

JONATHAN D. COHEN

CURRICULUM VITAE

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EDUCATION and TRAINING

APPOINTMENTS and POSITIONS

HONORS and AWARDS

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 - Editorial Boards
 - Grant Review
 - Conference Organization
 - Membership in Professional Organizations
 - Software Development

BIOGRAPHICAL

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Birth Date: 10/5/55
Birth Place: New York City
Citizenship: U.S.A.

EDUCATION and TRAINING

UNDERGRADUATE:

1973-77 Yale University B.A., 1977 Biology and Philosophy

GRADUATE:

1979-83 University of Pennsylvania M.D., 1983 Medicine
1987-90 Carnegie Mellon University Ph.D., 1990 Cognitive Psychology

POST-GRADUATE:

1983-89 Internship in General Medicine, Neurology and Psychiatry
Residency in Psychiatry
Stanford University School of Medicine

1985-87 NIMH Research Training Fellowship,
Department of Psychiatry and Behavioral Sciences
Stanford University School of Medicine

APPOINTMENTS and POSITIONS

ACADEMIC:

- 1989- present Assistant to Full Professor of Psychiatry
Western Psychiatric Institute and Clinic
University of Pittsburgh
- 1990-98 Assistant to Associate Professor of Psychology
Carnegie Mellon University
- 1992- present Director, Clinical Cognitive Neuroscience Laboratory
University of Pittsburgh
- 1998- 2005 Professor of Psychology, Princeton University
- 1999- 2007 Founding Director, Center for the Study of Brain, Mind and Behavior
Princeton University
- 2000- 2008 Director, Program in Neuroscience
Princeton University
- 2005- 2012 Eugene Higgins Professor of Psychology, Princeton University
- 2005- present Founding Co-Director, Princeton Neuroscience Institute
- 2012- present Robert Bendheim and Lynn Bendheim Thoman Professor in Neuroscience
Princeton University

HONORS and AWARDS

- B.A. Cum Laude 1977
Distinction in the Biology Major
Distinction in the Philosophy Major
Yale University
- Miller Foundation Prize for Research in Psychiatry 1986
Department of Psychiatry and Behavioral Sciences
Stanford University School of Medicine
- Annual Resident Research Award 1986
Northern California Psychiatric Society
- Joseph Zubin Memorial Fund Award for Research in Psychopathology 1993

Kempf Fund Award for Research Development in Psychobiological Psychiatry, American Psychiatric Association	2000
James McKeen Cattell Fund Sabbatical Fellowship Award	2003
Eugene Higgins Chaired Professorship, Princeton University	2005
Salmon Award Lecturer, New York Academy of Medicine	2006
Fellow, Association for Psychological Science	2007
Edward J. Sachar Award, Columbia University School of Medicine	2007
American Psychological Association Distinguished Scientific Contribution Award	2010
Fellow, American Association for the Advancement of Science	2012
William James Fellow Award, Association for Psychological Science	2018

PUBLICATIONS

1. Peer-Reviewed Articles

- Cohen JD, Van Putten T, Marder S, Berger PA & Stahl SM (1987). Treatment of the symptoms of schizophrenia with piquindone, a new atypical neuroleptic. Psychopharmacology Bulletin, 23(3), 514-518.
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- Cohen JD & Servan-Schreiber D (1992). Context, cortex and dopamine: A connectionist approach to behavior and biology in schizophrenia. Psychological Review, 99, 45-77.
- Cohen JD, Servan-Schreiber D & McClelland JL (1992). A parallel distributed processing approach to automaticity. American Journal of Psychology, 105, 239-269.
- Cohen JD, MacWhinney B, Flatt M & Provost J (1993). PsyScope: A new graphic interactive environment for designing psychology experiments. Behavioral Research Methods, Instruments & Computers, 25(2), 257-271.

