

Current Position: Research Scientist at Carnegie Mellon University

EDUCATION

- 2012 Ph.D. in Computer Science
Computer Science Department
Carnegie Mellon University, Pittsburgh PA
Thesis Title: "Human Modeling and Interaction for Effective Task Autonomy"
Advised By: Manuela Veloso (co-chair), Anind K. Dey (co-chair), Manuel Blum, Eric Horvitz (Microsoft Research)
- 2009 Master of Science in Computer Science
Computer Science Department
Carnegie Mellon University, Pittsburgh PA
- 2007 Bachelor of Science in Computer Science
Double Major in Human-Computer Interaction
Carnegie Mellon University, Pittsburgh PA
Honors Thesis: "Template-based Approach to Mobile Reminders"
Honors Thesis Advised By: Anind K. Dey

PUBLICATIONS

REFEREED JOURNAL PAPERS

- S. Rosenthal**, M. Veloso, A.K. Dey. "Acquiring Accurate Responses to Robots' Questions." In *Journal of Social Robotics*, Special Issue on Expectations, Actions, and Intentions, 2012.
- S. Rosenthal**, M. Veloso, A.K. Dey. "Is Someone in this Office Available to Help Me? Proactively Seeking Help from Spatially-Situated Humans." In *Journal of Intelligent and Robotic Systems*, Special Issue on Domestic Service Robots in the Real World, 2011.

REFEREED CONFERENCE PAPERS

- S. Rosenthal**, D. Bohus, E. Kamar, and E. Horvitz. "Look vs Leap: Value of Information with Streaming Evidence." in Proc. 23rd *International Joint Conference on Artificial Intelligence (IJCAI 2013)*, August 2013. (acceptance rate 28%)
- S. Rosenthal**, M. Veloso. "Monte Carlo Preference Elicitation for Learning Additive Reward Functions." in Proc. *IEEE Symposium on Robot and Human Interactive Communication (RO-MAN 2012)*, pgs. 886-891, September 2012.
- S. Rosenthal**, M. Veloso. "Mobile Robot Planning to Seek Help with Spatially-Situated Tasks." In Proc. *Twenty-Sixth Conference on Artificial Intelligence (AAAI 2012)*, pgs. 2067-2073, July 2012. (acceptance rate 26%)
- S. Rosenthal**, M. Veloso, A.K. Dey. "Learning Accuracy and Availability of Humans who Help Mobile Robots." In Proc. *Twenty-Fifth Conference on Artificial Intelligence (AAAI 2011) Special Track on Physically Grounded Artificial Intelligence*, August 2011. (acceptance rate 25%)
- S. Rosenthal**, M. Veloso. "Modeling Humans as Observation Providers using POMDPs." In Proc. *International Symposium on Robot-Human Communication (Ro-Man 2011)*, July 2011.
- S. Rosenthal**, A.K. Dey, M. Veloso. "Using Decision-Theoretic Experience Sampling to Build Personalized Mobile Phone Interruption Models." In Proc. *International Conference on Pervasive Computing (Pervasive 2011)*, pp. 170-187. June 2011. (acceptance rate 24%)

S. Rosenthal, S.K. Kane, J.O. Wobbrock, D. Avrahami. "Augmenting On-Screen Instructions with Micro-Projected Guides: When it Works, and When it Fails." In Proc. *ACM International Conference on Ubiquitous Computing (UbiComp 2010)*, pp. 203-212. September 2010. (acceptance rate 19%)

S. Rosenthal, J. Biswas, M. Veloso. "An Effective Personal Mobile Robot Agent Through Symbiotic Human-Robot Interaction." in Proc. *International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2010)*, pp. 915-922. May 2010. (acceptance rate 24%)

S. Rosenthal and A.K. Dey. "Towards Maximizing the Accuracy of Human-Labeled Sensor Data" in Proc. *International Conference on Intelligent User Interfaces (IUI 2010)*, pp. 259-268. February 2010. (acceptance rate 30%)

S. Rosenthal, A.K. Dey, M. Veloso. "How Robots' Questions Affect the Accuracy of the Human Responses" in Proc. *International Symposium on Robot-Human Interactive Communication (Ro-Man 2009)*, pp. 1137-1142, September 2009. (acceptance rate 40%)

S. Rosenthal and S. Finger. "Design Collaboration in a Distributed Environment." in Proc. *Frontiers in Education (FIE 2006)*, pp. M2G-13 - 18. October 2006.

