# Paul R. Cohen

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## Education

Ph.D., Computer Science and Psychology, Stanford University, 1983.
M.A., Psychology, University of California, Los Angeles, 1978.
B.A., Psychology, University of California, San Diego, 1977.

## Honors and Awards

Fellow, Association for the Advancement of Artificial Intelligence, elected 1993.
Fellowship, Engineering and Physical Sciences Research Council, UK, 2000.
Faculty Fellowship, University of Massachusetts, 1998.
Councillor, Association for the Advancement of Artificial Intelligence, 1991—1994.

## Summary

I am a professor in the School of Computing and Information and director of the Institute for Modeling and Managing Complicated Systems (momacs) at the University of Pittsburgh. I joined Pitt in 2017 to serve as the Founding Dean of the School. Immediately prior, I was a program manager in DARPA's Information Innovation Office, where I designed and managed the Big Mechanism, Communicating with Computers and World Modelers programs. I worked at DARPA under an IPA agreement with the University of Arizona, where I served as a professor and head of Computer Science and founded the School of Information: Science, Technology and Arts (SISTA), now part of the UA School of Information). My research is in aspects of artificial intelligence and cognitive science. I am interested in language, communication, and AI methods to help us understand very complicated systems such as cell signaling pathways, biophysical and socio-economic systems. For details, videos, blogs etc. visit my website at paulrcohen.github.io.

## Positions

- Professor and Director of the Institute for Modeling and Managing Complicated Systems (momacs), School of Computing and Information, University of Pittsburgh. August 1, 2020 - present.
- Founding Dean, School of Computing and Information, University of Pittsburgh. August 1, 2017 – August 1, 2020.
- Professor, Department of Computer Science, University of Pittsburgh. Aug. 1, 2017 – present.
- Affiliate Scholar, Institute for Cyber Law, Policy and Security. University of Pittsburgh. Dec. 1 – present.
- Program Manager, IPA at Defense Advanced Research Projects Agency (DARPA), Sept. 2013 - July, 2017
- Professor and Founding Director, School of Information: Science, Technology and Arts, University of Arizona, 2010 - 2013.
- Professor and Head, Department of Computer Science, University of Arizona, 2008 - 2010
- Director, Center for Research on Unexpected Events, and Deputy Director, Intelligent Systems Division, Information Sciences Institute, University of Southern California, 2003 - 2008
- Professor (Research) Department of Computer Science. University of Southern California., 2003 - 2008
- Assistant, Associate and Full Professor of Computer Science, University of Massachusetts (1983-2003)

## Consulting

I have served as an advisor to corporations on the design of challenge problems; and to DARPA and other government organizations, helping them design and analyze the results of evaluations for several programs, including HPKB, RKF, PAL (CALO and RADAR), Coordinators, PANDA, KD-D, Transfer Learning, and Machine Reading.

## Research Grants and Contracts

- Hyperlocal Elicitation and Understanding of Risks to Stability in Complicated Systems. DARPA Habitus program. $5,670,000. Paul Cohen, PI.
- Probabilistic Relational Agent-based Systems. DARPA ASKE program. $990,000. 2019.
- Inaugural of the MOMACS Institute. Ford Foundation. $150,000. 2018.
- Semantics of Spatial Referring Expressions. DARPA I2O, subcontractor to SRI. $675,000 for three years.
- The Bayesian Blackboard. DARPA seedling grant, subcontractor to iRobot. $300,000. 2013.
- Robotoddler: Grounded Language Learning for Shared Human-robot Tasks. 2011. DARPA I2O. $3,000,000 for five years. Program Area E canceled after one year. Reconstituted as Semantics of Spatial Referring Expressions (above).
- Inferring Structure and Forecasting Dynamics on Evolving Networks. Multi-disciplinary University Research Initiative (MURI). Jeff Brantingham, PI (UCLA). University of Arizona part is $1,501,438 for five years.
- Persistent Stare Through Imagination (Kobus Barnard, co-PI). 2010. DARPA TCTO. $5,000,000 for five years.
- Teach Ourselves (Carole Beal, co-PI). 2010. DARPA IPTO. $1,500,000 for three years.
- Cognitive Semantics for Soar Wubbles. 2010. Office of Naval Research. $450,000 for three years.
- Wubble World Phase II. DARPA IPTO. 2010. $256,000. Nine-month seedling project.
- Markov Decision Process Policies for Teaching Strategies: BattleSmarts Nine-month Seedling Project. DARPA IPTO. 2008. $300,000
- Deep Green. DARPA IPTO. 2008. SAIC is the prime, my part is $1.2M/year for 3 years. (SAIC lost the contract after one year.)
- Wubble World. DARPA IPTO. 2007. Nine-month seedling project. $100,000
- Deep Green. DARPA IPTO. 2007. Six month seedling project. $200,000
- Bootstrap Learning. DARPA IPTO. 2007. SRI is the prime. I am the principal scientist. $3.6M over three years.
- Windward: Workflows for Intelligence Analysis. 2006. Yolanda Gil (PI) $450K.
- Transfer Learning. DARPA/IPTO. $1.44M over three years.
- Integrated Learning. DARPA/IPTO. 2005. $900,000 over three years.
- Human-like Learning Seedling. DARPA IPTO Carole Beal (PI) and Paul Cohen (Co-PI). $600K
- Learning by Doing. DARPA/IPTO. Paul Cohen (PI) Carole Beal (co-PI) and Tim Oates. $1.5M
- Assessing the Robustness of Relational Classifiers (with Aram Galstyan). NSA. 2005. $100,000.
- Multidisclinary University Research Initiative: Spatiotemporal nonlinear filtering with applications for information assurance and counterrorism. Prof. Boris Rozovsky, Center for Applied Mathematical Sciences (PI), co-PIs from USC, UCLA and Brown. 2006. $900,000 over three years.
- Developmental Chunking. NSF. 2005. $150,000.
- Tracking Scientists. IBM. 2004. $100,000.
- COGENT: Architecture for Cognitive Information Processing. DARPA. Co-principal investigator with Raytheon and John Granacki. 2004. $2,000,000
- The Terrorist Adversary. DARPA/ATO Integrated Battle Command. Subcontract to SAIC. 2004. $300,000

