Jim Davies

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Education

2004 **Ph.D., Computer Science**
Georgia Institute of Technology
Thesis: Visual Analogical Problem Solving
Advisors: Profs. Ashok K. Goel and Nancy J. Nersessian
Committee: Profs. Ronald W. Ferguson, Richard Catrambone
Certificate: Cognitive Science

1997 **M.S., Psychology**
Georgia Institute of Technology
Thesis: Correlation and Consistent Contrast Biases Shown in Free Sort Categorization
Advisor: Prof. Dorrit O. Billman
Committee: Dr. Tony J. Simon, Prof. Timothy A. Salthouse

1993 **B.A., Philosophy**
State University of New York College at Oswego

Professional Academic Experience

Fall 2006-Present **Carleton University, Institute of Cognitive Science** Ottawa, Ontario
Assistant Professor

Fall 2004-2006 **Queen's University, School of Computing** Kingston, Ontario
Postdoctoral Fellow
Applied visual analogy techniques to bioinformatics
Supervisor: Prof. Janice Glasgow

Fall 2001-2004 **Georgia Institute of Technology** Atlanta, GA
Graduate Research Assistant - College of Computing
Studied learning and cognition in biomedical engineering laboratories using ethnographic observation and interviews
Supervisors: Profs. Nancy J. Nersessian and Wendy C. Newstetter

1997-1998 **Georgia Institute of Technology** Atlanta, GA
Graduate Research Assistant - EduTech Institute
Designed evaluative rubrics and coded student work in a Learning-by-Design curriculum creation project
Supervisor: Prof. Janet L. Kolodner

1995-1996 **Georgia Institute of Technology** Atlanta, GA
Graduate Research Assistant - Department of Psychology
Designed and ran experiments researching categorization biases
Supervisor: Prof. Dorrit O. Billman

Industrial and Governmental Research Experience

Summer 2000 **Mitsubishi Electric Research Labs** Cambridge, MA
Research Intern
Designed a tutorial extension to the COLLAGEN collaborative agent software
Supervisor: Dr. Charles Rich

Summer 1997 **Los Alamos National Laboratory** Los Alamos, NM
Graduate Research Assistant - Nonproliferation and International Security Division (NIS), Space Data Systems Group (NIS-3)
System administrated and conducted neural network research
Supervisor: Dr. Mark Galassi

1994-1995 **Los Alamos National Laboratory** Los Alamos, NM
Graduate Research Assistant - Computer Research and Applications Group (CIC-3)
Conducted full-text information retrieval of physics documents using an *n-gram* method
Supervisor: Dr. Timothy J. Thomas

Teaching Experience

CGSC 6800 **Proseminar in Cognitive Science** Carleton University
Instructor
Winter 2007, 2008, Fall 2008

CGSC 5001 **Artificial Intelligence for Cognitive Science** Carleton University
Instructor
Fall 2008

CGSC 2002 **Theories and Methods in Cognitive Science** Carleton University
Instructor
Winter 2007, 2008

CGSC 4001/5001 **Special Topics in Cognitive Science** (Artificial Intelligence) Carleton University
Instructor
Fall 2006, 2007

CISC 453 **Advanced Artificial Intelligence** Queen's University
Instructor (one-third)
Spring 2006

CS 4000 **Computing and Society** Georgia Tech
Teaching Assistant
Faculty: Dr. Colin Potts
Summer 2001

CS/PSY/ISyE 6795 **Introduction to Cognitive Science** Georgia Tech
Teaching Assistant
Faculty: Dr. Alexander Kirlik
Spring 2001

CS 6010 **Principles of Design** Georgia Tech
Teaching Assistant
Faculty: Dr. Wendy C. Newstetter, Michael McCracken, Dr. Ashok K. Goel
Fall 2000

CS/PSY/ISyE 6795 **Introduction to Cognitive Science** Georgia Tech
Teaching Assistant
Faculty: Dr. Dorrit O. Billman
Spring 2000

Research Theme

When making analogies, a reasoner must sometimes find similarity between very different things. In my research I endeavour to show that reasoners change knowledge representations to facilitate the identification of hidden similarities. In particular I focus on visual and spatial representations.

Publications

Formally Refereed Journal Papers

Davies, J., Goel, A. K. & Yaner, P. W. (2008). Proteus: Visuospatial analogy in problem solving. *Knowledge-Based Systems* 27(7), 636-654.

Davies, J., Goel, A. K. (2008). Visual re-representation in analogical reasoning. *The Open Artificial Intelligence Journal*, 2, 11–20.

Davies, J. & Goel, A. K. (2007). Transfer of Problem-Solving Strategy Using Covlan. *Journal of Visual Languages and Computing*: 18, 149–164.

Davies, J., Glasgow, J. & Kuo, T. (2006). Visio-spatial case-based reasoning: A case study in prediction of protein structure. *Computational Intelligence*, 22:3/4, 194–207.

