

# Computer Science and Computational Intelligence at Hampshire

Lee Spector

Cognitive Science

Hampshire College, Amherst, Massachusetts

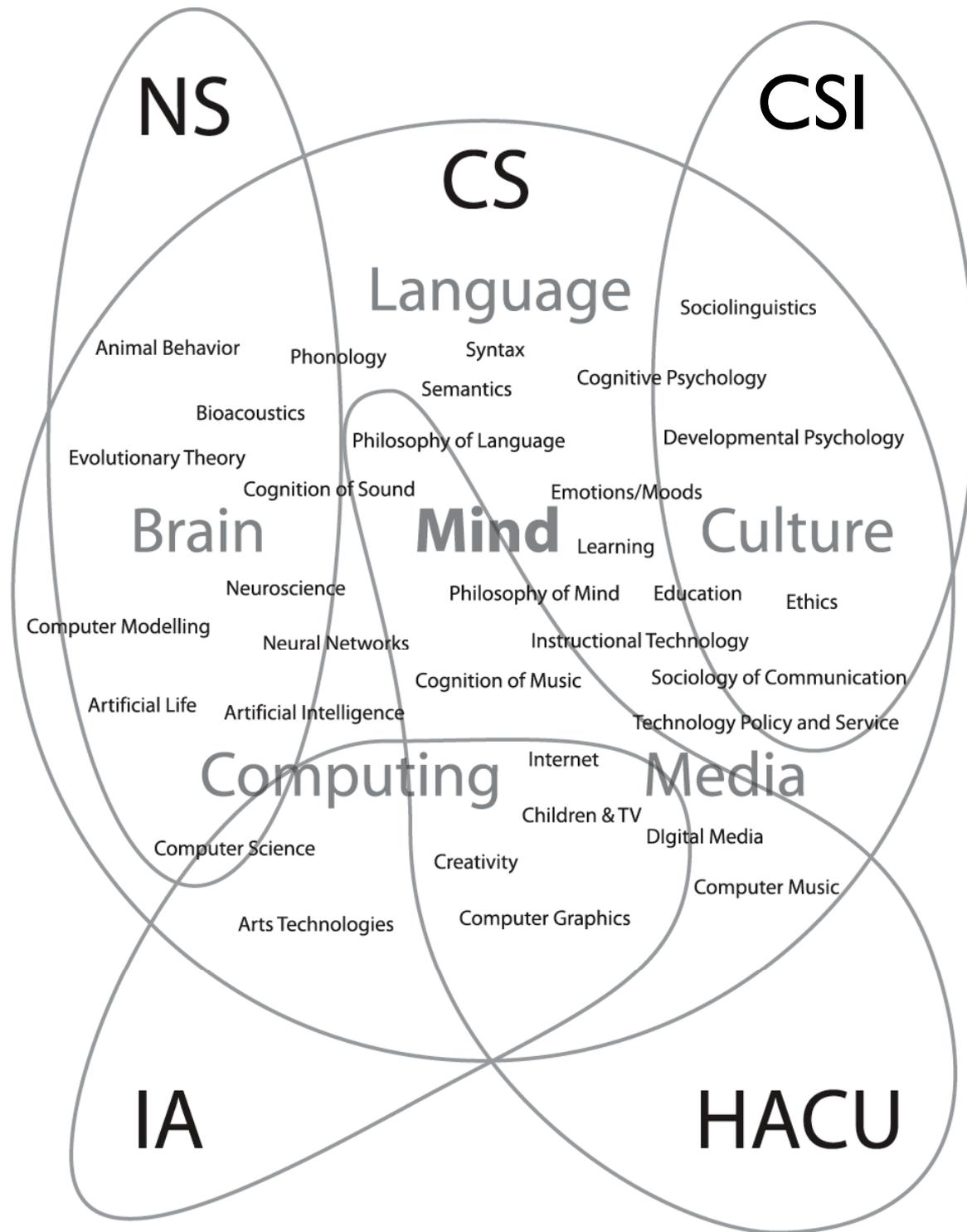
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# Outline

- Background and context
- Courses and projects
- Evolutionary computing
- Questions

