

## Robert Aubrey Hearn

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EDUCATION **Massachusetts Institute of Technology**, Cambridge, Massachusetts USA

Ph.D., Computer Science, June 2006

- Dissertation topic: “Games, Puzzles, and Computation”
- Thesis committee: Erik D. Demaine and Gerald Jay Sussman (advisors); Marvin Minsky, Michael Sipser, and Patrick Winston (readers)
- Ph.D. minor: astrophysics

M.S., Artificial Intelligence, June 2001

- Dissertation Topic: “Building Grounded Abstractions for Artificial Intelligence Programming”
- Advisor: Gerald Jay Sussman

**Rice University**, Houston, Texas USA

B.A., Computer Science, May 1987

ACADEMIC EXPERIENCE **Dartmouth College**, Hanover, New Hampshire USA

*Visiting Research Scholar*

**July 2008 - present**

*Research Assistant Professor*

**September 2007 - June 2008**

*Postdoctoral Researcher*

**September 2006 - August 2007**

Work involves building computational models of cortical and basal-ganglia function from an artificial-intelligence perspective, and testing those models on simulated real and robots.

**Massachusetts Institute of Technology**, Cambridge, Massachusetts USA

*Graduate Student*

**September, 1999 - May, 2006**

Experience includes Masters and Ph.D. research, Masters- and Ph.D.-level coursework.

*Teaching Assistant, 6.046, Introduction to Algorithms*

**Fall 2001**

Duties included twice-weekly teaching and office hours.

BOOKS *Games, Puzzles, and Computation* (with E. Demaine). A K Peters, March 2009, to appear.

PUBLICATIONS Hearn, R. A. and R. H. Granger. Learning Hierarchical Representations and Behaviors. In *Proceedings of the American Association for Artificial Intelligence Fall Symposium Series*, November, 2008.

Demaine, E. D. and R. A. Hearn. Constraint Logic: A Uniform Framework for Modeling Computation as Games. In *Proceedings of the 23rd Annual IEEE Conference on Computational Complexity*, June 2008.

Demaine, E. D. and R. A. Hearn. Playing Games with Algorithms: Algorithmic Combinatorial Game Theory. In R. J. Nowakowski, editor, *Games of No Chance 3*, 2008.

Hearn, R. A. Amazons, Konane, and Cross Purposes are PSPACE-complete. In R. J. Nowakowski, editor, *Games of No Chance 3*, 2008.

Demaine, E., M. Demaine, R. Fleischer, R. A. Hearn, and T. von Oertzen. The complexity of the Dyson Telescopes Puzzle. In R. J. Nowakowski, editor, *Games of No Chance 3*, 2008.

Granger, R. H. and R. A. Hearn. Models of Thalamocortical System. *Scholarpedia*, 2(11):1796, 2007.

Hearn, R. A. Tipover is NP-complete. *Mathematical Intelligencer*, 2006, 28(3), pages 10–14.

Hearn, R. A. and E. Demaine. PSPACE-completeness of sliding-block puzzles and other problems through the nondeterministic constraint logic model of computation. *Theoretical Computer Science*, 343(1-2):72–96, October 2005. Special issue Game Theory Meets Theoretical Computer Science.

Hearn, R. A. The complexity of sliding block puzzles and plank puzzles. In *Tribute to a Mathematician*, pages 173–183. A K Peters, 2004.

Hearn, R. A., E. Demaine, and G. Frederickson. Hinged dissection of polygons is hard. In *Proc. 15th Canad. Conf. Comput. Geom.*, pages 98–102, 2003.

Demaine, E., R. A. Hearn, and M. Hoffmann. Push-2-f is PSPACE-complete. In *Proc. 14th Canad. Conf. Comput. Geom.*, pages 31–35, Lethbridge, Alberta, Canada, August 12–14 2002.

Hearn, R. A., and E. Demaine. The nondeterministic constraint logic model of computation: Reductions and applications. In Peter Widmayer, Francisco Triguero Ruiz, Rafael Morales Bueno, Matthew Hennessy, Stephan Eidenbenz, and Ricardo Conejo, editors, *ICALP*, volume 2380 of *Lecture Notes in Computer Science*, pages 401–413. Springer, 2002.

IN PREPARATION

Lieberman, E., R. A. Hearn, S. Aaronson, and E. Demaine. Evolving populations and their computational ability.

DEMONSTRATIONS

December 2007: “Basal-ganglia-inspired Hierarchical Reinforcement Learning in an AIBO Robot”. At Neural Information and Processing Systems 2007, Vancouver, Canada.

ORGANIZED  
SYMPOSIA

“Games People Play: Challenges of Applying Mathematics and Computers to Games”, AAAS Annual Meeting, February, 2009 (upcoming). Speaking on “Games Computers Can’t Play”.

INVITED TALKS

May 2008: “Games, Puzzles, and Computation”, Computer and Information Science Colloquium, the University of Oregon, Eugene, OR.

