

# Tom Williams

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*Assistant Professor, Colorado School of Mines*

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## Research Interests

**Mission:** Developing genuinely helpful language-enabled intelligent agents

**Interests:** Artificial intelligence (AI); human-robot interaction (HRI); Cognitive science and systems; natural language understanding and pragmatics; intelligent agents; assistive technologies; augmented reality; multi-modal interaction; robot ethics; dempster-shafer theory; uncanny valley

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## Education

- 2013 – 2017 **Ph.D., Computer Science: Cognitive Science, Tufts University.**  
(Defended) Dissertation: Situated Natural Language Interaction in Uncertain and Open Worlds  
Committee: Matthias Scheutz (Chair), Jan P. de Ruiter, Anselm Blumer, Candace Sidner
- 2011 – 2013 **M.S., Computer Science, Tufts University.**
- 2007 – 2011 **B.A., Computer Science, Hamilton College.**

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## Employment

- Aug. 2017 – **Assistant Professor, Colorado School of Mines.**
- Sum. 2016 **Visiting Researcher, University of Bremen.**
- Sum. 2009 **Cyberforensics Consultant, Assured Information Security.**

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## Honors and Awards

- New and Future AI Educator Award, EAAI, 2017.**
- Teaching Fellowship, Tufts Graduate Institute for Teaching, 2015.**
- Doctoral Consortia, YRRSDS 2014, HRI 2015, AAAI 2016.**

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## Publications

### *Journal Articles*

- [J1] Gordon Briggs, Tom Williams, and Matthias Scheutz. “Enabling Robots to Understand Indirect Speech Acts in Task-Based Interactions”. In: *Journal of Human-Robot Interaction (JHRI)* (2017).
- [J2] Tom Williams, Priscilla Briggs, and Matthias Scheutz. “Covert Robot-Robot Communication: Human Perceptions and Implications for Human-Robot Interaction”. In: *Journal of Human-Robot Interaction (JHRI)* (2015).

### *Book Chapters*

- [B1] Tom Williams and Matthias Scheutz. “Reference Resolution in Robotics: A Givenness Hierarchy Theoretic Approach”. In: *The Oxford Handbook of Reference*. Ed. by Jeanette Gundel and Barbara Abbott. Oxford University Press, 2017.
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*Refereed Conference Papers*