# Personal Background

- B.A., Oberlin College, 1984  
Philosophy, art/music and technology
- Ph.D., U. Maryland (College Park), 1992  
Computer Science (artificial intelligence)
- At Hampshire College since 1992, MacArthur Chair 1997–2000, full professor since 2004; Dean, Cognitive Science, 2002–2005; Co-chair, Re-visioning Committee, 2006–2007; Faculty Trustee, 1998–2000; Co-director of the Design, Art and Technology program, 2009–2012.
- Adjunct Professor at UMass; Editor-in-Chief of *Genetic Programming and Evolvable Machines*; Editorial board member of *Evolutionary Computation*; Executive Committee of the ACM Special Interest Group on Evolutionary Computation



# Some of My Courses

- Programming Creativity
- Code Immersion
- Quantum Computing with No Prerequisites of Any Kind
- Cognitive Science Fiction
- What Computers Can't Do
- Algorithmic Arts
- Artificial Intelligence in 3D Virtual Worlds
- Genetic Programming
- Research in Artificial Intelligence

# Other Hampshire Courses

- Programming Web Pages for Poets, Artists, and Scientists
- Video Game Design: Building Video Games from Scratch
- Coding Images: An Introduction to Programming in C through Image Manipulation and Creation
- Art Programming: Creating Art Using the Medium of Computers
- Advanced Web Design: Building Complex Web Pages and Sites
- Software Engineering

# Elsewhere in the Valley

- Three excellent undergraduate computer science programs covering the entire standard curriculum.
- A top-20 university program (#8 in AI) where Hampshire students routinely take graduate-level courses and occasionally work in graduate research labs.

# A Few Div II Titles

Software Development and Biology

Social Machine Learning

Computer Science

Artificial Intelligence and Mathematics Studies in  
Computer Animation

Computer Science and Visual Communication

Molecular Biology and Bioinformatics

Communicating Computers

Naturally Inspired Systems

The Science of Computer Science

Media Production with a Focus in Computer  
Animation

Computer Science and Multiagent Systems

An Aggregate of Educational Interest: Political  
Science, Legal Studies, Computer Science

The Magic of Technology

Elements of Computer Game Design: Cognitive  
and Artistic Explorations

Computer Science and Communications

Arts Management for Game Production

Exploring Digital Media

Computer Science: Software Development

Computational Biology and Biological  
Computation

Computer Science and Mathematics

Cognitive Science with Emphasis on Computer  
Science and Human Computer

Quantitative Models of Natural Systems

Interface Design, Through Theory and Practice

Multimedia and Programming

Computer Science in Context

Where Cinema, Storytelling, and Computer  
Science Intersect

Computer Systems and Network Engineering

Imaginary Stimuli: Applications of Computer  
Science in Theatre

The Human/Computer Barrier: Languages,  
Compilers and Interface

Natural and Artificial Languages

Digital Media: Design, Production and  
Application

Computer Programming and Graphics

From Stage to Cage to Code: A transition from  
the world of art to the science of computers

The Application of Computers in Modern Music  
Psychology, Computer Science, and Design

Communicating Mathematical and Computer-  
related Knowledge

Electric Art

Computer Science: Techniques and Teaching

Technology and Narratives: Machines Telling  
Stories, Stories about Machines

# A Few Div III Titles

- Solving E-mail Overload
- Comfort Creatures: Therapeutic Robots
- The Hostile Takeover: A procedurally generated video collage videogame
- Evolution of Perception: Automatic Programming of Visual Navigation Systems
- Genetic Programming of Memristor Circuits
- Theoretical Cybernetics
- Parasitic Processing: Building an Installation-Free Distributed Processing Platform
- Smartphones and Social Enterprise: Keeping Your Health in Sight

*Daniel Chapsky: Division III Project*

# Psychometric Test Score Prediction with Machine Learning and Social Networks

- Predicting an individual's score on a personality test using social data
- Social data gathered from Facebook
- Using the data to create a Bayesian Network which will probabilistically predict personality score.

# Ariel Soutar: Division III Project



## Home Views

Main

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Faculty Finder

## Faculty Finder

### Lee Spector



Professor of Computer Science



ASH 201

Computer Studies

Art

Biology

Cognitive Science

Mathematics

Lee Spector, professor of computer science, holds a Ph.D. in computer science from the University of Maryland and a B.A. in philosophy from Oberlin College.

His main interests are artificial intelligence and the connections between cognition, computation, and evolution. He is also interested in the use of technology in music and other arts.