R. Kirby, F. Broz, J. Forlizzi, M.P. Michalowski, A. Mundell, **S. Rosenthal**, B.P. Sellner, R. Simmons, K. Snipes, A. Schultz, and J. Wang. "Designing Robots for Long-Term Social Interaction." in Proc. *International Conference on Intelligent Robots and Systems (IROS 2005)*, pp. 1338 - 1343. August 2005. (acceptance rate 55%)

REFEREED SHORT PAPERS

S. Rosenthal, M. Gaston. "Early Stage Data Exploration and Analysis: A Case Study." *ACM CHI Conference on Human Factors in Computing Systems (CHI 2014)*, in submission.

S. Rosenthal, S. Skaff, M. Veloso, D. Bohus, E. Horvitz. "Execution Memory for Grounding and Coordination." in Proc. *International Conference on Human Robot Interaction (HRI 2013)*, pgs. 213-214, March 2013. (acceptance rate 24% long paper, 95% short paper)

M. Veloso, J. Biswas, B. Coltin, **S. Rosenthal**, T. Kollar, C. Mericli, M. Samadi, S. Brandao, and R. Ventura. "CoBots: Collaborative Robots Servicing Multi-Floor Buildings." In Proc. of *IROS 2012*, October 2012.

S. Rosenthal. "Modeling Users of Intelligent Systems." *ACM CHI Conference on Human Factors in Computing Systems Doctoral Consortium (CHI 2011)*, May 2011.

REFEREED WORKSHOP PAPERS

S. Rosenthal, A. Mellinger, D. Shepard, E. Werner, M. Gaston. Association for the Advancement of Artificial Intelligence (AAAI) Spring Symposium on Cognitive Security, March 2014.

S. Rosenthal, M. Veloso, A.K. Dey. "Task Behavior and Interaction Planning for a Mobile Service Robot that Occasionally Requires Help," Workshop on Automated Action Planning for Autonomous Mobile Robots, *Twenty-Fifth Conference on Artificial Intelligence (AAAI 2011)*, August 2011.

M. Veloso, **S. Rosenthal**, R. Ventura, B. Coltin, J. Biswas. "Autonomous Mobile Service Robots for Humans, With Human Help, and Enabling Human Remote Telepresence. Workshop on Human Robot Interaction, Robotics Science and Systems (RSS 2011), July 2011.

S. Rosenthal, M. Veloso, A.K. Dey. "Hello? Is Someone in this Office Available to Help Me? Proactively Seeking Help from Spatially-Situated Humans." Young Pioneers Workshop, International Conference on Human Robot Interaction (HRI 2011), March 2011.

S. Rosenthal, M. Veloso. "Mixed-Initiative Long-Term Interactions with an All-Day-Companion Robot." Association for the Advancement of Artificial Intelligence (AAAI) Fall Symposium on Dialog with Robots, November 2010.

S. Rosenthal, M. Veloso. "Using Symbiotic Relationships with Humans to Help Robots Overcome Limitations." Workshop on Collaborative Human/AI Control for Interactive Experiences (CHACIE), International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2010), May 2010.

S. Rosenthal, A.K. Dey, M. Veloso. "Using Interaction to Improve Intelligence: How Intelligent Systems Should Ask Users for Input." Workshop on Intelligence and Interaction, International Joint Conference on Artificial Intelligence (IJCAI 2009), July 2009.

S. Rosenthal, M. Veloso, A.K. Dey. "Online Selection of Mediated and Domain-Specific Predictions for Improved Recommender Systems." Workshop on Intelligent Techniques in Web Personalization and Recommender Systems, International Joint Conference on Artificial Intelligence (IJCAI 2009) July 2009.

S. Rosenthal, M. Veloso, A.K. Dey. "Asking Questions and Developing Trust." Association for the Advancement of Artificial Intelligence (AAAI) Spring Symposium on Agents that Learn from Humans Teachers, March 2009.

INVITED ARTICLES

R. Simmons, *et. al.* "GRACE and GEORGE: Autonomous Robots for the AAAI Robot Challenge". *Mobile Robot Competition 2003*, *AAAI Magazine*, pp. 52–62. August 2003.