- AIID as an Integration Architecture. Evidence Extraction and Link Discovery, Continuation. 2004. $500,000
- Learning by Doing. DARPA. 2004. $1,950,000
- How Human Office Assistants Learn. DARPA. 2003. $150,000
- An Evaluation Plan for IPTO. DARPA. 2003. $150,000
- Sidekick Seedling project, DARPA, 2003, $187,000
- RKF plus-up (subcontract to Information Extraction and Transport, Inc.), DARPA, 2003, $375,000
- Office Assistant Knowledge and Learning Inventory (OAKLI) Seedling project, DARPA, 2003, $150,000
- Research gift, SAIC, $50,000
- Director of the CIA postdoctoral research program award, 2003 – 2005, $100,000
- Principal Investigator : Patterns of Behavior, NSF / KD-D, 2002, $600,00
- Principal Investigator : Evidence Extraction and Link Discovery, DARPA / IAO, 2001 - 2004, $1,050,000
- Principal Investigator : Effects-based Operations, Air Force Research Laboratory, 2001 – 2004, $300,000
- Co-Principal Investigator: Rapid Knowledge Formation (with SRI as prime contractor), DARPA/ISO 2000—2003. $248,000
- Principal Investigator: Probabilistic Dynamic Analysis of Plans. DARPA/ISO, 2000—2003. $550,000.
- Research Fellow: Engineering and Physical Sciences Research Council, UK, 2000. $30,000
- Principal Investigator: Convivial Computers: The Case for Natural Semantics. DARPA/ITO, 1999—2002. $854,014.
- Principal Investigator: Course of Action Simulation, Testing, Evaluation and Revision. DARPA/ISO, 1999—2002. $869,000.
- Principal Investigator: Building and Acquiring Interactionist Ontologies. DARPA/AFOSR, 1997—2000. $1,113,788.
- Principal Investigator: Mixed Initiative Plan Evaluation and Repair. DARPA/Rome Laboratory, 1997—2000. $967,102.
- Co-Principal Investigator: A Facility for Cross Disciplinary Research on Sensorimotor Development in Humans and Machines. National Science Foundation, 1997—2002. $1,316,755.
- Co-Principal Investigator: Sensorimotor Cognition, The Earliest Knowledge Structures. National Science Foundation, 1997—1999. $344,885.
- Senior Scientist: AIDE, The Data Analyst's Assistant. SBIR (ACSIOM Labs, Inc.) National Science Foundation, 1997. $74,920.
- Associated Faculty, Gaining Confidence in Math, Intelligent Tutors for Girls and Women. National Science Foundation, 1996—1997. $116,355.
- Principal Investigator, Campaign-at-a-Glance, Conceptual Models for Visualization, Information Extraction and Simulation. DARPA, 1996—1999. $960,420.
- Co-Principal Investigator, Evaluation Methods for Complex, Intelligent, Information-Driven Systems. Sterling Software, Inc./Rome Laboratory, 1995—1997. $224,330.
- Principal Investigator, Prototyping the ECS Fault Management Application Service. Hughes Information Technology Co./NASA, 1995—1997. $191,542.
- Principal Investigator, A Substrate and Tools for Experimental Testbeds. ARPA/Rome Laboratory, 1995—1999. $942,447.
- Principal Investigator, A Next-Generation Data Analysis System. ARPA/Army (AASERT Program), 1995—1998. $117,000.
- Principal Investigator, Experimental Methods for Evaluating Planning Systems. ARPA/Rome Laboratory, 1993—1997. $1,004,000.
- Principal Investigator, Exploring the Foundations of a Plan Steering Architecture. DARPA (AASERT Program), 1992—1994. $84,097.
- Principal Investigator, Visualization and Simulation for Interactive Plan Development and Plan Steering. DARPA, 1991—1994. $951,931.