Glasgow, J., Kuo, T. & Davies, J. (2006). Protein structure from contact maps: A case-based reasoning approach. *Information Science Frontiers*, Special Issue on Knowledge Discovery in High-Throughput Biological Domains. 8: 29–36.

Davies, J., Nersessian, N. J. & Goel, A. K. (2005). Visual models in analogical problem solving. *Foundations of Science*, Special Issue on Model-Based Reasoning: Visual, Analogical, Simulative. L. Magnani & N. J. Nersessian (Eds.) 10, 133-152.

Billman, D. O. & Davies, J. (2005). Consistent contrast and correlation in free sorting. *American Journal of Psychology*. 118(3) 353–383

Accepted For Publication

Davies, J., Goel, A. K., & Nersessian, N. J. (in press). A Computational Model of Visual Analogies in Design. *Cognitive Systems Research: Special Issue on Analogies*, Accepted July, 2008.

Formally Refereed Conference and Workshop Papers

Davies, J., Glasgow, J. & Kuo, T. (2007). Protein structure prediction with visuospatial analogy. In T. Barkowsky, M. Klnauff, G. Ligozat, & D. R. Montello (Eds.) *Lecture Notes in Artificial Intelligence 4387 Spatial Cognition V: Reasoning, Action, Interaction (LNAI 4387)* 127–139.

Davies, J., Goel, A. K. & Nersessian, N. J. (2005). Transfer of problem-solving strategy using the Cognitive Visual Language. *Proceedings of the International Workshop on Visual Languages and Computing (VLC05)*. 293–298.

Davies, J., Goel, A. K. & Nersessian, N. J. (2005). Transfer in visual case-based problem-solving. In H. Munoz-Avila & F. Ricci (Eds.) *Proceedings of the 6th International Conference on Case-Based Reasoning*. LNAI 3620. Springer-Verlag. Berlin Heidelberg. 163–176.

Davies, J., Goel, A. K. & Nersessian, N. J. (2005). A Cognitive Model of visual analogical problem-solving transfer. Poster paper in L. P. Kaelbling & A. Saffioti (Eds.) *Proceedings of the Nineteenth Annual International Joint Conference On Artificial Intelligence*. Professional Book Center. Denver, Colorado. 1556–1557.

Davies, J. & Goel, A. K. (2003). Representation Issues in visual analogy. In R. Alternam & D. Kirsh (Eds.) *Proceedings of the Twenty-fifth Annual Conference of the Cognitive Science Society.* Erlbaum. Hillsdale, New Jersey. 300-305.

Nersessian, N. J., Kurz-Milke, E., Newstetter, W. C. & Davies, J. (2004). Research laboratories as evolving distributed cognitive systems. In A. Markman & L. Barsalou (Eds.) *Proceedings of the Twenty-fifth Annual Conference of the Cognitive Science Society.* Erlbaum. Hillsdale, New Jersey. 857–862.

Davies, J. & Goel, A. K. (2003). Visual case-based reasoning I: Transfer and adaptation. *Proceedings of the First Indian International Conference on Artificial Intelligence.* Hyderabad, India.

Davies, J., Goel, A. K., & Nersessian, N. J. (2003). Visual re-representation in creative analogies. In A. Cardoso & J. Gero (Eds.) *The Third Workshop on Creative Systems, International Joint Conference on Artificial Intelligence.*

Nersessian, N. J., Newstetter, W. C., Kurz-Milcke, E. & Davies, J. (2002). A Mixed-method Approach to Studying Distributed Cognition in Evolving Environments. *Proceedings of the International Conference on Learning Sciences.* 307–314.

Davies, J., & Goel, A. K. (2001). Visual analogy in problem solving. *Proceedings of the Seventeenth International Joint Conference on Artificial Intelligence.* 377-382. Morgan Kaufmann publishers.

Davies, J. R., Nersessian, N. J. & Goel, A. K. (2001). The role of visual analogy in scientific discovery. *Model-Based Reasoning: Scientific Discovery, Technological Innovation, Values.* Pavia, Italy.

Davies, J. R., Lesh, N., Rich, C., Sidner, C. L., Gertner, A. S., & Rickel, J. (2001). Incorporating tutorial strategies into an intelligent assistant. *Proceedings of the 2001 International Conference on Intelligent User Interfaces.*

Murdock, W. J., Simina, M., Davies, J., & Shippey, G. (1998). Modeling invention by analogy in ACT-R. *Proceedings of the Twentieth Annual Conference of the Cognitive Science Society*, Madison, WI.