January 2008: “Constraint Logic”, Combinatorial Game Theory Workshop, Banff International Research Station, Banff, AB, Canada.

November 2007: “Games, Puzzles, and Computation”, Mathematics Colloquium, Reed College, Portland, OR.

October 2007: “Games, Puzzles, and Computation”, Mathematics Colloquium, Dartmouth College, Hanover, NH.

December 2006: “Games, Puzzles, and Computation”, Computer Science Colloquium Series, Williams College, Williamstown, MA.

November 2006: “Games, Puzzles, and Computation”, THINK Conference, Santa Cruz, CA.

October 2006: “Games, Puzzles, and Computation”, Computer Science Seminar Series, Middlebury College, Middlebury, VT.

June 2006: “Games, Puzzles, and Computation”, Laboratory for Computational Intelligence Forum, University of British Columbia, Vancouver, BC, Canada.

March 2006: “Games, Puzzles, and Computation”, Gathering for Gardner 7, Atlanta, GA.

January 2006: “Some thoughts on a general cognitive architecture”, Brain Inspired Cognitive Architecture Project Retreat, Dedham, MA.

November 2005: “Games, Puzzles, and Computation”, CSAIL Student Seminar, Massachusetts Institute of Technology, Cambridge, MA.

June 2005: “Amazons, Konane, and Cross Purposes are PSPACE-complete”, Combinatorial Game Theory Workshop, Banff International Research Station, Banff, AB, Canada.

May 2005: “The Nondeterministic Constraint Logic Model of Computation: Reductions and Applications”, Combinatorial Optimization and Distributed Algorithms Seminar, Laboratoire d’Informatique

de l'universit Paris-Nord, Paris, France.

March 2004: "The complexity of hinged dissections and plank puzzles", Gathering for Gardner 6, Atlanta, GA.

November 2003: "Implementing Minsky's Society of Mind", THINK Conference, Fish Camp, CA.

June 2003: "Putting Brooks and Minsky Together", Laboratory for Computational Intelligence Forum, University of British Columbia, Vancouver, BC, Canada.

April 2003: "The Complexity of Sliding-Blocks Puzzles and Related Problems, via Nondeterministic Constraint Logic", Theory Seminar, University of British Columbia, Vancouver, BC, Canada.

April 2003: "Putting Brooks and Minsky Together", MIT Dangerous Ideas Seminar, Massachusetts Institute of Technology, Cambridge, MA.

March 2002: "Sliding-block puzzles are PSPACE-complete", Gathering for Gardner 5, Atlanta, GA.

March 2002: "Implementing Minsky's Society of Mind", Laboratory for Computational Intelligence Forum, University of British Columbia, Vancouver, BC, Canada.

February 2002: "The complexity of sliding-block puzzles", Seminar on Algorithmic Combinatorial Game Theory, Schloss Dagstuhl, Germany.

November 2001: "Sliding-block puzzles are PSPACE-complete", THINK Conference, Fish Camp, CA.

November 2001: "Implementing Minsky's Society of Mind", AI Lab Student Seminar, Massachusetts Institute of Technology, Cambridge, MA.

SERVED AS  
REFEREE

Theoretical Computer Science, Discrete Mathematics, SIAM Journal on Computing, Complex Systems, INTEGERS: The Electronic Journal of Combinatorial Number Theory

PATENTS

Hearn, R. A. and S. D. Holdaway: "Computer system integrating different data types into a single environment", US Patent #6,154,756, issued Nov. 8, 2000.

HONORS AND  
AWARDS

Numerous software-industry awards for ClarisWorks 1.0 – 4.0.

Member, Rice University team, 3rd place at ACM National Scholastic Programming Contest, 1986.

SOFTWARE-  
INDUSTRY  
EXPERIENCE  
(1989 FORWARD)

**Gobe Software**, Portland, Oregon USA

*Chief Technology Officer*

**September, 1997 - August, 1999**

Contributed to design and implementation of BeOS integrated office package Gobe Productive. Designed and worked on implementation of MOOSE, a constraint-based programming framework.

**Claris Corporation**, Santa Clara, California USA

*Consultant*

**July, 1990 - March, 1996**

Designed and implemented large portions of ClarisWorks 1.0–4.0. Throughout this period, ClarisWorks was the market leader in the "Works" category for Macintosh, winning many awards, and supporting a user base of millions.

**Spartacus Software**, Santa Clara, California USA

*Partner*

**April, 1989 - July, 1990**

Co-designed and implemented, with Scott Holdaway, the software that later became ClarisWorks. Work included majority of overall architecture, entirety of graphics module, large portions of spreadsheet and database modules, and some word processing code. Later sold the software to Claris Corporation. (See <http://groups.csail.mit.edu/mac/users/~bob/clarisworks.php> for details.)

OTHER INTERESTS

Running, playing go, playing the harpsichord, astronomy, mechanical puzzles, juggling