- Principal Investigator, Automated Path Analysis: A Tool for the Discovery of Causal Structure. NASA Graduate Student Researchers Program, Minority Focus, 1993—1994. $22,000.
- Principal Investigator, A Workshop on AI Methodology and Evaluation. NSF and DARPA, 1991—1992. $30,000.
- Principal Investigator, Real-time Problem-solving for Large Networks of Agents. NTT Data Communications Systems Corp., 1991—1995. $132,000.
- Principal Investigator, Adapting the Contact Migration Policy Algorithm to Dynamic Planning in Phoenix. ONR, 1991—1992. $49,800.
- Co-Principal Investigator, Intelligent, Real-time, Complex Computing Systems. DARPA and NSF, 1991—1994, With W. Richards Adrion, Roderic Grupen, Edward M. Riseman, and John A. Stankovic. $7,718,745.
- Principal Investigator, Intelligent Real-time Problem Solving. AFOSR. Phase 3, through April 1992. $130,000.
- Principal Investigator, Modeling AI Systems with Functional Relations. ONR and AFOSR. Oct. 1990—Sept. 1990. $40,000.
- Principal Investigator, Intelligent Real-time Problem Solving. AFOSR. Phase 1, through Sept. 1989. $30,000.
- Principal Investigator, An Adaptive Planner for Real-time, Uncertain Environments. DARPA, 1989—1992. $714,000.
- Principal Investigator, Collaborative work between EKSL and Digital Equipment Corporation, 1989. $50,000.
- Co-Principal Investigator, A Distributed Fire-fighting System, RADC/NAIC Consortium grant, 1989. (With Victor Lesser; and Susan Conry, and Bob Myer, Clarkson College.) $100,000
- Co-Principal Investigator, Knowledge Base Retrieval using Plausible Inference, AFOSR, 1988—1991. (With Bruce Croft). $321,750
- Principal Investigator, Digital Equipment Corporation, Collaborative Research between DEC and EKSL, 1988, $25,000.
- Principal Investigator, Control Strategies for Reasoning Under Uncertainty, ONR, 1987—1990, $150,000.
- Principal Investigator, Unrestricted, Tektronix, 1987, $15,000.
- Principal Investigator, Equipment Grant, Tektronix, 1987, $30,000.
- Principal Investigator, Personal Computing Workstations, Texas Instruments, 1987, $14,000.
- Co-Principal Investigator, Center for Excellence in Artificial Intelligence. URI, ONR, DARPA, 1986—1991, $4,500,000. (With Victor Lesser and Wendy Lehnert.)
- Principal Investigator, Reasoning About Uncertainty in Data. NUSC, 1986—1987, $25,000.
- Co-Principal Investigator, Artificial Intelligence Applied to Mechanical Design. National Science Foundation, 1986—1989, (With Jack Dixon, Dept. of Mechanical Engineering.) $483,608.
- Principal Investigator, An Expert System for Diagnosing Economically Important Plant Pathologies. Public Service Endowment, University of Massachusetts, 1986—1987, $12,500.
- Principal Investigator, Expert Systems Technology Program. DARPA, 1985—1989, $1,044,169.
- Principal Investigator, Request for Lisp Machines. DARPA, 1985, $258,000.
- Principal Investigator, Heuristic Reasoning about Uncertainty: An Artificial Intelligence Approach. National Science Foundation, 1983—1986, $113,908.
- Principal Investigator, Faculty Research Grant. 1983, $2,500.

## Publications

See http://bit.ly/1mf5Bwa for access to many of these publications.

**Books Published:**

Paul R. Cohen, Niall M. Adams, Michael R Berthold (Editors) Advances in Intelligent Data Analysis IX. Proceedings of the 9th Symposium on Intelligent Data Analysis. 2010. Heidelberg: Springer-Verlag.

X. Liu, P. Cohen, M. Berthold (Editors) Advances in Intelligent Data Analysis: Reasoning about Data Proceedings of the 2nd Symposium on Intelligent Data Analysis. 1997. Heidelberg: Springer-Verlag.

Paul R. Cohen. 1995. Empirical Methods for Artificial Intelligence. Cambridge, Mass: The MIT Press.

Avron B. Barr, Paul R. Cohen and Edward A. Feigenbaum. 1989. The Handbook of Artificial Intelligence, Volume IV. Reading, Mass: Addison Wesley.

Paul R. Cohen. 1985. Heuristic Reasoning about Uncertainty: An Artificial Intelligence Approach (Doctoral Dissertation). London: Pitman Advanced Publishing Program.

Paul R. Cohen and Edward A. Feigenbaum. 1982. The Handbook of Artificial Intelligence, Volume III. Los Altos, CA.: William Kaufmann.

**Books in Preparation:**

*Great Ideas of the Information Age.* An introductory text for the 100-level course in the School of Information at the University of Arizona.

**Journal Articles Published:**

Paul R. Cohen. Harold Cohen and AARON. AI Magazine. December, 2016.

Paul R. Cohen. DARPA's Big Mechanism Program. Physical Biology, 12, 045008 doi:10.1088/1478-3975/12/4/045008. http://iopscience.iop.org/1478-3975/12/4/045008

Nikolich-Zugich, J., D.P. Goldman, P.R. Cohen, D. Cortese, L. Fontana, B.K. Kennedy, M.J. Mohler, S.J. Olshansky, T. Perls, D. Perry, A. Richardson, C. Ritchie, A.M. Wertheimer, R.G.A. Faragher and M.J. Fain. 2015. Preparing for an Aging World: Engaging Biogerontologists, Geriatricians and the Society. J Gerontol A Biol Sci Med Sci. 2016 Apr;71(4):435-44. doi: 10.1093/gerona/glv164. Epub 2015 Sep 29.

Carole R. Beal, Jane Strohm, Lauren Schwindy, and Paul R. Cohen. Teach Ourselves: A peer-to-peer learning community linking in- and out-of-class activity. Bulletin of the IEEE Technical Committee on Learning Technology, Volume 15, Number 1, January 2013.