- Cohen JD, Noll DC & Schneider W (1993). Functional Magnetic Resonance Imaging: Overview and methods for psychological research. Behavioral Research Methods, Instruments & Computers, 25(2), 101-113.
- Cohen JD & Servan-Schreiber D (1993). A theory of dopamine function and cognitive deficits in schizophrenia. Schizophrenia Bulletin, 19(1), 85-104.
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- Schneider W, Noll DC & Cohen JD (1993). Functional topographic mapping of the cortical ribbon in human vision with conventional MRI scanners. Nature, 365, 150-153.
- Cohen JD, Forman SD, Braver TS, Casey BJ, Servan-Schreiber D & Noll DC (1994). Activation of prefrontal cortex in a non-spatial working memory task with functional MRI. Human Brain Mapping, 1, 293-304.
- Cohen JD & Huston TA (1994). Progress in the use of parallel distributed processing models for understanding attention and performance. In Umiltà C. and Moscovitch M. (Eds.), Attention and Performance XV: Conscious and Nonconscious Information Processing. Cambridge, MA: MIT Press, pp. 453-476.
- Cohen JD, Romero RD, Servan-Schreiber, D & Farah MJ (1994). Mechanisms of spatial attention: The relation of macrostructure to microstructure in parietal neglect. Journal of Cognitive Neuroscience, 6(4), 377-387.
- Armony JL, Servan-Schreiber D, Cohen JD & LeDoux JE (1995). An anatomically-constrained neural network model of fear conditioning. Behavioral Neuroscience, 109(2), 246-256.
- Carter CS, Mintun M & Cohen JD (1995). Interference and facilitation effects during selective attention: An [¹⁵O]-H₂O PET study of Stroop task performance. NeuroImage, 2, 264-272.
- Casey BJ, Cohen JD, Jezzard P, Turner R, Noll DC, Trainor R, Giedd J, Pannier L, Kaysen D & Rapoport JL (1995). Activation of prefrontal cortex in children during a non-spatial working memory task with functional MRI. NeuroImage, 2, 221-229.
- Forman SD, Cohen JD, Fitzgerald M, Eddy WF, Mintun MA & Noll DC (1995). Improved assessment of significant activation in functional magnetic resonance imaging (fMRI): Use of a cluster-size threshold. Magnetic Resonance in Medicine, 33, 636-647.
- Noll DC, Cohen JD, Meyer CH & Schneider W (1995). Spiral k-space MR imaging of cortical activation. Journal of Magnetic Resonance Imaging, 45, 49-56.
- Barch D, Cohen JD, Servan-Schreiber D, Steingard S, Steinhauer S & van Kammen D (1996). Semantic priming in schizophrenia: An examination of spreading activation using word pronunciation and multiple SOAs. Journal of Abnormal Psychology, 105, 592-601.
- Cohen JD, Braver TS & O'Reilly RC (1996). A computational approach to prefrontal cortex, cognitive control, and schizophrenia: Recent developments and current challenges. Philosophical Transactions of the Royal Society of London Series B (Biological Sciences), 351(1346), 1515-1527.
- Servan-Schreiber D, Cohen JD & Steingard S (1996). Schizophrenic deficits in the processing of context: A test of a theoretical model. Archives of General Psychiatry, 53, 1105-1112.

- Armony JL, Servan-Schreiber D, Cohen JD & LeDoux JE (1997). Computational modeling of emotion: Explorations through the anatomy and physiology of fear conditioning. Trends in Cognitive Sciences, 1, 28-34.
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- Suo DC, Hutchinson JB, deBettencourt M, Mennen A, Wang Y, Willke T, Turk-Browne NB, Norman KA, Cohen JD & Li K (2017). Real-time fMRI analysis in the cloud. [Society for Neuroscience Abstracts](#).
- Kane G, James M, Shenhav A, Wilson RC, Daw N, Aston-Jones G & Cohen JD (2018). Does the anterior cingulate contribute to foraging decisions? [Computational and Systems Neuroscience \(CoSyNe\)](#).
- Shvartsman M, Charles A, Cohen JD, Aoi M, Sundaram N & Wilke T (2018). Matrix-normal models for fMRI analysis. [Computational and Systems Neuroscience \(CoSyNe\)](#).
- Shvartsman M, Sundaram N, Aoi M, Charles A, Willke T & Cohen JD (2018). Matrix-normal models for fMRI analysis. [AISTATS](#).
- Jordan MC, Ellis CT, Lesnick M, Osherson DN & Cohen JD. Feature ratings and empirical dimension-specific similarity explain distinct aspects of semantic similarity judgments. [CogSci 2018: Proceedings of the Annual Meeting of the Cognitive Science Society](#).
- Musslick S, Cohen JD & Shenhav A (2018). Estimating the costs of cognitive control from task performance: Theoretical validation and potential pitfalls. [CogSci 2018: Proceedings of the Annual Meeting of the Cognitive Science Society](#).
- Musslick S, Jang SJ, Shvartsman M, Shenhav A & Cohen JD (2018). Constraints associated with cognitive control and the stability-flexibility dilemma. [CogSci 2018: Proceedings of the Annual Meeting of the Cognitive Science Society](#).
- Sagiv Y, Musslick S, Niv Y & Cohen JD (2018). Efficiency of learning vs. processing: Towards a normative theory of multitasking. [CogSci 2018: Proceedings of the Annual Meeting of the Cognitive Science Society](#).