RESEARCH PROJECTS

- Software Development Tools for Big Data Analytics**
While big data analytics continue to grow in popularity among companies and organizations, the analytic implementations are often completed by software developers with little or no formal classroom experience in machine learning or data analysis. As a result, they often adopt tools to help non-experts create analytics efficiently by abstracting away the details of the algorithms. In practice, we find that the tools are fairly rigid in their data formatting and algorithm requirements which may not be appropriate especially for early-stage data exploration. We began our research by following a development team through their two-week data exploration on a novel analytics challenge. We analyzed their interactions with their data and tools and used the results to direct our future work towards creating tools that support collaboration and iteration on data exploration and analytics.
- 2013-
- Understanding and Defending Against Attacks on Big Data Analytics**
People and organizations collect data to update their beliefs about the world and to make decisions. However, as the amount of data grows, they rely on analytics that mine and analyze 'big data' to make predictions about future events and determine future courses of action. With so much depending on this data, big data analytics are prime targets for subversion by adversaries. However, little is known about what is actually happening to our data. This research focuses on understanding how and where attacks on analytics may happen and how we can build better defenses against them. We aim to answer questions such as what are indicators of adversarial subversion, would we find anything if we looked for it, and how are current organizations and researchers defending against it.
- 2013-
- Execution Memory for Grounding Interactions (with Bossa Nova, Microsoft Research, and Carnegie Mellon)**
As robots are introduced into human environments for long periods of time, human owners and collaborators will expect them to remember shared events that occur during execution. We define execution memory as the capability of saving interaction event information and recalling it for later use. We divide the problem into four parts: *salience filtering* of sensor evidence and saving to short term memory, *archiving* from short to long term memory and *caching* from long to short term memory, and *recalling* memories for use in state inference and policy execution. We then provide examples of how execution memory can be used to enhance user experience on current and future robot applications.
- 2012-
2013

2009- 2012	Creating Symbiotic Relationships Between Humans and Robots
	Created the interfaces for people to use when speaking or interacting with a robot that escorts visitors to meetings around the computer science building. In addition to the robot helping the human, the visitor relationship creates an incentive for the human to help the robot when its localization is uncertain by indicated its location on a map or when it lacks a capability that the visitor requires (e.g., no arms if the visitor wants coffee) by pouring the coffee and placing it on the robot. Results show that when our robot asks for localization help, it can navigate faster to its destinations compared to a robot that navigates completely autonomously by reducing or eliminating to wrong or missed turns.
2008- 2010	Towards Increasing Accuracy of User Responses to Agent Questions
	Evaluated how the content (context, suggestions, prediction, uncertainty) an agent provides while asking for help for labeling data affected the user's accuracy at labeling the data in four agent domains (desktop email sorter, cell phone activity recognizer, robot shape recognition and robot localization). Validations show that our guidelines for the content of the agents' questions result in higher accuracy responses than questions that human-computer interaction specialists generated for each domain.
2007- 2009	Learning to Trust Users as Experts
	Designed new machine learning algorithms to dynamically build trust of reviewers over all product domains in recommender systems and for each domain with the goal of providing better recommendations to new users based on the availability and trust of reviewers. Results show that users can receive more accurate predictions for product preferences using our dynamic algorithms that use both over all and domain-specific trust compared to predictions generated using either trust method alone.
2006- 2007	Senior Thesis: Reminder Systems for Families
	Designed a reminder system for dual income households that incorporated a variety of media to give families flexibility in how they make and receive reminders about extracurricular or enrichment activities for their children and used ethnographies and paper prototypes to analyze the end product.
2004- 2006	Collaboration for Student Design Groups
	Performed experiment analyzing effects of location on the creativity, conversation, and overall performance of student design groups to determine whether non-colocated groups would learn and interact as much as collocated groups.
2003- 2004	Social Robots: Carnegie Mellon Robot Receptionist (www.roboreceptionist.com)
	Designed rule-based system for natural language processing and response generation for visitors to type to a robot receptionist that helps give directions to offices and buildings around campus.

