence Lab., February 1987. Master's thesis. (Supervisor)

D. Chapman. Planning for conjunctive goals. Technical Report 802, MIT Artificial Intelligence Lab., November 1985. Master's thesis. Winner, Phil Cooper Award for Research, MIT AI Laboratory. (Supervisor)

D.C. Brotsky. An algorithm for parsing flow graphs. Technical Report 704, MIT Artificial Intelligence Lab., March 1984. Master's thesis. (Supervisor)

Undergraduate Students (MIT)

S. Maggioni. An abstraction oriented OPS rule generator, May 1988. Bachelor's thesis, MIT Dept. of Elec. Eng. and Comp. Sci. (Supervisor)

L. M. Zelinka. Providing abstract data types in Ada for ease in prototyping, August 1985. Bachelor's thesis, MIT Dept. of Elec. Eng. and Comp. Sci. (Supervisor)

S. M. Levitin. Toward a richer language for describing software errors. Working Paper 270, MIT Artificial Intelligence Lab., May 1985. Bachelor's thesis. (Supervisor)

D. L. Doughty. A general purpose, display-oriented browser for directed graph databases, May 1983. Bachelor's thesis, MIT Dept. of Elec. Eng. and Comp. Sci. (Supervisor)