His recent research includes projects on the development of new genetic programming techniques, the use of artificial intelligence technologies in the study of quantum computation, the interdisciplinary study of human and machine cognition, and the development of technologies to support inquiry-based education.

Professor Spector is also an active editor, reviewer, and organizer for scientific journals and conferences. He recently received the highest honor bestowed by the National Science Foundation for excellence in both teaching and research, the NSF Director's Award for Distinguished Teaching Scholars. He has held the College's MacArthur Chair and has served as the dean of the School of Cognitive Science and as the elected faculty member of Hampshire's board of trustees.

Homepage: <http://hampshire.edu/lspector/>

## Courses

### Related Faculty



Jaime Davila

Special Presidential Assistant for Diversity Computer Science



Christopher Perry

Media Arts and Sciences

less related



Kenneth Hoffman

Mathematics



Colin Twitchell

Design and Innovation for Social Change Instructional Staff



Donna Cohn

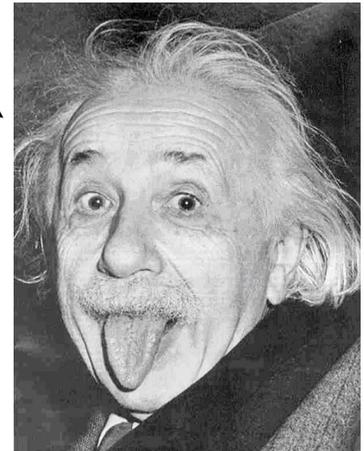
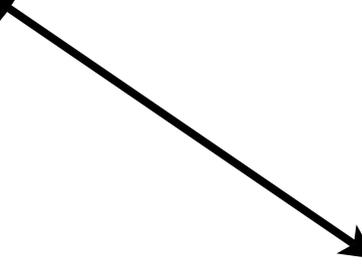
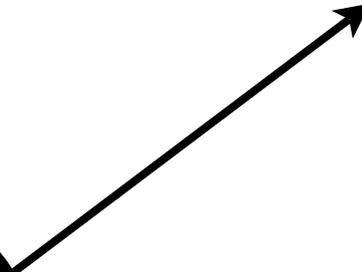
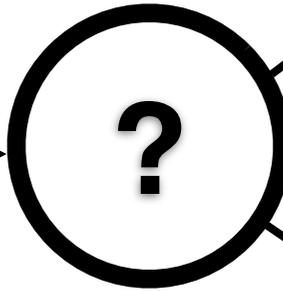
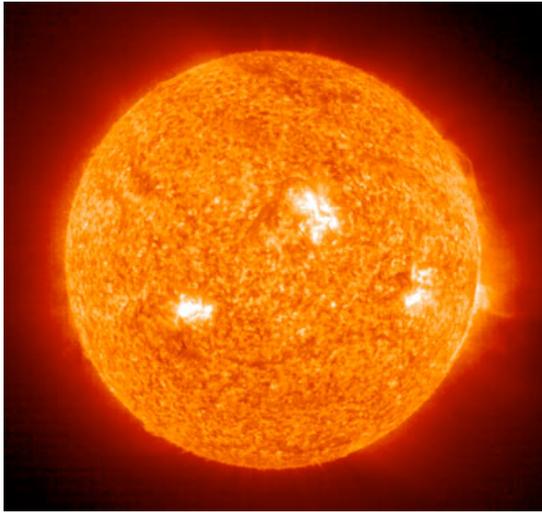
Applied Design



James Miller

Communications

show more



# Evolution, the Designer

“Darwinian evolution is itself a designer worthy of significant respect, if not religious devotion.” *Boston Globe* OpEd, Aug 29, 2005