ACADEMIC HONORS AND AWARDS

GRADUATE FELLOWSHIPS	
2011	Siebel Scholar, Class of 2012 – awarded annually for academic excellence and demonstrated leadership to 85 top students from the world's leading graduate schools.
2007	National Science Foundation Graduate Fellowship
2007	National Physical Science Consortium Fellowship (National Security Agency Funded)
2007	Google Anita Borg Scholarship
GRADUATE TRAVEL GRANTS	
2011	Conference-Funded Student Travel Grant to attend Conference on Artificial Intelligence (AAAI) 2011
2011	Conference-Funded Student Travel Grant to attend Computer-Human Interaction (CHI) 2011
2011	Conference-Funded Student Travel Grant to attend Human-Robot Interaction (HRI) 2011
2010	Conference-Funded Student Travel Grant to attend Ubiquitous Computing (UbiComp) 2010
2010	Carnegie Mellon Graduate Conference Funding to attend Ubiquitous Computing (UbiComp) 2010
2010	Conference-Funded Student Travel Grant to attend Autonomous and Multiagent Systems (AAMAS) 2010
2010	Conference-Funded Student Travel Grant to attend Intelligent User Interfaces (IUI) 2010

- 2009 Conference-Funded Student Travel Grant to attend Computer-Human Interaction (CHI) 2009
- 2009 AAAI Spring Symposium Graduate Travel Funding
- 2008 Carnegie Mellon Graduate Conference Funding to attend Human-Robot Interaction (HRI) 2008

UNDERGRADUATE

- 2007 CRA Outstanding Undergraduate Award Winner
- 2007 Andrew Carnegie Society Scholar (40 selected university-wide)
- 2006 Phi Beta Kappa
- 2006 Microsoft National Female Scholarship Winner
- 2005 Phi Kappa Phi Honors Fraternity
- 2005 Boeing Leadership Scholarship
- 2005 Microsoft Research Academic All-Star

SERVICE

POST-GRADUATE

- 2013 **Program Committee Member – Intelligent User Interface Conference Interactive Machine Learning Workshop**

GRADUATE

- 2011 **Program Committee Member – IJCAI Workshop on Agents that Learn Interactively from Human Teachers**
- 2011 **Computer Science Graduate Admissions Committee 2011**
- Student Conference Volunteer**
- 2009- Ubiquitous Computing (UbiComp) 2010
- 2010 Autonomous and Multi-Agent Systems (AAMAS) 2010
- Computer-Human Interaction (CHI) 2009
- 2008- **Admission Visit Weekend**
- 2011 Act as Student Contact, Graduate Student Panelist, and help plan dinner events for the admitted students to the Computer Science Department

UNDERGRADUATE

- 2005- **Undergraduate Review Committee**
- 2007 Served as inaugural undergraduate member of the undergraduate curriculum with 7 faculty, helped redefine the curriculum of the introductory courses based on feedback from the faculty and students
- 2006- **School of Computer Science Day** (Workshop Chair 2006, General Chair 2007, 2008)
- 2008 Planned all-day workshops, art show, and talent show for undergraduate, graduate, faculty, and staff of the School of Computer Science to celebrate the diversity of the community

OUTREACH THROUGH WOMEN@SCS

- 2007- **Big Sister/Little Sister**
- 2012 Matched with an undergraduate woman in computer science to mentor and answer questions about research, internships, graduate school, and any other questions she has about careers in CS
- 2005- **Creative Technology Nights** (<http://women.cs.cmu.edu/technights/>)
- 2012 Develop and teach free workshops including sewing circuits, robotics, HCI design for middle school girls in Pittsburgh to learn about different aspects of computer science
- 2003- **Computer Science Roadshows** (<http://women.cs.cmu.edu>)
- 2012 Visit middle and high schools promoting computer science as a possible major and career

PEER REVIEWING

Journal of Artificial Intelligence Research (JAIR)

Artificial Intelligence Journal (AIJ)

ACM Ubicomp 2010, 2011

IEEE Ro-Man 2011, 2012

ACM HRI 2011, 2012, 2013, 2014

Pervasive 2011

ACM CHI 2011, 2014

IEEE ICRA 2010, 2012

IEEE IROS 2009, 2010, 2011, 2013, 2014

MEMBERSHIP

Association for Computing Machinery (ACM)

Association for the Advancement of Artificial Intelligence (AAAI)

Institute for Electrical and Electronics Engineers (IEEE)

TEACHING

POST-GRADUATE

Predictive Analytics Class Lecturer (November 2013)

Demonstrative lecture on predictive analytics to secure funding for up to 3 different types of classes for the Department of Defense (DoD)

Researched, wrote, and presented to Computer Science Education specialists with the DoD a single lecture outlining the important basic principles of predictive and big data analytics and the current challenges that are faced during implementation

Designed and proposed in-class, online, and undergraduate summer classes covering the basic and state-of-the-practice data exploration, data analysis, machine learning techniques to be formally written and presented in 2014

Mentor for Human-Computer Interaction Undergraduate Senior Capstone Project (Spring 2013)