- [C1] Maxwell Bennett, Tom Williams, Daria Thames, and Matthias Scheutz. “Differences in Interaction Patterns and Perception for Teleoperated and Autonomous Humanoid Robots”. In: *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2017.
  - [C2] Tom Williams, Collin Johnson, Matthias Scheutz, and Benjamin Kuipers. “A Tale of Two Architectures: A Dual-Citizenship Integration of Natural Language and the Cognitive Map”. In: *Proceedings of the 16th International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*. 26% acceptance rate, 2017.
  - [C3] Tom Williams and Matthias Scheutz. “Resolution of Referential Ambiguity in Human-Robot Dialogue Using Dempster-Shafer Theoretic Pragmatics”. In: *Proceedings of Robotics: Science and Systems (RSS)*. 2017.
  - [C4] Tom Williams, Saurav Acharya, Stephanie Schreitter, and Matthias Scheutz. “Situated Open World Reference Resolution for Human-Robot Dialogue”. In: *Proceedings of the 11th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*. 25% acceptance rate, 2016.
  - [C5] Tom Williams and Matthias Scheutz. “A Framework for Resolving Open-World Referential Expressions in Distributed Heterogeneous Knowledge Bases”. In: *Proceedings of the 30th AAAI Conference on Artificial Intelligence (AAAI)*. 26% acceptance rate, 2016.
  - [C6] Tom Williams, Gordon Briggs, Bradley Oosterveld, and Matthias Scheutz. “Going Beyond Command-Based Instructions: Extending Robotic Natural Language Interaction Capabilities”. In: *Proceedings of the Twenty-Ninth AAAI Conference on Artificial Intelligence (AAAI)*. 27% acceptance rate, 2015.
  - [C7] Tom Williams and Matthias Scheutz. “A Domain-Independent Model of Open-World Reference Resolution”. In: *Proceedings of the 37th annual meeting of the Cognitive Science Society (COGSCI)*. 2015.
  - [C8] Tom Williams and Matthias Scheutz. “POWER: A Domain-Independent Algorithm for Probabilistic, Open-World Entity Resolution”. In: *Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2015.
  - [C9] Evan Krause, Michael Zillich, Tom Williams, and Matthias Scheutz. “Learning to Recognize Novel Objects in One Shot through Human-Robot Interactions in Natural Language Dialogues”. In: *Proceedings of the Twenty-Eighth AAAI Conference on Artificial Intelligence (AAAI)*. 28% acceptance rate, 2014.
  - [C10] Tom Williams, Priscilla Briggs, Nathaniel Pelz, and Matthias Scheutz. “Is Robot Telepathy Acceptable? Investigating Effects of Nonverbal Robot-Robot Communication on Human-Robot Interaction”. In: *Proceedings of the 23rd IEEE Symposium on Robot and Human Interactive Communication (RO-MAN)*. 2014.
  - [C11] Tom Williams, Rafael C Núñez, Gordon Briggs, Matthias Scheutz, Kamal Premaratne, and Manohar N Murthi. “A Dempster-Shafer Theoretic Approach to Understanding Indirect Speech Acts”. In: *Advances in Artificial Intelligence– Proceedings of the 14th Ibero-American Conference on AI (IBERAMIA)*. 26% acceptance rate for Natural-Language Processing track, 2014.
  - [C12] Tom Williams, Rehj Cantrell, Gordon Briggs, Paul Schermerhorn, and Matthias Scheutz. “Grounding Natural Language References to Unvisited and Hypothetical Locations”. In: *Proceedings of the Twenty-Seventh AAAI Conference on Artificial Intelligence (AAAI)*. 29% acceptance rate, 2013.
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- [C13] Leanne Hirshfield, Rebecca Gulotta, Stuart Hirshfield, Sam Hincks, Matthew Russell, Rachel Ward, Tom Williams, and Robert Jacob. “This is your brain on interfaces: enhancing usability testing with functional near-infrared spectroscopy”. In: *Proceedings of the annual conference on Human factors in computing systems (CHI)*. 23% acceptance rate, 2011.
- [C14] Leanne Hirshfield, Stuart Hirshfield, Sam Hincks, Matthew Russell, Rachel Ward, and Tom Williams. “Trust in Human-Computer Interactions as Measured by Frustration, Surprise, and Workload”. In: *Foundations of Augmented Cognition. Directing the Future of Adaptive Systems (FAC)*. 2011.

### *Refereed Workshop and Symposium Papers*

- [W1] Tom Williams and Matthias Scheutz. “Referring Expression Generation Under Uncertainty in Integrated Robot Architectures”. In: *Proceedings of the Robotics: Science and Systems Workshop on Human-Centered Robotics: Interaction, Physiological Integration and Autonomy*. 2017.
- [W2] Tom Williams and Matthias Scheutz. “Resolution of Referential Ambiguity Using Dempster-Shafer Theoretic Pragmatics”. In: *Proceedings of the AAAI Fall Symposium on AI for HRI (AI-HRI)*. 2016.
- [W3] Tom Williams, Stephanie Schreitter, Saurav Acharya, and Matthias Scheutz. “Towards Situated Open-World Reference Resolution”. In: *Proceedings of the AAAI Fall Symposium on AI for HRI (AI-HRI)*. 2015.
- [W4] Matthias Scheutz, Gordon Briggs, Rehj Cantrell, Evan Krause, Tom Williams, and Richard Veale. “Novel Mechanisms for Natural Human-Robot Interactions in the DIARC Architecture”. In: *Proceedings of the 2013 AAAI Workshop on Intelligent Robotic Systems*. 2013.