WHAT WOULD DARWIN SAY? | LEE SPECTOR

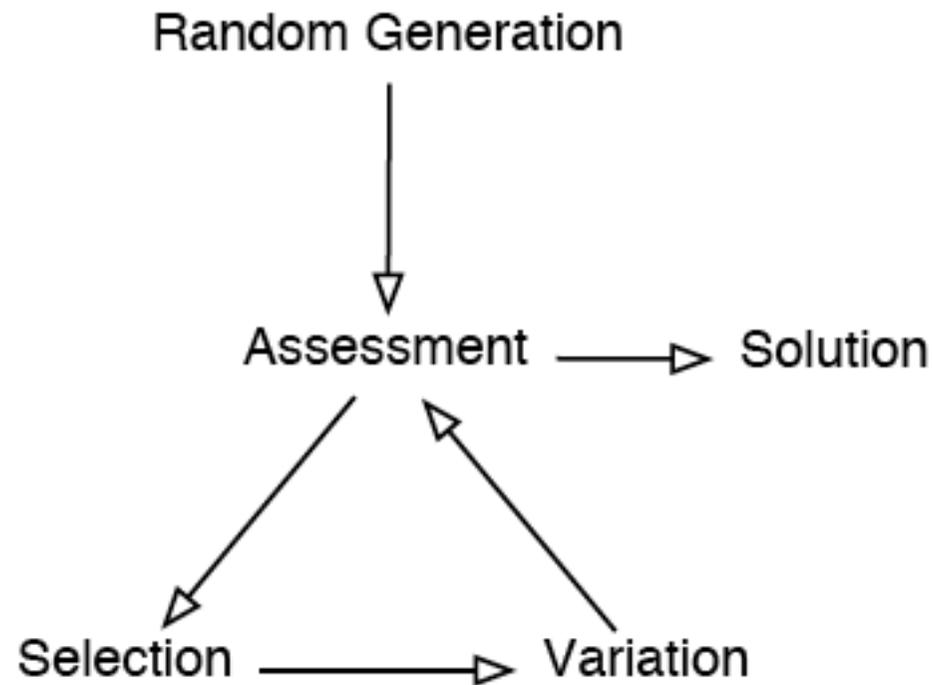
## And now, digital evolution

The Boston Globe

By Lee Spector | August 29, 2005

RECENT developments in computer science provide new perspective on "intelligent design," the view that life's complexity could only have arisen through the hand of an intelligent designer. These developments show that complex and useful designs can indeed emerge from random Darwinian processes.