Project course for students to practice HCI methods (need finding, design, user studies) for a real product

Proposed, designed, and scoped project with Bossa Nova robot to design out-of-box experience of buying and starting the robot for the first time

Met weekly (or more) with students to provide feedback and advice on their project

Designed demo code for students to use to test their interface

GRADUATE

Teaching Assistant for CMRoboBits (Fall 2008)

Project course for students to implement algorithms on iRobot Create robots

Graded weekly demonstrations on the robots and held office hours to help students between demo days

Teaching Assistant for Data Structures and Algorithms (Summer 2008)

Course for practical application, design and analysis of fundamental algorithms and data structures

Held recitations 2 times per week and office hours, helped design and grade assignments and exams

UNDERGRADUATE

Course Assistant for Principles of Computation (Spring 2007)

Introductory course on theoretical foundations of computer science (no programming) for non-CS majors

Held office hours and graded assignments and exams, taught review sessions before exams

Course Assistant for Effective Programming for C and UNIX (Fall 2006)

Course to teach the C language basics of pointers, memory addressing, copying and moving memory, etc.

Held office hours and graded assignments and exams

PROFESSIONAL EXPERIENCES

Research Scientist at Software Engineering Institute at Carnegie Mellon University (August 2013-Present)

The Emerging Technology Center at the SEI focuses on big data analytics and high performance computing research and development. I was brought on as the first research scientist in a group of software engineers to implement a new research agenda as well as act as an advisor for the rest of the group on machine learning, human-computer interaction, and general research methods. As part of my position, I was also responsible for finding and writing grant proposals to fund my position and research agenda. I secured a grant from the Department of Defense over 2 years for designing and teaching classes in Predictive and Big Data Analytics.

Human-Robot Interaction Scientist at Bossa Nova Robotics Pittsburgh (July 2012- August 2013)

Bossa Nova Robotics is developing commercially viable ballbots (robots that balance on a ball). Ballbots have many features that make them particularly fit for human-robot interaction; namely, that they can be built tall and thin, they are compliant and pushed around in crowded environments, and omni-directional to navigate around people. My job was to design demonstrations of these features. I designed and developed applications that use the Kinect RGBD camera to detect people and obstacles, dialog with people, and plan paths through the environment. These demonstrations were controlled through the Microsoft gamepad controller or through websites that I created. Additionally, I was consulted on the sensor packages that should be bought for the robot products and for developing a cost plan for product development including people and time to completion. I also started my own research agenda focusing on long-term personalization of robots (see "Execution Memory" project).

Research Internship at Microsoft Research (Summer 2011)

Autonomous agents collect observations from a variety of sources to infer their own state and the states of others in their proximity and determine which actions to take. While some observations from sensors are streaming and available for the agent at any time during execution, there are often additional observations that the agent can receive by taking explicit information gathering actions, such as asking humans to disambiguate between two predicted states, multi-modally both in the world and through various sources online. We investigate the value of gathering information in parallel from multi-modal sources with delays in observations. We formalize the problem and contribute a decision-theoretic algorithm that determines the best sequence of concurrent multi-modal information gathering actions and actions to complete a task. We then discuss the intractability of computing the optimal policy and provide approximations that are more computationally efficient in practice.

Research Internship at National Security Agency (Summer 2010)

I developed interfaces to help researchers understand and analyze the content of a file to determine if it contains any malware. The interfaces display evaluations of the file on various metrics and alerts researchers to possible problem areas found in those evaluations in addition to providing a suite of tools for researchers to use to evaluate different parts and types of files.

Research Internship at Intel Research Seattle (Summer 2009)

I designed, implemented, and ran a study to understand how a new micro-projection technology attached to a laptop can help users perform manual tasks like tracing, folding, and cutting better.

Program Manager Internship at Microsoft (Summer 2006)

I helped brainstorm demo applications of the Microsoft Surface, and designed, wrote specs, drove development/testing, produced user interface, and completed corporate demonstrations of the Surface technology.

Program Manager Internship at Microsoft (Summer 2005)

I designed, specified, and drove development for the "print," "save," and "open" menus for the Windows Presentation Foundation SDK.

Research Internship at Naval Research Laboratory (2002-2003, Summer 2004)

I participated in the IJCAI Robot Challenge with robots GRACE and George from NRL, CMU, NASA, etc where I designed robot facial expressions of mood based on visitor responses and developed algorithms for the robots to move around the conference.