- Bustamante LA, Burton AR, Baker AL, Shenhav AL, Daw ND & Cohen JD (2018). The cost of cognitive control and the balance of random versus directed exploration. Society for Neuroscience Abstracts.
- Jordan MC, Ritvo VJH, Norman KA, Turk-Browne NB & Cohen JD (2018). Using closed loop real-time fMRI neurofeedback to induce neural plasticity and influence perceptual similarity. Society for Neuroscience Abstracts.
- Musslick S, Cohen JD & Shenhav A (2018). Estimating the costs of cognitive control: Theoretical validation and potential pitfalls. Society for Neuroscience Abstracts.
- Novick A, Musslick S, Jordan M & Cohen JD (2018). Why we struggle to multitask: Converging evidence from computational modeling, human behavior, and neuroimaging. Society for Neuroscience Abstracts.
- Wilson RC & Cohen JD (2018). Deep exploration explains the tradeoff between directed and random exploration. Society for Neuroscience Abstracts.

5. Manuscripts Under Review / In Preparation

- Bornstein AM, Aly M, Feng SF, Turk-Browne NB, Norman KA & Cohen JD (under review). Perceptual decisions result from the continuous accumulation of memory and sensory evidence.
- Cohen JD, Ericson KM, Laibson D & White JM (under review). Measuring Time Preferences.
- Ellis CT, Lesnick M, Henselman-Petrusek G, Keller B & Cohen JD (under review). Limitations of topological data analysis for event-based fMRI.
- Ellis CT, Baldassano C, Schapiro A, Cai M, & Cohen JD. Facilitating open-science with realistic fMRI simulation: Validation and application.
- Ozcinmer K, Dey B, Musslick S, Patwary MMA, Willke TL & Cohen JD (under review). A graphic-theoretic analysis of parallel processing capability in neural networks.
- Petri G, Musslick S, Dey B, Özcimder K, Ahmed NK, Willke TL & Cohen JD (under review). Universal limits to parallel processing capability of network architectures.
- White JM, Ericson KMM, Laibson D & Cohen JD (under review). Measuring impatience: What can intertemporal choice experiments tell us?
- Wilson RC, Shenhav A, Straccia M & Cohen JD (under review). The eighty-five percent rule for optimal learning. bioRxiv, 1/27/18, doi: <http://dx.doi.org/10.1101/255182>.
- Shvartsman M, Sundaram N, Srivasta V, & Cohen JD (in preparation). A normative theory of decision making from multiple stimuli
- Lloyd KTodd MT, Schwemmer M, Botvinick MM, Cohen JD & Dayan P (in preparation). Task switching and cost minimization.

PROFESSIONAL ACTIVITIES

TEACHING:

1. Courses

- 1989-96 Introduction to Cognitive Psychology (undergraduate survey course)
Department of Psychology, Carnegie Mellon University
- 1989-96 Cognitive Neuroscience section of Cognitive Core (graduate survey course).
Department of Psychology, Carnegie Mellon University
- 1990-93 Co-coordinator, Fellowship Training Program in Schizophrenia Research. Western
Psychiatric Institute and Clinic, University of Pittsburgh
- 1992-93 Research Methods in Cognitive Neuroscience (advanced undergraduate seminar).
Department of Psychology, Carnegie Mellon University
- 1992-93 Functional Neural Circuits (graduate and advanced undergraduate seminar).
Department of Psychology, Carnegie Mellon University
- 1994-95 Neural and Psychological Mechanisms of Working Memory (graduate and advanced
undergraduate seminar). Department of Psychology, Carnegie Mellon University
- 1996-97 Advanced Topics in Cognitive Neuroscience (graduate and advanced undergraduate
seminar). Department of Psychology, Carnegie Mellon University.
- 1996-97 Biological and Psychological Mechanisms of Attention (graduate and advanced
undergraduate seminar). Department of Psychology, Carnegie Mellon University;
co-taught with Gary Aston-Jones.
- 1999-00 Neural Bases of Cognitive Control (undergraduate course). Department of
Psychology, Princeton University.
- 1999-01 Topics in Molecular and Cognitive Neuroscience (graduate seminar). Departments of
Psychology and Molecular Biology, Princeton University.
- 1999-01 Introduction to Neural Networks (undergraduate course). Department of Psychology,
Princeton University.
- 2001-02 Advanced Topics in Neural Network Models of Psychological Function (advanced
undergraduate / graduate seminar). Department of Psychology, Princeton University.
- 2002-03 Statistical Methods in Psychological Research (advanced undergraduate / graduate
course). Department of Psychology, Princeton University.
- 2004-07 Graduate Proseminar in Cognitive Psychology. Department of Psychology, Princeton
University.

- 2009-16 Core Course for Ph.D. Program in Neuroscience, Princeton Neuroscience Institute, Princeton University.
- 2017 Introduction to Cognitive Psychology (undergraduate survey course, including laboratory component). Department of Psychology, Princeton University
- 2018 Computational Models of Psychological Function (undergraduate course, including laboratory component). Princeton Neuroscience Institute, Department of Psychology, and Department of Computer Science, Princeton University

2. Tutorials and Workshops

- May, 1990-93 — Cohen JD, Servan-Schreiber D. Course co-directors, A primer on neural modeling in psychiatry. 144-7th Annual Meetings of the American Psychiatric Society, New York.
- July, 1991 — Invited faculty member. James S. McDonnell Summer Institute in Cognitive Neuroscience, Dartmouth College, Hanover.
- October, 1993 — Applications of Functional MRI to Studies of Human Memory. Invited tutorial, Memory Disorders Research Society, Boston.
- November, 1993 — Functional neuroimaging. Invited tutorial, Neural Information Processing Society, Boulder.
- August, 1996 — Neuroimaging and Behavior. Invited workshop, XXVI International Congress of Psychology, Montreal.
- January, 1997 — The Role of Neuromodulation in Cognition: Physiological and Computational Approaches. Panel organizer, 30th Winter Conference on Brain Research, Breckenridge, Colorado.
- July, 1997 — Invited faculty member. James S. McDonnell Summer Institute in Cognitive Neuroscience, Dartmouth College, Hanover.
- September, 2000 — International Workshop on Neural Bases of Executive Functions and Performance Monitoring, Jena, Germany.
- July, 2001 — Invited faculty member. James S. McDonnell Summer Institute in Cognitive Neuroscience, Dartmouth College, Hanover.

3. Trainees

Graduate advisees:

Therese Huston, Ph.D. (1990-1995)
 CMU Department of Psychology
 Behavioral and computational modeling studies of selective attention
 Director, Center for Excellence in Teaching & Learning, University of Seattle

Todd Braver, Ph.D. (1992- 97)
CMU Department of Psychology
Computational and neuroimaging studies of prefrontal cortex and cognitive control
Professor of Psychology, Washington University, St. Louis

Matthew Botvinick, M.D., Ph.D. (1995-2001)
CMU Department of Psychology
Computational modeling and fMRI studies of the role of anterior cingulate cortex in conflict monitoring and control
Professor of Psychology and Neuroscience, Princeton University

Mark Gilzenrat, Ph.D. (1996-2006)
CMU Department of Psychology (1996-1998)
Princeton Department of Psychology (1998-2006)
Computational models and pupillometric studies of neuromodulatory influences on selective attention
Software architect, Navaraga Corporation

Raymond Cho, M.D. (1999-2003)
Department of Psychology, Princeton University
Assistant Professor of Psychiatry, University of Pittsburgh