# Evolutionary Computation



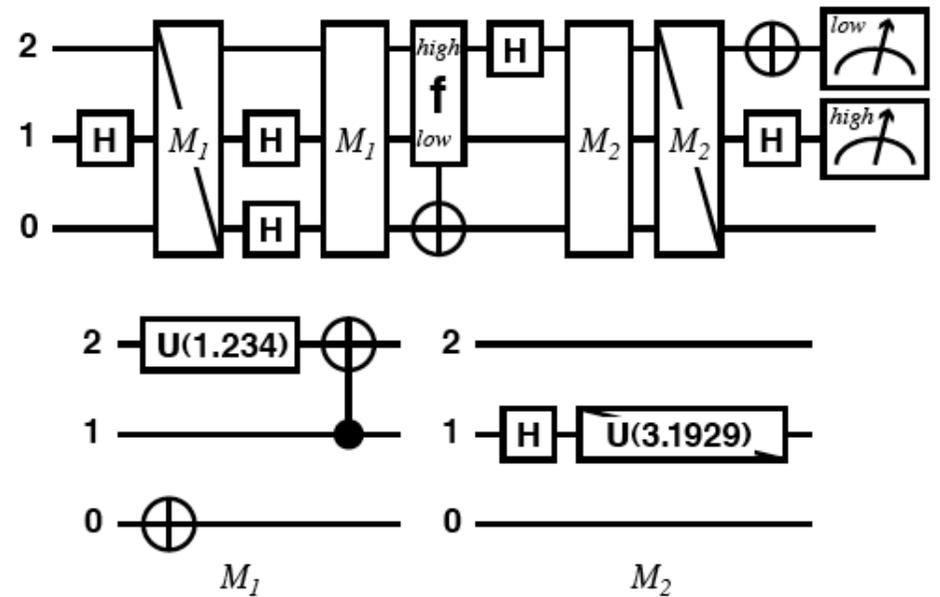
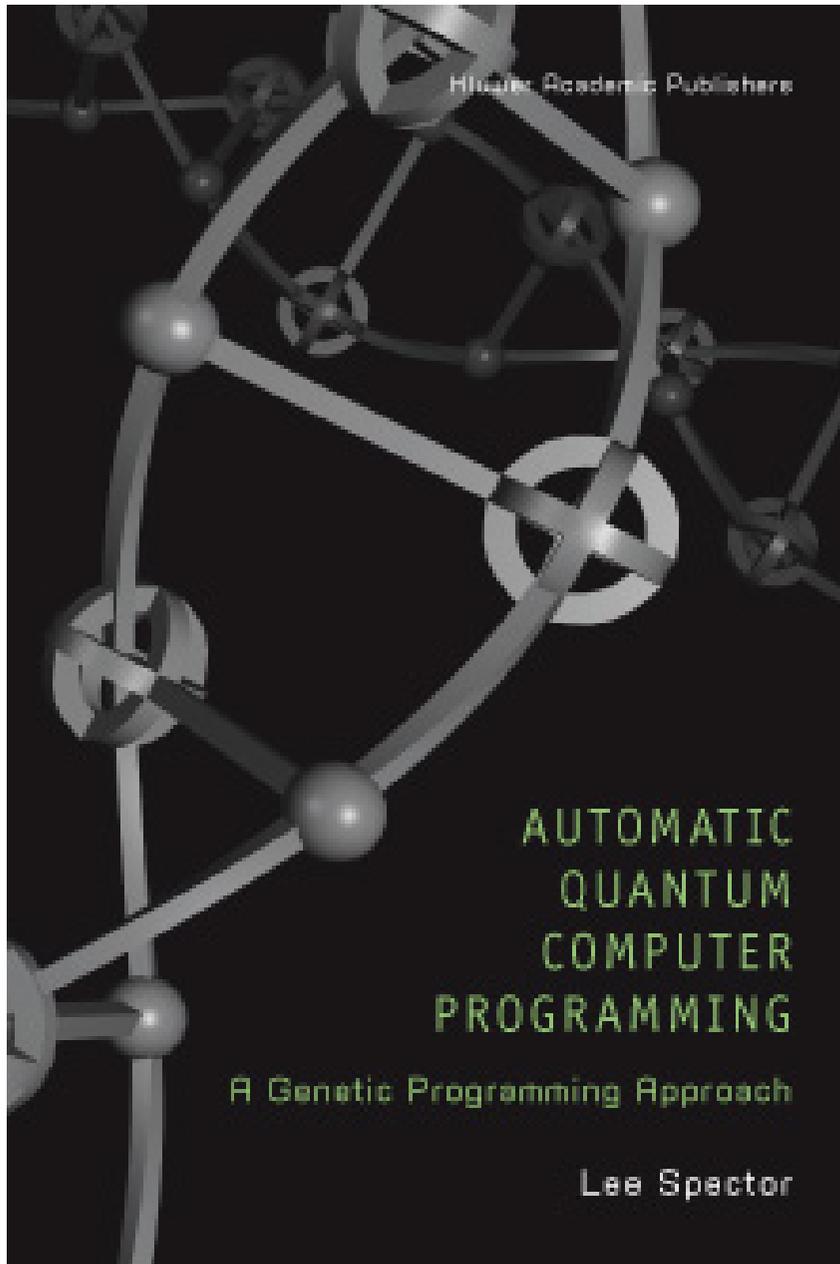