Formally Refereed Abstracts

Abelson, A., Davies, J., Fraser, R., Kuo, T., Zuviria, E. & Glasgow, J. (2005). Protein structure from contact maps: An hierarchical approach. *Intelligent Systems for Molecular Biology (ISMB05).*

Accepted Presentations

Davies, J., Nersessian, N. J. & Goel, A. K. (2001). Visual analogy in scientific discovery. *Cognitive Studies of Science and Technology Workshop*, University of Virginia, March 24-27.

Galassi, M., Davies, J., Theiler, J., Gough, B., Priedhorsky, R., Jungman, G., & Booth, M. (1999). The GNU scientific library. October 1999, *Open Source/Open Science Conference*, Brookhaven National Laboratory.

Billman, D., Davila, D. & Davies, J. (1996). Hierarchy and consistent contrast aid supervised and unsupervised concept learning. November 1996, Accepted talk, *Conference of the Psychonomics Society.*

Books

Galassi, M., Davies, J., Theiler, J., Gough, B., Jungman, G., Booth, M., & Rossi, F. (2003) *Gnu Scientific Library Reference Manual - Second Edition.* Network Theory Ltd.

Galassi, M., Davies, J., Theiler, J., Gough, B., Jungman, G., Booth, M., & Rossi, F. (2001) *Gnu Scientific Library Reference Manual.* Network Theory Ltd.

Invited Book Chapters

Davies, J. R. (2001). Ocelots are endangered South American wild cats. In J. Ohler (Ed.) *Future Courses: A Compendium of Thought About the Future of Technology and Education.* Technos Press.

Refereed Book Chapters

Nersessian, N. J., Kurz-Milcke, E. & Davies, J. (2005). Ubiquitous computing in science and engineering labs: A case study of a biomedical engineering lab. In G. Kouzelis, M. Pournari, M. Stoeppler and V. Tselfes, (Eds.), *Knowledge in the New Technologies.* Peter Lang: Berlin: 167–195.

Invited Talks

Davies, J. (2007). *A.I.: Past and Future.* Institute on Biotechnology and the Human Futures (IBHF) Conference, *The Spotless Mind? Policy, Ethics & the Future of Human Intelligence,* February 16. National Press Club Washington, D.C.

Davies, J. (2006). *The role of visual reasoning in analogical problem solving.*
University of California at Merced. February 16.
Institute of Cognitive Science, Carleton University. February 13.

Davies, J. (2004). *Constructive adaptive visual analogy.*
School of Information Science & Learning Technologies, University of Missouri. May 19.
School of Computing, Queen's University. May 13.
University College Dublin. April 27.
University of Wisconsin at Green Bay. March 24.

Grants and Contracts

Davies, J. (2008). *Graphical Representations of Scientific Inter-relationships* SciTech Strategies, Inc. grant. $10,765 USD.

Davies, J. (2008). *Toward a Theory of Visual Instantiation.* Carleton University Internal Research Grant from the NSERC General Research Fund. $7,000 CAD.

Davies, J. (2007). *Toward a Theory of Visual Instantiation.* Carleton University Internal Research Grant from the NSERC General Research Fund. $5,000 CAD.

Ferres, L. & Davies, J. (2006). *Interaction between Linguistic & Visual Cues During Graph Comprehension Tasks.* Statistics Canada. $18,000 CAD.

Davies, J., Essa, I., & Maple, T. The Primatech project: An interactive simulation of a signing orangutan. Seed Grant awarded 1998-1999. GVU, Georgia Institute of Technology.

Other Presentations

Davies, J. (2006) *Visualization in Human Imagination.* HOT Lab presentation. Carleton University. December 1.

Davies, J. (2006) *Visualization in Human Imagination.* Cognitive Science Colloquium Series. Carleton University. October 13.

Abelson, A., Davies, J., Fraser, R., Kuo, T., Zuviria, E. & Glasgow, J. (2006). Protein structure from contact maps: An hierarchical approach. Poster at *First Canadian Student Conference on Biomedical Computing (CSCBC06)*, Kingston, Ontario.

Davies, J. (2004). Constructive adaptive visual analogy. *Cognitive Science Student Conference.* Georgia Institute of Technology. April 23.

Nersessian, N. J., Newstetter, W. C., Kurz-Milcke, E., Davies, J. & Malone, K. (2003) *Laboratory learning: Cognition and learning in biomedical engineering labs.* National Science Foundation Presentation.

Newstetter, W. C., Nersessian, N. J., Davies, J., Kurz, E. & Malone, K. (2002) Biomedical Engineering Thinking and Learning: Phase 1–Reasoning in the lab. National Science Foundation presentation.

Davies, J. (1999). An evaluation of SIRRINE2 as a cognitive architecture based on a model of human arithmetic. *Proceedings of the Twenty-first Annual Conference of the Cognitive Science Society*, Vancouver, BC.

Davies, J. & Billman D. (1996) Hierarchical categorization and the effects of contrast inconsistency in an unsupervised learning task. *Proceedings of the Eighteenth Annual Conference of the Cognitive Science Society.* Lawrence Erlbaum, Mahwah, NJ. p750.

