

# Wheeler Ruml

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- Research Interests** Artificial intelligence, operations research, cognitive science, information visualization.
- Education** HARVARD UNIVERSITY Ph.D. in Computer Science, 2002  
Dissertation: *Adaptive Tree Search*, on exploiting learning for solving combinatorial optimization and constraint satisfaction problems under time constraints.
- HARVARD UNIVERSITY A.B. *cum laude* in Computer Science, 1993  
Honors thesis: *Stochastic Approximation Algorithms for Number Partitioning*, on the effect of problem representation in combinatorial optimization.
- Honors** Personal letter of commendation from the President of R&D, Xerox Corporation 2006  
PARC Golden Acorn Award for most valuable patent of the year (co-winner) 2005  
Best Application Paper Award, Int'l Conf. on Automated Planning and Scheduling 2005  
PARC Outstanding Performance Award 2003, 2005  
Thomas T. Hoopes Prize for outstanding undergraduate scholarship and research 1993  
Award for Most Enthusiastic member of Winthrop House 1993
- Professional Experience** UNIVERSITY OF NEW HAMPSHIRE  
*Assistant Professor* July 2007–present  
Founding and leading a research group in artificial intelligence, teaching courses in computer science, and supervising students in the BS, MS, and PhD programs.
- PALO ALTO RESEARCH CENTER  
*Area Manager, Embedded Reasoning* April 2005–June 2007  
Technical and managerial leadership for a group of seven Ph.D.-level researchers in artificial intelligence and automatic control. Responsible for sponsor relationships (\$2.3M/year), hiring, discretionary budget (\$42K/year), and evaluation of potential patents.
- Research Staff* July 2002–March 2005  
Initiated group research direction in artificial intelligence planning and time-bounded heuristic search. Designed and built core software for a major on-going Xerox robotics project.
- Edited Proceedings** Ian Miguel and Wheeler Ruml (eds), *Abstraction, Reformulation, and Approximation: Proceedings of the Seventh International Symposium*, Springer Lecture Notes in Artificial Intelligence, volume 4612, 418 pp., 2007.
- Raja Bala, Linda Emberley, Patrick Mazeau, Howard Mizes, Emily Moore, Peter Odell, Sudhendu Rai, Palghat Ramesh, Cheryl Roland, Wheeler Ruml, and Tracie Zanders (eds), *Proceedings of the First Annual Xerox Innovation Group Research and Technology Conference*, 328 pp., 2006. (not distributed externally)
- Wheeler Ruml and Frank Hutter (eds), *Learning for Search: Papers from the AAAI Workshop*, AAAI Press Technical Report WS-06-11, 154 pp., 2006.

**Refereed  
Journal  
Publications**

Yi Shang, Wheeler Ruml, Markus P. J. Fromherz, “Positioning using Local Maps,” *Ad Hoc Networks*, 4(2), pp. 240–253, 2006.

Wheeler Ruml, Alfonso Caramazza, Rita Capasso, and Gabriele Miceli, “Interactivity and Continuity in Language Production: An Investigation Using Italian Aphasics,” *Cognitive Neuropsychology*, 22(2), pp. 131-168, 2005.

Yi Shang, Wheeler Ruml, Ying Zhang and Markus P. J. Fromherz, “Localization from Connectivity in Sensor Networks,” *IEEE Transactions on Parallel and Distributed Systems*, 15(11), pp. 961–974, 2004.

Alfonso Caramazza, Costanza Papagno, and Wheeler Ruml, “The Selective Impairment of Phonological Processing in Speech Production,” *Brain and Language*, 75(3), pp. 428–450, 2000.

Wheeler Ruml, Alfonso Caramazza, Jennifer R. Shelton, and Doriana Chialant, “Testing Assumptions in Computational Theories of Aphasia,” *Journal of Memory and Language*, 43(2), pp. 217–248, 2000.

Wheeler Ruml and Alfonso Caramazza, “An Evaluation of a Computational Model of Lexical Access: Comment on Dell et al. (1997),” *Psychological Review*, 107(3), pp. 609–634, 2000.

Wheeler Ruml, J. Thomas Ngo, Joe Marks, and Stuart Shieber, “Easily Searched Encodings for Number Partitioning,” *Journal of Optimization Theory and Applications*, 89(2), pp. 251–291, 1996. Also appeared as Harvard CS Technical Report TR-10-94r.

**Refereed  
Conference  
Publications**

Wheeler Ruml and Minh B. Do, “Best-first Utility-guided Search,” *Proceedings of the Twentieth International Joint Conference on Artificial Intelligence (IJCAI-07)*, pp. 2378–2384, 2007.

Haitham Hindi and Wheeler Ruml, “Network Flow Modeling for Flexible Manufacturing Systems with Re-entrant Lines,” *Proceedings of the 45th IEEE Conference on Decision and Control (CDC-06)*, to appear, 2006.