### *Doctoral Consortia*

- [DC1] Tom Williams. “Architectural Mechanisms for Situated Natural Language Understanding in Uncertain and Open Worlds”. In: *Proceedings of the 2016 AAAI Doctoral Consortium*. 38% acceptance rate, 2016.
- [DC2] Tom Williams. “Towards More Natural Human-Robot Dialogue”. In: *Proceedings of the 6th Pioneers Workshop at HRI 2015*. 2015.
- [DC3] Tom Williams. “Position Paper”. In: *Proceedings of the 10th Young Researchers’ Roundtable on Spoken Dialog Systems*. 2014.

### *Theses*

- [T1] Tom Williams. “Situated Natural Language Interaction in Uncertain and Open Worlds”. PhD thesis. Tufts University, 2017.

### *Other Publications*

- [O1] Eric Eaton, Sven Koenig, Claudia Schulz, Francesco Maurelli, John Lee, Joshua Eckroth, Mark Crowley, Richard Freedman, Rogelio Cardona-Rivera, Tiago Machado, and Tom Williams. “Blue Sky Ideas in Artificial Intelligence Education from the EAAI’17 New and Future AI Educator Program”. In: *Educational Advances in Artificial Intelligence*. 2017.
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- [O2] Tom Williams. “Dissertation Briefing: Situated Natural Language Interaction in Uncertain and Open Worlds”. In: *AI Matters*. 2017.
- [O3] Tom Williams, Stephanie Schreitter, Saurav Acharya, and Matthias Scheutz. “Towards Situated Open World Reference Resolution”. In: *Late Breaking Papers at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. 2015.
- [O4] Stuart Hirshfield, Colden Prime, and Tom Williams. *A Next-Generation Model for Live Cyber Forensics*. Tech. rep. Rome, NY: AFRL Rome Laboratory, Aug. 2008.
- [O5] Stuart Hirshfield, Colden Prime, and Tom Williams. *A New Model for Live Cyber-Forensics*. Tech. rep. Rome, NY: AFRL Rome Laboratory, Aug. 2007.

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## Talks

### Invited Talks

#### **JHRI Session Invited Speaker, March 2017.**

ACM/IEEE International Conference on Human-Robot Interaction, Vienna, Austria

“Covert Robot-Robot Communication: Human Perceptions and Implications for Human-Robot Interaction”

#### **Colloquium Speaker, April 2017.**

MIT Lincoln Laboratory, Lexington, MA

“A Tale of Two Architectures: A Dual-Citizenship Integration of Natural Language and the Cognitive Map”

#### **Colloquium Speaker, April 2017.**

University of Massachusetts Amherst, Amherst, MA

“Genuine Helpers: Enabling Natural Language Capabilities for Interactive Robots”

#### **Colloquium Speaker, July 2016.**

MITRE Corporation, Bedford, MA

“Against Robot Telepathy: the Why and How of Verbal Robot-Robot Communication”

### Other Seminars

#### **Lab Seminar Speaker, June 2016.**

Institute for Artificial Intelligence, Universität Bremen, Bremen, Germany

“Natural Language Understanding for Human-Robot Interaction”

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## Professional Service

### Program Committee Work

#### **Workshop and Symposium Program Co-Chair.**

AAAI Fall Symposium on AI for HRI (AI-HRI) 2016

HRI Pioneers Workshop 2016

#### **Workshop and Symposium Program Committee Member.**

ACL/EMNLP Workshop on NLP and Robotics 2017

HRI Pioneers Workshop 2017

### Referee Service

#### **Referee for Journal Articles.**

Cognitive Systems Research, 2016

International Journal of Robotics Research, 2015-2016

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Autonomous Robots, 2015

**External Referee for Conference Proceedings.**

ACM/IEEE International Conference on Human-Robot Interaction (HRI), 2016-2017

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2015-2017

IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN), 2016

IEEE International Conference on Development and Learning and on Epigenetic Robotics (ICDL-EPIROB), 2016

**External Referee for Workshop and Symposia Proceedings.**

AAAI Fall Symposium on Artificial Intelligence for Human-Robot Interaction (AI-HRI) 2015