Carole R. Beal, Niall M. Adams and Paul R. Cohen. Reading Proficiency and Mathematics Problem Solving by High School English Language Learners. Urban Education 2010; 45; 58 DOI: 10.1177/0042085909352143

Carole R. Beal, Ivon M. Arroyo, Paul R. Cohen and Beverly P. Woolf. Evaluation of AnimalWatch: An intelligent tutoring system for arithmetic and fractions. Journal of Interactive Online Learning. March, 2010. http://www.ncolr.org/jiol/

Paul R. Cohen and Carole R. Beal. Temporal Data Mining for Educational Applications. International Journal of Software and Informatics, Vol.3, No.1, March 2009, pp. 29-44

Aram Galstyan, Vahe Musoyan, and Paul Cohen. Maximizing influence propagation in networks with community structure. Physical Review E 79 (5), 056102

Aram Galstyan and Paul R. Cohen. Cascading Dynamics in Modular Networks. Physical Review E, **75**, 036109, 2007

Paul R. Cohen, Niall Adams, Brent Heeringa. Voting Experts: An Unsupervised Algorithm for Segmenting Sequences. Journal of Intelligent Data Analysis. Volume 11, Number 6 (2007)

Paul Cohen. If Not Turing's Test, Then What? AI Magazine. 26 (4). 2006.

Ken Barker, Jim Blythe, Gary Borchardt, Vinay K. Chaudhri, Peter E. Clark, Paul Cohen, Julie Fitzgerald, Ken Forbus, Yolanda Gil, Boris Katz, Jihie Kim, Gary King, Sunil Mishra, Clayton Morrison, Ken Murray, Charley Otstott, Bruce Porter, Robert C. Schrag, Tom Uribe, Jeff Usher, Peter Z. Yeh. A Knowledge Acquisition Tool for Course of Action Analysis. AI Magazine.

Marco Ramoni, Paola Sebastiani, Paul R. Cohen. 2002. Bayesian Clustering by Dynamics. *Machine Learning*. 47 (1), 91D121.

Miranda Barrows, Lixin Gao, Dawn E. Gregory, Arnold L. Rosenberg and Paul R. Cohen. An Empirical Study of Dynamic Scheduling on Rings of Processors. *Parallel Computing* 25 (1999) 1063-1079.

David Jensen and Paul R. Cohen. 1999. Multiple Comparisons in Induction Algorithms. *Machine Learning*, Vol. 38, No. 3, pp. 309-338.

Robert St. Amant and Paul R. Cohen. Intelligent Support for Exploratory Data Analysis. *Journal of Computational and Graphical Statistics*, Vol. 7, No. 4, pp. 545-558.

Paul R. Cohen, Robert Schrag, Eric Jones, Adam Pease, Albert Lin, Barbara Starr, David Easter, David Gunning and Murray Burke. 1998. The DARPA High Performance Knowledge Bases Project. *Artificial Intelligence Magazine*, Vol. 19, No. 4, pp. 25-49.

Robert St. Amant and Paul R. Cohen. 1997. Interaction with a Mixed-Initiative System for Exploratory Data Analysis. *Journal of Knowledge-Based Systems*, Vol. 10, No. 5, pp. 265-273.

Paul R. Cohen. Getting What You Deserve From Data. *IEEE Expert Intelligent Systems & Their Applications*, Volume 11, Number 5, October 1996, pp. 12-14.

Scott D. Anderson and Paul R. Cohen. Timed Common LISP: The Duration of Deliberation. *SIGART Bulletin*, Volume 7, Number 2, 1996, pp. 11-15.

Marc S. Atkin and Paul R. Cohen. Monitoring Strategies for Embedded Agents: Experiments and Analysis. *Journal of Adaptive Behavior*, Vol. 4, No. 2, 1996, pp. 125-172.

Scott D. Anderson, David M. Hart, David L. Westbrook and Paul R. Cohen. A Toolbox for Analyzing Programs. *International Journal on Artificial Intelligence Tools*, Vol. 4, Nos. 1 & 2, pp. 257-279, 1995.

Adele E. Howe and Paul R. Cohen. Understanding Planner Behavior. *Artificial Intelligence*, Special Issue on Planning Systems, Vol. 76, Nos. 1 & 2, pp. 125-166, 1995.

Steve Hanks, Martha E. Pollack and Paul R. Cohen. Benchmarks, Testbeds, Controlled Experimentation, and the Design of Agent Architectures. *AI Magazine*, Vol. 14, No. 4, pp. 17-42, 1993.

Paul R. Cohen. A Survey of the Eighth National Conference on Artificial Intelligence: Pulling Together or Pulling Apart? *AI Magazine*, Vol. 11, No. 4, pp. 16-41, 1991.

Adele E. Howe, David M. Hart, and Paul R. Cohen. Addressing Real-Time Constraints in the Design of Autonomous Agents, *The Journal of Real-Time Systems*, Vol. 1, pp. 81-97, 1990.

Adele Howe and Paul R. Cohen. 1990. Steps Toward Automating Decision Making. *Information and Decision Technologies*, Vol. 16, pp. 161-182.

Paul R. Cohen, Michael L. Greenberg, David M. Hart, and Adele E. Howe. Trial by Fire: Understanding the Design Requirements for Agents in Complex Environments. *AI Magazine*. Vol. 10, pp. 32-48, 1989. Reprinted in Nikkei Artificial Intelligence, published by Nikkei Business Publications, Inc., pp. 102-119, 1990.

Paul R. Cohen and David S. Day. 1988. The Centrality of Autonomous Agents in Theories of Action Under Uncertainty. *International Journal of Approximate Reasoning*. Fall, 1988.

Paul R. Cohen, Jefferson DeLisio, David Hart. 1988. A Declarative Representation of Control Knowledge. *IEEE Transactions on Systems, Man and Cybernetics*. Vol. 19, No. 3. pp. 546-557.

Paul R. Cohen and Adele Howe. 1988. Toward AI Research Methodology: Three Case Studies. *IEEE Transactions on Systems, Man and Cybernetics*. Vol. 19, No. 3. pp. 634-646.