Minh B. Do and Wheeler Ruml, “Lessons Learned in Applying Domain-independent Planning to High-speed Manufacturing,” *Proceedings of the Sixteenth International Conference on Automated Planning and Scheduling (ICAPS-06)*, pp. 370–373, 2006.

Wheeler Ruml, Minh B. Do, and Markus P. J. Fromherz, “On-line Planning and Scheduling for High-speed Manufacturing,” *Proceedings of the Fifteenth International Conference on Automated Planning and Scheduling (ICAPS-05)*, pp. 30–39, 2005. Winner of the Best Application Paper Award.

Hai Fang and Wheeler Ruml, “Complete Local Search for Propositional Satisfiability,” *Proceedings of the Nineteenth National Conference on Artificial Intelligence (AAAI-04)*, pp. 161–166, 2004.

Yi Shang and Wheeler Ruml, “Improved MDS-Based Localization,” *Proceedings of the 23rd Conference of the IEEE Communications Society (Infocom ’04)*, pp. 2640–2651, 2004.

Yi Shang, Wheeler Ruml, Ying Zhang and Markus P. J. Fromherz, “Localization from Mere Connectivity,” *Proceedings of the Fourth ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc ’03)*, pp. 201-212, 2003.

Wheeler Ruml, “Constructing Distributed Representations using Additive Clustering,” *Advances in Neural Information Processing Systems 14 (NIPS-01)*, 2001. A preliminary version appeared as “Assigning Features using Additive Clustering,” Harvard CS Technical Report TR-04-01.

Wheeler Ruml, “Incomplete Tree Search using Adaptive Probing,” *Proceedings of the Seventeenth International Joint Conference on Artificial Intelligence (IJCAI-01)*, pp. 235–341, 2001.

Joe Marks, Wheeler Ruml, Stuart Shieber, and Tom Ngo, “A Seed-Growth Heuristic for Graph Bisection,” *Proceedings of Algorithms and Experiments '98*, pp. 76–87, 1998. Also appeared as Harvard CS Technical Report TR-01-98.

Brad Andalman, Kathy Ryall, Wheeler Ruml, Joe Marks, and Stuart Shieber, “Design Gallery Browsers Based on 2D and 3D Graph Drawing,” *Proceedings of Graph Drawing '97*, Lecture Notes in Computer Science, vol. 1353, Springer-Verlag, pp. 322-329, 1998.

Joe Marks, Brad Andalman, Paul Beardsley, William Freeman, Sarah Gibson, Jessica Hodgins, Tom Kang, Brian Mirtich, Hanspeter Pfister, Wheeler Ruml, Kathy Ryall, Josh Seims, and Stuart Shieber, “Design Galleries: A General Approach to Setting Parameters for Computer Graphics and Animation,” *Proceedings of SIGGRAPH '97*, pp. 389–400, 1997.

**Lightly  
Refereed  
Publications**

J. Benton, Minh B. Do, and Wheeler Ruml, “A Simple Testbed for On-line Planning,” *Proceedings of the ICAPS-07 Workshop on Moving Planning and Scheduling Systems into the Real World*, 8 pp., 2007. Also appeared in the *Proceedings of the Second International Competition on Knowledge Engineering for Planning and Scheduling (ICKEPS-07)*.

Wheeler Ruml, “Tightly Integrated Parallel Printing: An Overview”, *Proceedings of the First Annual Xerox Innovation Group Research and Technology Conference*, pp. 84–85, 2006. (not distributed externally)

Minh B. Do, Wheeler Ruml, and Rong Zhou, “Beyond Scheduling: Using On-line Planning to Control Printers,” *Proceedings of the First Annual Xerox Innovation Group Research and Technology Conference*, pp.91–94, 2006. (not distributed externally)

Wheeler Ruml and Elisabeth H. Crawford, “Best-first Utility-Guided Search,” *Working Notes of the IJCAI-05 Workshop on Planning and Learning in A Priori Unknown or Dynamic Domains*, pp. 103–109, 2005.

Ying Lu, Lara S. Crawford, Wheeler Ruml, Markus P. J. Fromherz, “Feedback Control for Real-Time Solving,” *Working Notes of the CP-04 Workshop on Constraint Solving under Change and Uncertainty (Changes-04)*, pp. 21–35, 2004.

Wheeler Ruml and Markus P. J. Fromherz, “On-line Planning and Scheduling in a High-speed Manufacturing Domain,” *Proceedings of the ICAPS-04 Workshop on Integrating Planning into Scheduling*, pp. 60–66, 2004.

Wheeler Ruml, “Heuristic Search in Bounded-depth Trees: Best-Leaf-First Search,” *Working Notes of the AAAI-02 Workshop on Probabilistic Approaches in Search*, pp. 45–51, 2002. Preliminary version appeared as Harvard CS Technical Report TR-01-02.