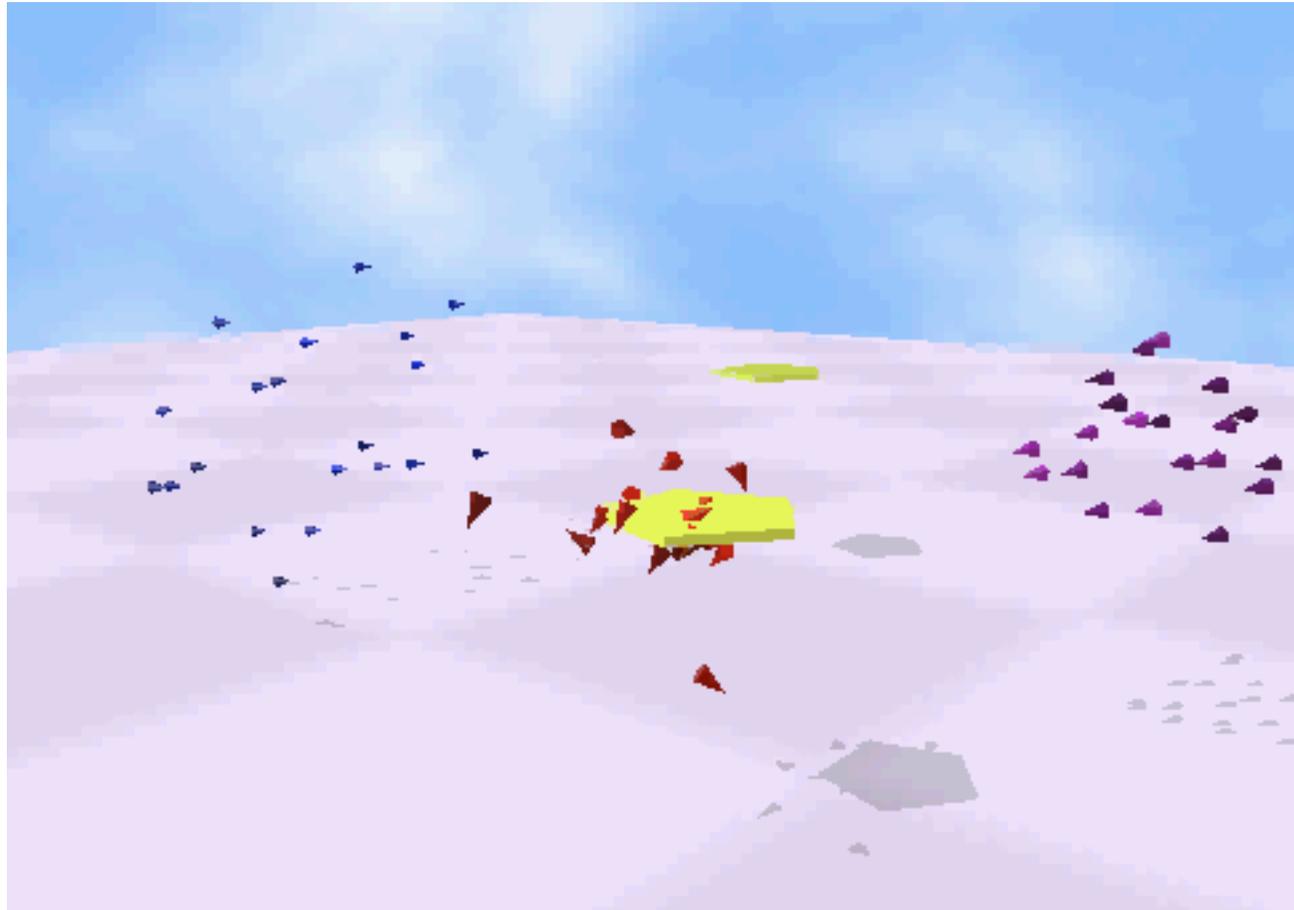
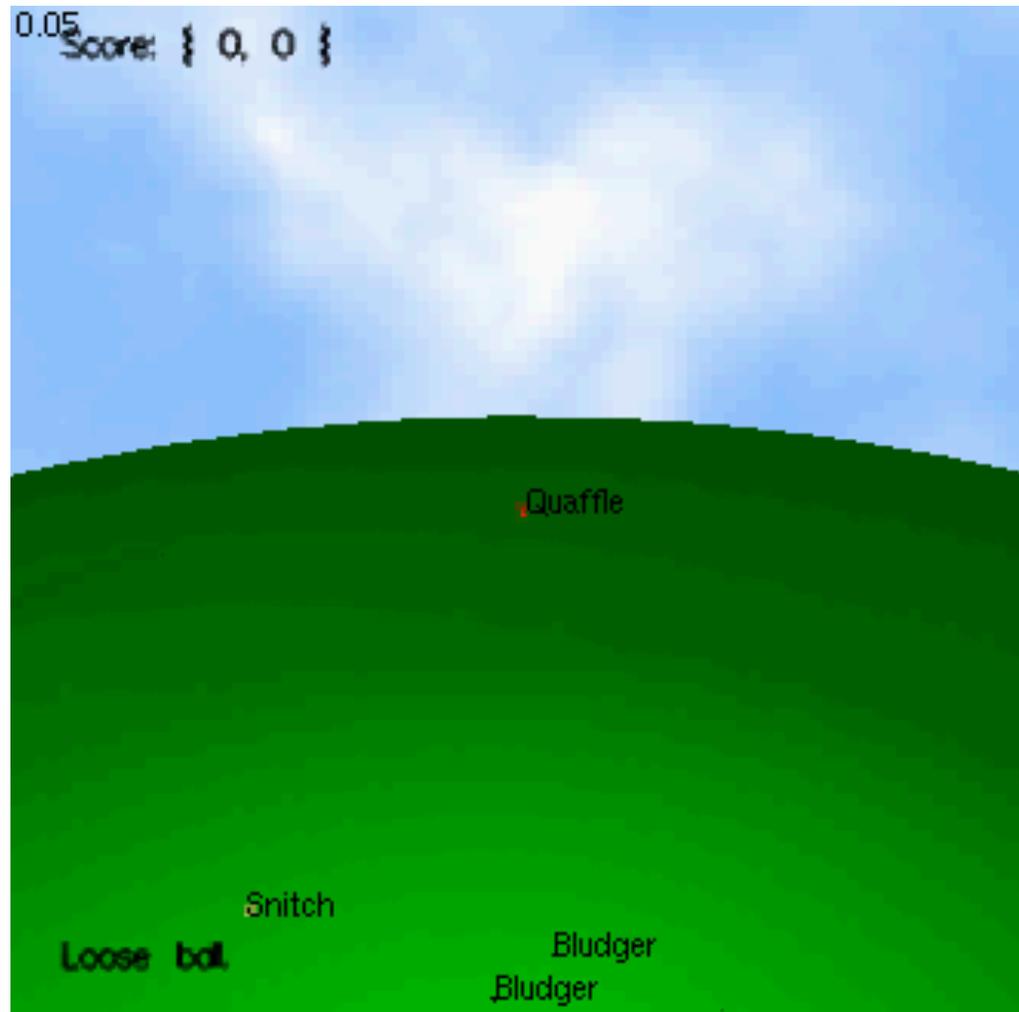