Paul R. Cohen and Adele E. Howe. 1988. How Evaluation Guides AI Research. *AI Magazine*, Winter, 1988. Vol. 9, No. 4, pp. 35-43. Reprinted in *A Sourcebook of Applied Artificial Intelligence*, Gerald Hopple and Stephen Andriole, Eds. TAB Books, Inc.

Paul R. Cohen. 1987. The Control of Reasoning Under Uncertainty: A Discussion of Some Programs. *The Knowledge Engineering Review*. Vol. 2, No. 1, pp. 5-25. Reprinted in *Readings in Uncertain Reasoning*, Glenn Shafer and Judea Pearl (Eds.). Morgan-Kaufmann, Inc. 1990.

Paul R. Cohen, Glenn Shafer, and Prakash P. Shenoy. 1987. Modifiable Combining Functions. *AI-EDAM* (Artificial Intelligence for Engineering Design and Manufacturing). Vol. 1, No. 1, pp. 47-57.

Paul R. Cohen and Rick Kjeldsen. 1987. Information Retrieval by Constrained Spreading Activation. *Information Processing and Management*. Vol. 23, No. 4, pp. 255-268.

Rick Kjeldsen and Paul R. Cohen. 1987. The Evolution and Performance of the GRANT System. *IEEE Expert*. Vol. 2, No. 2, pp. 73-79.

Paul R. Cohen, David Day, Jeff Delisio, Michael Greenberg, Rick Kjeldsen, Daniel Suthers and Paul Berman. 1986. Management of Uncertainty in Medicine. *International Journal of Approximate Reasoning*. Vol. 1, No. 1, pp. 103-116.

Thomas Gruber and Paul Cohen. 1986. Design for Acquisition: Principles of Knowledge System Design to Facilitate Knowledge Acquisition. *International Journal of Man-Machine Studies*. Vol. 26. pp. 143-159.

Adele Howe, Paul R. Cohen, John Dixon and Melvin Simmons. 1986. DOMINIC: A Domain-Independent Program for Mechanical Engineering Design. *Journal of Artificial Intelligence in Engineering*, April, 1986.

Paul R. Cohen, Alvah Davis, David Day, Michael Greenberg, Rick Kjeldsen, Susan Lander and Cynthia Loiselle. 1985. Representativeness and Uncertainty in Classification Systems. *AI Magazine*, Fall 1985.

Paul R. Cohen and Milton R. Grinberg. 1983. A Theory of Heuristic Reasoning about Uncertainty. *AI Magazine*, Spring-Summer, 1983.

**Refereed Conference Proceedings Published:**

Allegra Cohen, Paul Cohen and Gregory Kiker, "Modeling Gender Inequity in Household Decision-making" Proceedings of Social, Cultural, and Behavioral Modeling 12th International Conference, SBP-BRiMS 2019, Washington, DC, USA, July 9-12, Springer Lecture Notes in Computer Science, 2019

Paul Cohen, "Probabilistic Relational Agent-based Models (PRAM)" Proceedings of Social, Cultural, and Behavioral Modeling 12th International Conference, SBP-BRiMS 2019, Washington, DC, USA, July 9-12, Springer Lecture Notes in Computer Science, 2019 (reviewed and accepted but inadvertently left out of the proceedings, arxiv version)

Paul Cohen, Tomek Loboda. Redistribution Systems and PRAM. arxiv version

Anh Tran, Mihai Surdeanu and Paul Cohen. Extracting Latent Attributes from Video Scenes Using Text as Background Knowledge. The Third Joint Conference on Lexical and Computational Semantics (*SEM 2014). Dublin, Ireland. August 23,24, 2014.

Colin Dawson, Jeremy Wright, Antons Rebguns, Marco Valenzuela Escarcega, Daniel Fried and Paul Cohen. A generative probabilistic framework for learning spatial language. Third Joint IEEE Conference on Development and Learning and on Epigenetic Robotics. Aug. 18 - 22. Osaka, Japan. *Winner of the Overall Best Paper award.*

Nathan Dykhuis, Paul R. Cohen and Yu-Han Chang. Team Formation in Social Networks. SocialCom: ASE/IEEE International Conference on Social Computing. Sept. 8-14, 2013.

Daniel Hewlett, Thomas J. Walsh, and Paul Cohen. Teaching and Executing Verb Phrases. Proceedings of the First Joint IEEE International Conference on Development and Learning and on Epigenetic Robotics. August, 2011.

Raquel Torres Peralta, Tasneem Kaochar, Ian R. Fasel, Clayton T. Morrison, Thomas J. Walsh, Paul R. Cohen. Challenges to Decoding the Intention Behind Natural Instruction. Proceedings of 20th IEEE International Symposium on Robot and Human Interactive Communication (Ro-Man) Atlanta, Georgia - 31 July - 3 August 2011

Wesley Kerr, Paul Cohen and Niall Adams. Recognizing Players' Activities and Hidden State. The 6th International Conference on the Foundations of Digital Games. June 28 - July 1. Bordeaux, France.

Daniel Hewlett and Paul Cohen. Fully Unsupervised Word Segmentation with BVE and MDL. ACL Conference on Empirical Methods in Natural Language Processing. Edinburgh, UK. July 27–31.

Daniel Hewlett and Paul Cohen. An Information-Theoretic Model of Chunking, International Association for Computing and Philosophy (IACAP) . Aarhus University, Denmark, July 4-6, 2011.

Daniel Hewlett and Paul Cohen. Word Segmentation as General Chunking. Proceedings of the Fifteenth Conference on Computational Natural Language Learning. Portland, Oregon, USA, June 23-24, 2011.