Wheeler Ruml, “Using Prior Knowledge with Adaptive Probing,” *Proceedings of the 2001 AAAI Fall Symposium on Using Uncertainty Within Computation* (AAAI Technical Report FS-01-04), pp. 116-120, 2001.

Wheeler Ruml, “Stochastic Tree Search: Where to Put the Randomness?,” *Proceedings of the IJCAI-01 Workshop on Stochastic Search*, pp. 43–47, 2001.

Wheeler Ruml, “Learning to Search Trees,” selected for oral presentation at *The AAAI-2000 Workshop on Leveraging Probability and Uncertainty in Computation*, 2000.

Wheeler Ruml, “Alan W. Biermann, *Great Ideas in Computer Science*” (book review), *Mind and Machines*, 9(3), pp. 417–421, 1999.

**Unrefereed**

Wheeler Ruml, Adam Ginsburg, and Stuart Shieber, “Speculative Pruning for Boolean Satisfiability,” Harvard CS Technical Report TR-02-99, 18 pp.

Wheeler Ruml, Joe Marks, Stuart Shieber, and Tom Ngo, “Seed-Growth Heuristics for Graph Bisection,” Harvard CS Technical Report TR-10-99, 33 pp.

Wheeler Ruml, “Stochastic Approximation Algorithms for Number Partitioning,” undergraduate honors thesis and Harvard CS Technical Report TR-17-93, 79 pp.

## Patents

Seven applications in preparation by attorneys.

Two applications filed but not yet public.

Wheeler Ruml and Elisabeth H. Crawford, “System and Method for Time-aware Path Finding,” pending.

Lara S. Crawford, Haitham A. Hindi, Markus P. J. Fromherz, Craig Eldershaw, Wheeler Ruml, and Kimon D. Roufas, “Coordination in a Distributed System,” pending.

Wheeler Ruml and Markus P. J. Fromherz, “System and Method for Production Planning Utilizing On-line State-space Planning,” pending.

Yi Shang and Wheeler Ruml, “Node Localization in Communication Networks,” pending.

Wheeler Ruml, Robert M. Lofthus, Ronald J. Root, Markus P. J. Fromherz, and Marc W. Webster, “Exception Handling in Manufacturing Systems Combining On-line Planning and Predetermined Rules,” US patent 7,043,321, May, 2006. Also filed in Europe and Japan.

Wheeler Ruml and Markus P. J. Fromherz, “System and Method Utilizing Temporal Constraints to Coordinate Multiple Planning Sessions,” US patent 6,898,475, May, 2005. Also filed in Europe and Japan. Co-winner of 2005 PARC Golden Acorn Award for most valuable patent of the year.

Wheeler Ruml, Joseph Marks, Kathleen Ryall, and Stuart M. Shieber, “User Interface for Creation of Image Generation and Transformation Functions,” US patent 6,421,050, July, 2002. Also filed in Europe.

## Invited

### *Invited Talks*

## External

“Planning Under Time Pressure”

## Presentations

Williams College, October, 2007

“Heuristic Search and Rational Agents”

University of New Hampshire, March 2007

Worcester Polytechnic Institute, February 2007

Pomona College, February 2007

“Learning to Search Trees”

Stanford University, March 2006

“On-line Planning for High-speed Manufacturing”

University of Nebraska, Lincoln, November 2005

University of Alberta, Edmonton, November 2005

“Best-first Search for Combinatorial Optimization”

University of California, Berkeley, April 2002

SRI International, April 2002

Palo Alto Research Center, April 2002

“Computational Modeling of Lexical Access”

U.S. Army Research Laboratory, Aberdeen Proving Ground, February, 2000

### *Panel presentations*

ICAPS Workshop on Planning and Learning, 2007

ICAPS Workshop on Planning Under Uncertainty and Execution Control for Autonomous Systems, 2006

AAAI Fall Symposium on Using Uncertainty Within Computation, 2001

**Teaching  
Experience**

UNIVERSITY OF NEW HAMPSHIRE

*Instructor*

Introduction to Artificial Intelligence Spring 2008  
 Undergraduate Presentation Seminar Fall 2007, Spring 2008

*Guest Lecturer*

Graduate Research Seminar Fall 2007

PALO ALTO RESEARCH CENTER

*Guest Lecturer*

Foundations of Constraint Processing (University of Nebraska, Lincoln) Fall 2005

HARVARD UNIVERSITY

*Instructor*

Introduction to Artificial Intelligence Fall 2001

*Co-lecturer*

Introduction to Artificial Intelligence Fall 1999, Fall 2000

*Teaching Fellow*

Multi-agent Planning (graduate course) Spring 2002  
 Natural Language Processing (graduate course) Spring 1999, Spring 2001  
 Introduction to Artificial Intelligence Fall 1995, Fall 1996  
 Introduction to Computer Science I Fall 1992