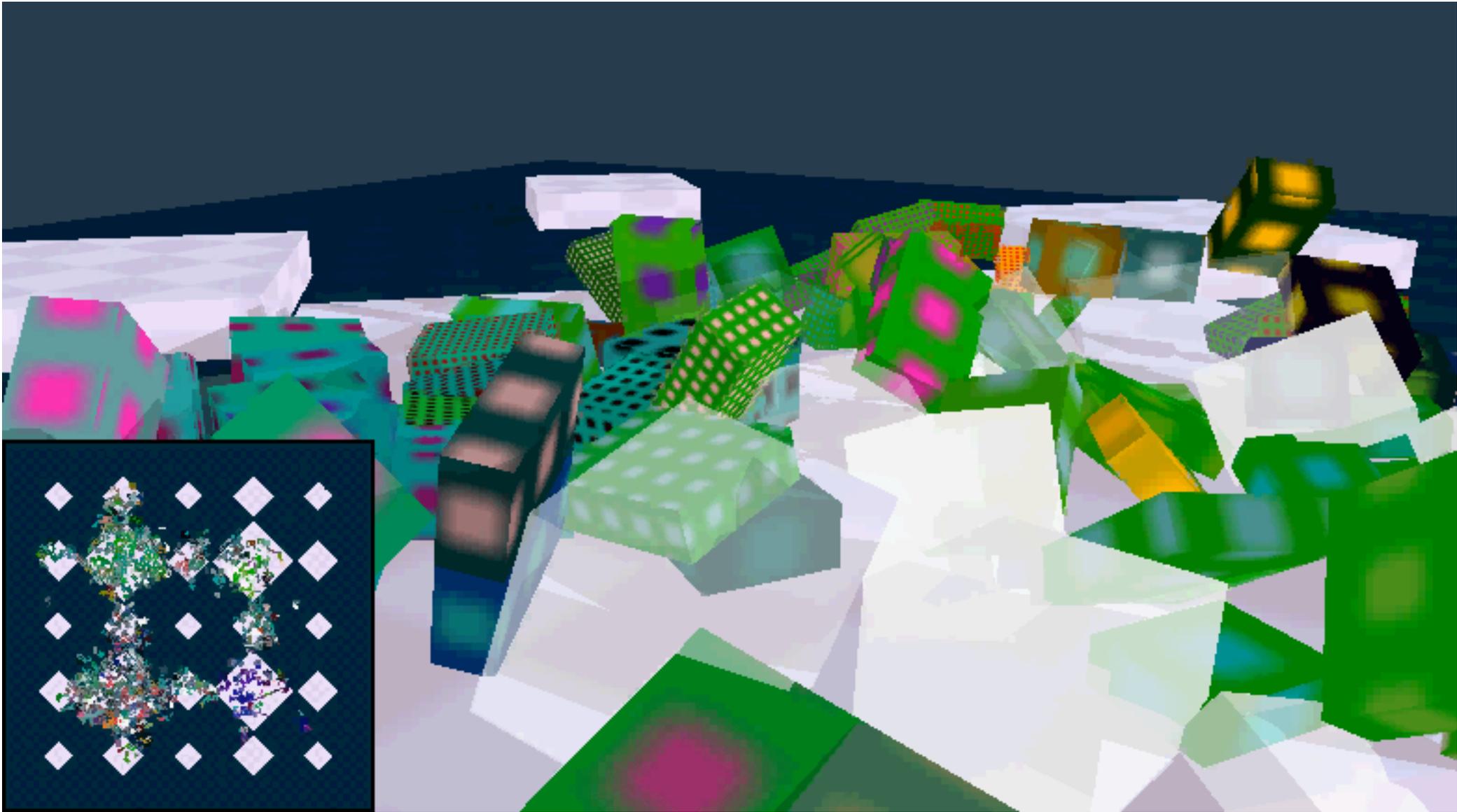
Figure 8.7. A gate array diagram for an evolved version of Grover's database search algorithm for a 4-item database. The full gate array is shown at the top, with  $M_1$  and  $M_2$  standing for the smaller gate arrays shown at the bottom. A diagonal line through a gate symbol indicates that the matrix for the gate is transposed. The "f" gate is the oracle.