Daniel Hewlett and Paul Cohen. Fully Unsupervised Word Segmentation with BVE and MDL. The 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies. Portland, Oregon, USA, June 19-24, 2011

Derek Green, Tom Walsh, Paul Cohen and Yu-Han Chang. Learning a Skill-Teaching Curriculum with Dynamic Bayes Nets. Proceedings of Innovative Applications of Artificial Intelligence. San Francisco, August 7 – 11 2011.

Wesley Kerr, Anh Tran and Paul Cohen. A Framework for Teaching and Executing Verb Phrases. Proceedings of the 22nd International Joint Conference on Artificial Intelligence, Barcelona, Spain, July 16 - 22. 2011

Derek Green, Tom Walsh, Paul Cohen, Carole Beal and Yu-Han Chang. . Gender Differences and the Value of Choice in Intelligent Tutoring Systems. Proceedings of UMAP: User Modeling, Adaptation and Personalization. Girona, Spain. July 11–15, 2011

Tasneem Kaochar, Raquel Torres Peralta, Clayton T. Morrison, Ian R. Fasel, Thomas J. Walsh and Paul R. Cohen. Toward an understanding of how humans teach robots. Proceedings of UMAP: User Modeling, Adaptation and Personalization. Girona, Spain. July 11–15, 2011

Wesley Kerr and Paul Cohen. Recognizing Behaviors and the Internal States of the Participants. Proceedings of the International Conference on Development and Learning. 2010.

Daniel Hewlett and Paul Cohen. Artificial General Segmentation. Proceedings of the Conference on Artificial General Intelligence. Lugano, Switzerland, March, 2010.

Paul R. Cohen and Niall Adams. Intelligent Data Analysis in the Twenty First Century. In Proceedings of the Intelligent Data Analysis Conference, Lyon, France, 2009.

Daniel Hewlett and Paul R. Cohen. Bootstrapped Voting Experts. Proceedings of the Twenty-First International Joint Conference on Artificial Intelligence (IJCAI-09). 2009.

Daniel Hewlett and Paul Cohen. Word Segmentation as General Chunking Psychocomputational Models of Language Acquisition Workshop (PsychoCompLA). 2009.

Aram Galstyan and Paul Cohen. "Empirical Comparison of "Hard" and "Soft" Label Propagation for Relational Classification" Proceedings of the Inductive Logic Programming Conference. 2007.

Wesley Kerr, Shane Hoversten, Daniel Hewlett, Paul Cohen, Yu-Han Chang. Learning in Wubble World. International Conference on Development and Learning, Imperial College, London, 2007.

Daniel Hewlett, Shane Hoversten, Wesley Kerr, Paul Cohen, Yu-Han Chang. Wubble World. To appear in the proceedings of The Third Artificial Intelligence for Interactive Digital Entertainment Conference. June 2007, Stanford University.

Carole Beal, Sinjini Mitra, Paul R. Cohen. Modeling learning patterns of students with a tutoring system using Hidden Markov Models. Proceedings of the 13th International Conference on Artificial Intelligence in Education (AIED), Marina del Rey, CA, July 2007

Paul R. Cohen. Constructing Career Histories: A Case Study in Disentangling the Threads. International Joint Conference on Artificial Intelligence, Hyderabad, India, 2007.

Paul R. Cohen, Yu-Han Chang, Clayton Morrison and Carole R. Beal. Learning and Transferring Action Schemas International Joint Conference on Artificial Intelligence, Hyderabad, India, 2007.

Yu-Han Chang, Paul R. Cohen, Clayton Morrison, Robert St. Amant. Piagetian Adaptation Meets Image Schemas: The Jean System. Proceedings of the Ninth Annual Conference on the Simulation of Adaptive Behavior. Rome. 2006.

Yu-Han Chang and Clayton Morrison and Wesley Kerr and Paul Cohen and Robert St. Amant . The Jean System. International Conference on Development and Learning. 2006.

Robert St. Amant, Clayton T. Morrison, Yu-Han Chang, Paul R. Cohen, and Carole Beal. An Image Schema Language. The International Conference on Cognitive Modeling. 2006. Trieste.

Clayton Morrison and Paul Cohen. The Hats Simulator and COLAB: An Integrated Information Fusion Challenge Problem and Collaborative Analysis Environment. IEEE Intelligence and Security Informatics Conference. 2006. San Diego.

Aram Galstyan and Paul Cohen. Iterative Relational Classification Through Three-State Epidemic Dynamics. IEEE Intelligence and Security Informatics Conference. 2006. San Diego.

Clayton T. Morrison and Paul R. Cohen. (2006). The Colab Mixed-Initiative Analysis Environment. In Proceedings of the 9th International Conference on Information Fusion (Fusion 2006), special session on Making Histories.

Paul Cohen, Clayton Morrison and Erin Cannon. Maps for Verbs: The Relationship between Interaction Dynamics and Verb Use. Nineteenth International Conference on Artificial Intelligence (IJCAI) Edinburgh, Scotland. 2005

Aram Galstyan and Paul Cohen. Inferring Useful Heuristics from the Dynamics of Iterative Relational Classifiers. Nineteenth International Conference on Artificial Intelligence (IJCAI) Edinburgh, Scotland. 2005

Carole Beal and Paul Cohen. Comparing apples and oranges: Computational methods for evaluating student and group learning histories in intelligent tutoring systems. Full paper at 12th International Conference on AI and Education. Amsterdam. 2005

Tim Oates, Paul Cohen, Bill Krueger, Carole Beal, Tom Armstrong. Learning by Doing and Knowledge Transfer. Nineteenth International Conference on Artificial Intelligence (IJCAI) Edinburgh, Scotland. 2005

Aram Galstyan and Paul Cohen. Is guilt by association a bad thing? First International Conference on Intelligence Analysis. Washington D.C. 2005.