*Founder and Discussion Leader*

AI Reading Group (non-credit) Spring 1995

*Guest Lecturer*

Introduction to Computer Science II (Harvard Summer School) Summer 1998, Summer 1999  
 Theory of Computation (Harvard University) Fall 1997  
 Theory of Computation (Harvard Extension School) Fall 1997

**Students  
Supervised**

UNIVERSITY OF NEW HAMPSHIRE

*Graduate Research*

Jake Mandel, Multi-agent planning Fall 2007–present  
 Jordan Thayer, Fast shortest-path search Summer 2007–present

*Undergraduate Research*

Austin Dionne, Shortest-path search under a deadline Fall 2007–present

*Student Mentoring*

International Conference on Automated Planning and Scheduling (ICAPS) 2007

PALO ALTO RESEARCH CENTER

*Graduate Interns*

J Benton (Arizona State), On-line planning Summer 2006–present  
 Elisabeth Crawford (Carnegie Mellon), Time-aware search Summer 2004  
 Hai Fang (Yale), Complete local search Summer–Fall 2003

*Undergraduate Interns*

Ephrat Bitton (Berkeley), Fast shortest-path search Summer 2006–Spring 2007  
 Kevin Canini (Cornell), Data structures for temporal planning Summer 2005  
 Daniel Hsu (Berkeley), Local search algorithms Summer 2003

*Student Mentoring*

International Conference on Automated Planning and Scheduling (ICAPS) 2004, 2005

## HARVARD UNIVERSITY

*Senior Theses*

Gaby Pollack, Cognitive modeling of brain-damaged picture naming Spring 1999–Spring 2000  
 Ellis Verosub, Heuristic search for protein folding Spring 1997–Spring 1998  
 Nailah Robinson, Analysis of algorithms for boolean satisfiability Spring 1997–Spring 1998  
 Adam Ginsburg, Heuristic search for boolean satisfiability Fall 1996–Spring 1997

*Undergraduate Research*

Paul Gusmorino, Visualization for combinatorial optimization Fall 2001  
 Lea Sullivan, Estimating probabilities for human naming errors Fall 2000–Spring 2001  
 Jeffrey Enos, Heuristic tree search algorithms Spring 2000  
 Jeffrey Shneidman, Heuristic tree search algorithms Spring 2000  
 Kevin Cheung, Stochastic search algorithms Spring 2000  
 Emil Gilliam, Local search algorithms for additive clustering Fall 1999  
 Joseph Turian, Move strategies for local search Fall 1998–Spring 1999  
 Pavel Vasilyev, Heuristic search and geometric embedding Fall 1997–Fall 1999  
 Angelos Kottas, Cognitive modeling of brain-damaged picture naming Fall 1997–Winter, 1999  
 Joshua Von Korff, Cross-validation for clustering Fall 1997–Spring 1998

**Professional  
Activities***Conference Organization*

Co-chair, AAAI-08 Workshop on Heuristic Search, 2008.  
 Co-chair, Seventh Symposium on Abstraction, Reformulation, and Approximation (SARA-07), 2007.  
 Organizing committee, International Knowledge Engineering Competition for Planning and Scheduling, 2007.  
 Organizing committee, First Annual Xerox Innovation Group Research and Technology Conference, 2006. (attendance restricted to employees)  
 Co-chair, AAAI-06 Workshop on Learning for Search, 2006.

*Editorial Board*

Journal of Artificial Intelligence Research, 2006–2009.

*Grant Reviewing*

Natural Sciences and Engineering Research Council of Canada

*Journal Reviewing*

Ad Hoc Networks  
 Artificial Intelligence  
 Cognitive Neuropsychology  
 IEEE Transactions on Mobile Computing  
 Journal of Artificial Intelligence Research  
 Journal of Automated Reasoning  
 Journal of Combinatorial Optimization  
 Journal of Heuristics  
 Journal of Machine Learning Research  
 Operations Research  
 Psychological Review  
 Telecommunication Systems

*Conference Reviewing*

AAAI Conference on Artificial Intelligence  
 European Conference on Artificial Intelligence  
 IEEE Wireless Communications and Networking Conference  
 International Conference on Automated Planning and Scheduling  
 International Conference on Machine Learning  
 International Federation of Automatic Control World Congress

International Joint Conference on Artificial Intelligence  
International Symposium on Artificial Intelligence and Mathematics  
Workshop of the UK Planning and Scheduling Special Interest Group

*Membership*

Association for the Advancement of Artificial Intelligence (life member)  
Association for Computing Machinery

**University**

*Department*

**Activities**

Graduate program committee, 2007–present.  
Video colloquium organizer, 2007–present.

*University*

Undergraduate research advisory committee, 2007–2010.

**Citizenship**

U.S.A.