**Referee for Workshop Proposals.**

Robotics: Science and Systems (RSS), 2016

**Workshop and Symposium Organization**

**Symposium, *Artificial Intelligence for Human-Robot Interaction (AI-HRI)*.**

Co-organizers: Elin A. Topp (Lund U), Laura M. Hiatt (NRL), Luca Iocchi (Sapienza), Kalesha Bullard (Georgia Tech), Emmanuel Senft (Plymouth U), Tian Zhou (Purdue), Marc Hanheide (U Lincoln), Frank Broz (Heriot-Watt), Dan Grollman (Sphero), Katrin Lohan (Heriot-Watt), Ross Mead (Semio). AAAI Fall Symposium, held in Arlington, VA, in November 2017

**Symposium, *Artificial Intelligence for Human-Robot Interaction (AI-HRI)*.**

Co-organizers: Ross Mead (Semio), Dan Grollman (Sphero), Tiago Ribeiro (U Lisbon), Patrícia Alves-Oliveira (U Lisbon), Richard Freedman (UMass Amherst), Nick DePalma (MIT), Gordon Briggs (NRL), Frank Broz (Heriot-Watt), Katrin Lohan (Heriot-Watt), Bradley Hayes (MIT). AAAI Fall Symposium, held in Arlington, VA, in November 2016

**Workshop, *HRI Pioneers*.**

Co-organizers: Jill Greczek (USC), Tiago Ribeiro (U Lisbon), Hee-Tae Jung (UMass Amherst), Sam Spaulding (MIT), Chris Crawford (U Florida), Maria Vanessa aus der Wieschen (U Southern Denmark), Hee Rin Lee (Indiana U), Jung Ju Choi (Ewha Womens U), Igor Zubrycki (Politechnika Lodzka). Human-Robot Interaction Conference, held in Christchurch, New Zealand, in March 2016

**Other Service**

**Invited Representative, School of Engineering, *Panel on Student Research at President's Council***, Tufts University, 2017.

**Puzzle Contributor**, “*My Favorite Marvin*”, AI Matters, 2017.

**Puzzle Contributor**, *Fun and Games Night*, AAAI Conference on Artificial Intelligence (AAAI), 2015.

## Teaching

### Courses Taught

Term	School	Course #	Course Title	Responses	Evaluation
Fall 2017	Mines	CSCI 512	Computer Vision	–	–
Spring 2017	Tufts	COMP 131	Artificial Intelligence	31	3.70/5.0
Fall 2015 <sup>1</sup>	Tufts	COMP 131	Artificial Intelligence	16	4.63/5.0

<sup>1</sup> Co-taught with Anselm Blumer

## Teaching Assistance

Term	School	Course #	Course Title	Course Lead
Fall 2014	Tufts	COMP 150-PR	Probabilistic Robotics	Anselm Blumer
Fall 2013	Tufts	COMP 50	Problem Solving by Computer	Norman Ramsey
Spring 2011	Hamilton	CS 105	Explorations in CS	Stuart Hirshfield
Fall 2010	Hamilton	CS 110	Introduction to CS	Alistair Campbell and Mark Bailey
Spring 2010	Hamilton	CS 110	Introduction to CS	Mark Bailey
Fall 2009	Hamilton	CS 110	Introduction to CS	Alistair Campbell

## Curriculum Development

### **Artificial Intelligence**, *Tufts University*.

This course is an introductory survey of artificial intelligence (AI). The course covers the history, theory, and computational methods of artificial intelligence, to enable students to (1) identify the major classical and modern AI paradigms, and explain how they relate to each other; (2) analyze the structure of a given problem such that they can choose an appropriate paradigm in which to frame that problem; and (3) implement a wide variety of both classical and modern AI algorithms.

## Outreach

### Public Talks and Presentations

**Panelist**, *A Study in Chrome: The Ethics of Silverside*, PAX East, 2015.

Organized and participated in a panel introducing robot ethics to members of the public.

**Presenter**, Open House, AAAI Conference on Artificial Intelligence, 2015.

Presented a poster to members of the public.

### Targeted Programs

**Volunteer**, AAAI Connections, AAAI Conference on Artificial Intelligence, 2017.

Outreach program targeted at K-12 students from underserved communities and their parents.