Aram Galstyan and Paul Cohen. Identifying Covert Sub-Networks Through Iterative Node Classification. First International Conference on Intelligence Analysis. Washington D.C. 2005.

Clayton T. Morrison, Paul R. Cohen, Gary W. King, Joshua Moody and Andrew Hannon Simulating Terrorist Threats in the Hats Simulator. First International Conference on Inelligence Analysis. Washington D.C. 2005.

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**Recent Refereed Workshops**

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Raquel Torres Peralta, Tasneem Kaochar, Ian Fasel, Clay Morrison, Tom Walsh and Paul Cohen. Challenges to Decoding the Intention Behind Natural Instruction (Extended Abstract). IJCAI Workshop on Agents Learning Interactively from Human Teachers. Barcelona, 2011

Tasneem Kaochar, Raquel Torres Peralta, Clayton T. Morrison, Thomas J. Walsh, Ian R. Fasel, Sumin Beyon, Anh Tran, Jeremy Wright and Paul R. Cohen. Human Natural Instruction of A Simulated Electronic Student. "Help Me Help You" – AAAI Spring Symposium Stanford University - Palo Alto, CA, March 22, 2011

Daniel Hewlett, Thomas J. Walsh, Paul Cohen. Teaching Robots to Execute Verb Phrases. 2011 Robotics: Science and Systems Workshop: The State of Imitation Learning: Understanding its Applications and Promoting its Adoption

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**Selected Recent Presentations**

Modeling and Managing Complicated Systems. Keynote talk at Phenome2020, Tucson, AZ. Feb. 25, 2020

Paul Cohen. Probabilistic Relational Agent-based Models. July 9, 2019. International Conference on Social Computing, Behavioral-Cultural Modeling, & Prediction and Behavior Representation in Modeling and Simulation.

Sustainable Urban Systems. Invited talk at NSF Workshop on Sustainable Urban Systems. Pittsburgh, PA, July 29, 2019.

Modeling and Managing the World's Complicated Systems: A Challenge for AI. National Academy President's Circle Meeting, Washington DC, April 17, 2018

Mining for Causal Results. Invited talk at the Intelligent Data Analysis conference, London, 26 October, 2017

Beyond Big Data. Presentation at the Defense Science and Technology Laboratory, Porton Down, England. Feb. 16, 2017

Beyond Big Data. Data Sciences Institute Distinguished Lecture Series, Imperial College, London, England. Feb. 13, 2017

Beyond Big Data. Seminar at the University of Birmingham Department of Computer Science, England. Feb. 9, 2017

Beyond Big Data. Lecture at the University of Manchester Department of Computer Science, England. Feb. 8, 2017

Big Mechanism and Watson. Presentation at IBM Almaden Research, Almaden CA, April 26, 2016.

Big Mechanisms and World Models. Presentation at Microsoft Research, Redmond WA, April 29, 2016.

Communicative Computers. Presentation at DARPA's Wait What? A Technology Forum. St. Louis, Sept. 10, 2015.

Some Research Challenges to the Big Mechanism program. Seminar at the National Library of Medicine, Bethesda, MD., June 30, 2015.

The Big Mechanism Program and the Future of Scholarship. Biology is Technology meeting, New York, NY, June 24, 2015.

Big Mechanism vs. Big Data. ATARC Federal Big Data Summit, panel discussion. June 18, 2015.

Publishing Models of Complicated Systems. Panel discussion at Society for Scientific Publishing, Washington D.C., May 28, 2015.

Machines that Assemble Cancer Pathways by Reading the Primary Literature. Keynote speech at the Cancer Genome Atlas annual meeting, National Institutes of Health, Bethesda MD, May 11, 2015.

Defense One Viewcast: Big Data for Defense and National Security: Maintaining the U.S. Technological Edge. Panel discussion. April 13, 2015.

Acquiring Big Mechanisms by Reading Primary Literature. Computer Science Colloquium, John's Hopkins University, March 13, 2015.

Artificial Intelligence and Autonomy. Briefing to JRAST. Pentagon, February 17, 2015.

The Future of Scholarship. Presentation to TTI Vanguard Conference, San Francisco, Dec. 5, 2014.

The Future of Artificial Intelligence. Panel at the Council on Foreign Relations, Washington, D.C., Oct. 6, 2014.

From Big Data to Big Mechanisms: Understanding Causes and Effects in Very Complicated Systems. DataLead Conference, UC Berkeley, Sept. 30, 2014

Discovering Big Mechanisms by Reading the Literature. Presentation at the AAAI Workshop on Discovery Informatics. July 27, 2014.

Big Mechanisms and the Future of Big Data. Invited talk to the Big Data Steering Committee, Networking and Information Technology Research and Development (NITRD). White House Conference Center, March 27, 2014.

Big Mechanism. Invited talk at the Beyond Watson workshop, Arundel Preserve, Maryland, February 4, 2014.

The Information School, Polymathy and the Liberal Arts. Invited talk at the University of Nebraska. Lincoln. Nov. 15, 2013

Invited Speaker: Sketches of an Analyst's Workbench. Advanced Analytics Workshop: Enhancing the User Experience Through Machine Learning. Washington DC. August 13, 14, 2013.