Demonstrations

Davies, J. R., Lesh, N., Rich, C., Sidner, C. L., Gertner, A. S., & Rickel, J. (2001). Demonstration of collaborative interface agents using COLLAGEN. The 2001 *International Conference on Intelligent User Interfaces.*

Research-related Web Sites

Davies, J. (Ed.) *Cognitive Science Summaries.*
Internet webpage: http://www.cc.gatech.edu/∼jimmyd/summaries/

Technical Reports

Davies, J., Nersessian, N. J., & Goel, A. K. (2001). Visual models in analogical problem solving. Georgia Institute of Technology Cognitive Science technical report GIT-COGSCI-2001/03. Atlanta, Georgia.

Davies, J. R., Goel, A. K., Murdock, J. W., Simina, M., & Shippey, G. (2000). Three Cognitive Models. Georgia Institute of Technology Cognitive Science Report Series GIT-COGSCI-2000/03. Atlanta, Georgia.

Davies, J. R., Lesh, N., Rich, C., Sidner, C. L., Gertner, A. S., & Rickel, J. (2000). Incorporating tutorial strategies into an intelligent assistant. Mitsubishi Electric Research Labs. Technical report TR-2000-30. Cambridge, Massachusettes.

Davies, J. (1998) Correlation and consistent contrast biases shown in free sort categorization. Georgia Institute of Technology Cognitive Science Report Series GIT-COGSCI-98/02. Atlanta, Georgia.

Student Research Supervision

Jordan Schoenherr Psychology Master's student at Carleton University. Fall 2008 - Present.

Heather Burch. Undergraduate at Carleton University. Summer 2008.

Alexander Miller. Undergraduate at Carleton University. Winter 2008 - Present.

Artem Tsvetkov. Undergraduate at Carleton University. Winter 2008 - Present.

Velian Pandeliev. Undergraduate at Carleton University. Winter 2008 - Present.

Connor Smith. Undergraduate at Carleton University. Winter 2008 - Present.

Sterling Somers. Undergraduate at Carleton University. Fall 2007 - Present.

Neal LaBlanc. Ph.D. student at Carleton University. Fall 2007 - Present.

Iva Nedeleva. Undergraduate at Carleton University. Fall 2007 - Present.

James MacAulay. Undergraduate at Carleton University. Summer 2007 - Present.

Nicolas DiNoia. Undergraduate at Carleton University. Spring 2007 - Present.

Wendy-Ann Deslauriers. Ph.D. Artificial Intelligence Rotation at Carleton University. Fall 2006 - Present.

Mark Fortney. Undergraduate at Carleton University. Fall 2006 - Present.

Shaista Mohammadi. Undergraduate at Carleton University. Fall 2006 - Present.

Robert Thomson. Ph.D. student at Carleton University. 2006. Fall 2006 - Present.

Jonathan Gagne. Undergraduate at Carleton University. Summer 2006 - Present.

Previous Students

Tyler Mair. Undergraduate at Carleton University. Honours Thesis. Fall 2007 - Winter 2008.

Manuel Alvarez Cos. Ph.D. student at Carleton University. Fall 2007.

Jobina Li. Ph.D. student at Carleton University. 2006. Fall 2006 - Summer 2007

Robert Bertschi. Undergraduate at Queen's University. Spring 2006.

Professional Service

Reviewer for
Journal on Cognitive Systems Research,
Software Practice and Experience,
Journal of Digital Information,
Journal of Human-Computer Interaction
Conference of the Cognitive Science Society.

Departmental Service

Cognitive Science / Psychology Promotion Committee (2008-2009)

Cognitive Science / Linguistics Promotion Committee (2008-2009)

Faculty calls to high school students, Carleton University (2008)

Coordinator, Cognitive Science Distinguished Lecture Series, Carleton University (2006-8). Under my tenure helped fund talks by Kepa Korta (2008), Terry Stewart, Michael L. Anderson (2007), Alison Gopnik, Wayne Gray, Gary Libben, William Bechtel (2006), David Stork

Member, Institute of Cognitive Science Director Search Committee, Carleton University (2007)

Member, Faculty of Arts and Social Sciences Promotion Review Committee, Carleton University (2008)

Member, Faculty of Arts and Social Sciences Tenure Review Committee, Carleton University (2007)

Speaker, Annual March Break Program, Pitch to high school students, Carleton University (2007, 2008)

Cognitive Science Student Representative, Georgia Institute of Technology (1995, 1996, 1997, 1998)

Thesis Committee Membership

Jordan Schoenherr 2008 (MS, Psychology, Carleton University)

Michael Henighan 2008 (MS, Psychology, Carleton University)

Joey Theberge 2008 (BA, Honours, Carleton University)