# Quidditch

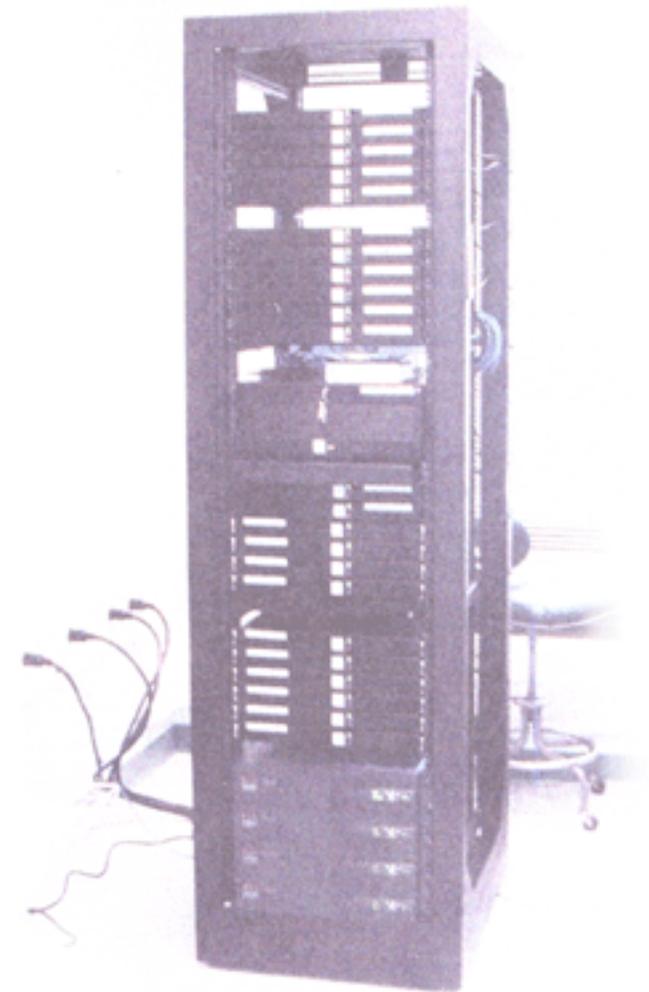
Raphael Crawford-Marks





# Hampshire College Cluster Computing Facility

- > 250 cores, GNU/Linux
- Project-driven development and maintenance by faculty, students and staff
- Funded by grants from NSF and DARPA



# GECCO-2012

- Premier international conference in genetic and evolutionary computation
- Six members of the Hampshire Computational Intelligence lab presented work, including two undergraduates



July 07 -11, 2012  
Philadelphia, USA

Genetic and Evolutionary  
Computation Conference

A recombination of the  
21st International Conference on  
Genetic Algorithms (ICGA) and the  
17th Annual Genetic Programming Conference (GP)

GECCO= RWA +GA +GP + EMO + ACO + AL + EDA + GBML + GDS + ES + ...

g+ t f

Visit Philly!  
★★★★★★★★

2012

www

# Thank You

- Questions?