Invited Speaker: Acquisition of Spatial Language. Dagstuhl Seminar on Mechanisms of Ongoing Development in Cognitive Robotics, Dagstuhl Castle, Germany, February 2013

Information and Immortality. Public lecture to 3000 citizens of Tucson at the College of Science series on Living Beyond 100. February 2012.

Word meanings for robots. Cognitive Science Colloquium, University of Colorado, Boulder, Sept. 29, 2011.

How robots represent and learn verb meanings. Invited presentation at the Italian Institute for Technology (Genoa). July 4, 2011.

Word meanings for robots. Invited presentation at the Florida Institute for Human and Machine Cognition. June 13, 2011.

Empirical Methods for Artificial Intelligence. Tutorial at the International Joint Conference on Artificial Intelligence, Hyderabad, India, January, 2007.

Colloquium on Tutoring Systems (with Carole Beal). Indian Institute of Information Technology, Hyderabad, India. January, 2007.

Assessing the Intelligence of Cognitive Decathletes. NIST Workshop on the Design of Cognitive Decathlons. Sponsored by DARPA/IPTO. January 2006.

Learning by Doing: First Results on Transfer Learning. DARPATech. August 2005

Paul Cohen, Clayton Morrison, Erin Cannon. Maps for Verbs: The relationship between interaction dynamics and verb use. Internatonal Joint Conference on Artificial Intelligence. Edinburgh. July 2005.

Toward a Cognitive Architecture: Chunking and Memory. Symposium on Representation and Learning in Humans and Animals. University of Edinburgh. July 2005.

Tutorial: Empirical Methods for Artificial Intelligence. 20th National Conference on Artificial Intelligence. Pittsburgh. July, 2005.

Evaluation of the CIA-sponsored KDD Challenge. Las Vegas. October, 2005.

AAAI Invited Talk: "If not Turing's Test, then what?" July 28 2004, San Jose.

ATAT: The Asymmetric Threat Assessment Tool. 14th Conference on Behavior Representation in Modeling and Simulation (BRIMS). May, 2005.

ISAT meeting on evaluation May 4, 2004, IBM Yorktown Heights. Lessons from PAL for Evaluating Cognitive Systems.

Department of Computer Science, USC, May 5, 2004, Patterns in Time. ISD AI Seminar. June 25 2004

TTI Vanguard meeting. Tots and 'bots: How the mind deals with complexity. Sept. 27 2004.

DARPA/IPTO meeting on Grand Challenges. The Handy Andy challenge. Jan 12 2005

Invited Speaker: How Robot Baby Learns Meaningful Representations. Second International Conference on Knowledge Capture. Sanibel Island. 10/23 - 10/26 2003.

Meaning from Movement: How Learning Algorithms Bias Lexical Semantics. At the Symposium on Language and Space, Indiana University, October 13, 2003.

Invited Speaker: It's About Time: Challenges of Robot Baby. FLAIRS 2003, St. Augustine FL. 5/13/2003

Invited speaker: It's About Time: Challenges of Robot Baby. presentation at the Information Sciences Institute (1/13/03), Indiana University (1/23/03), North Carolina State University (1/27/03), Ohio State University (2/4/03).

Synthesis, Gaps and Challenges: Semantic Autonomy. Workshop on the Future of Artificial Intelligence. Ito, Japan. 15/12/02.

Are Patterns Real? International Conference on Data Mining. Maebashi City, Japan. 10/12/02.

Toward Universal, Objective Features of Patterns. Workshop on Patterns. Imperial College, London. 17/9/02.

Empirical Methods for Computer Science. Tutorial at the Autonomous Agents and Multiagent Systems conference, Bologna, July 15, 2002.

Finding Patterns in Time. Invited talk at Yale University, January 2001.

The development of robot minds. Invited talk at Birmingham University and at Brunel University. November, 2000

Patterns and Episodes. Invited talk at Edinburgh University and at Aberdeen University. November, 2000.

Statistical methods for finding patterns in time. Invited talk at Imperial College, London, February 2000.

On Dretske's theory of Contentful Mental States. Invited talk at the Knowledge Media Institute, The Open University, February 2000

Empirical Methods for Computer Science. Tutorial with Ian Gent and Toby Walsh at Fourteenth European Conference on Artificial Intelligence, Berlin, August, 2000.

Empirical Methods for Artificial Intelligence and Computer Science. Tutorial with Ian Gent and Toby Walsh at Seventeenth National Conference on Artificial Intelligence, Austin, TX, August, 2000.

Learning Representations and Meanings from Robot Sensor Data. Co-author with Carole Beal. MARS Meeting, Houston, Texas, May, 2000.

Invited Speaker: Data Analysis and the Development of Robot Minds. Third Symposium on Intelligent Data Analysis, Amsterdam, August 1999.

Keynote Speaker: Fourteen Comments on Empirical Methods. Workshop on Empirical AI, Sixteenth International Joint Conference on Artificial Intelligence, Stockholm, Sweden, August 1999.

Invited Speaker: The Mind-Reading Problem. Workshop on Mixed Initiative Planning, Sixteenth National Conference on Artificial Intelligence, Orlando, FL, July 1999.

Invited Speaker: Agent Systems, the Semantic Challenge. Dagstuhl Seminar on Agent-Oriented Software Approaches in Distributed Modeling and Simulation: Challenges and Methodologies, Dagstuhl Castle, Germany, July 1999.

Invited Speaker: Tot's and 'bots: The Developement of Cognition. British Computer Society Specialist Group on Applied Artificial Intelligence and Knowlege-Based Systems, London, Birbeck College, August 4, 1999.