Eric Shea-Brown, Ph.D. (1999-2004)
Program in Applied and Computational Mathematics, Princeton University
Co-advisor with Philip Holmes
Neural oscillators and integrators in the dynamics of decision tasks
Associate Professor of Applied Mathematics, University of Washington, Seattle

Sean Polyn (2000-2005)
Department of Psychology, Princeton University
Computational modeling of context updating, reinforcement learning and dopamine function
Associate Professor of Psychology and Psychiatry, Vanderbilt University

Aaron Schurger (2001-2008)
Department of Psychology, Princeton University
Electrophysiological and fMRI studies of perceptual awareness
Associate Professor, Inserm-CEA

Agatha Lenartowicz (2002-2008)
Department of Psychology, Princeton University
Behavioral, electrophysiological and fMRI studies of task switching
Postdoctoral Fellow, UCLA

Kimberly D'Ardenne McClure (2005-2008)
Department of Chemistry, Princeton University
fMRI studies of brainstem neuromodulatory nuclei
Postdoctoral Fellow, Montague Lab, Virginia Tech

Susan Robison (2005-2009; co-advised with Ken Norman)
Department of Chemistry, Princeton University

Behavioral and fMRI studies of cognitive control and episodic memory

Emily Chakwin (2006-2008)

Department of Psychology, Princeton University
Behavioral and fMRI studies of moral reasoning

Michael Todd (2006-2012)

Department of Psychology, Princeton University
Computational modeling studies of cognitive control
Data Scientist, Netflix

Adam Moore (2006-2011; co-advised with Andy Conway)

Department of Psychology, Princeton University
Behavioral and fMRI studies of moral reasoning

John White (2008-2013)

Department of Psychology, Princeton University
Behavioral and fMRI studies of economic decision making
Data Scientist, Netflix

Sarah Getz (2008-2013; co-advised with Andy Conway)

Department of Psychology, Princeton University
Behavioral and fMRI studies of economic decision making

Andra Geana (2010-2016)

Department of Psychology, Princeton University
Behavioral and fMRI studies of exploration and exploitation in decision making

Jane Keung (2011-2016)

Princeton Neuroscience Institute, Princeton University
Behavioral and fMRI studies of prefrontal cortex and cognitive control

Olga Lositsky (2012-2017)

Princeton Neuroscience Institute, Princeton University
Behavioral and fMRI studies of decision making

Gary Kane (2012-2018)

Department of Psychology, Princeton University
Behavioral and neurophysiological studies of foraging behavior and LC function in rodents

Laura Bustamante (2014-present)

Princeton Neuroscience Institute, Princeton University
Behavioral and fMRI studies of the cost of cognitive control

Sebastian Musslick (2014-present)

Princeton Neuroscience Institute, Princeton University
Behavioral and fMRI studies of cognitive control

Abigail Novick (2014-present)

Department of Psychology, Princeton University

Behavioral and fMRI studies of representational sharing and multitasking

Ph.D. Committees (outside of Neuroscience and Psychology):

Cliona Golden (2004, Ingrid Daubechies), PACM, Princeton University

Adi Livnat (2005, Simon Levin), Ecology and Evolutionary Biology, Princeton University

Ilya Fischhoff (2006, Daniel Rubenstein), Ecology and Evolutionary Biology, Princeton University

Juan Gao (2007, Phil Holmes), Program in Applied and Computational Mathematics, Princeton University

Yuan (Sophie) Liu (2007, Phil Holmes), Physics, Princeton University

Caitlin Newberry (2007, Wolf Richter), Chemistry, Princeton University

Phil Eckoff (2008, Phil Holmes), Program in Applied and Computational Mathematics, Princeton University

Andrea Nedic (2011, Phil Holmes), Electrical Engineering, Princeton University

Samuel Feng (Phil Holmes), Program in Applied and Computational Mathematic, Princeton University

Stephanie Goldfarb (2013, Naomi Leonard), Program in Applied and Computational Mathematic, Princeton University

Eran Eldar (2014, Yale Niv), Princeton Neuroscience Institute, Princeton University

Paul Reverdy (2014, Naomi Leonard), Mechanical and Aerospace Engineering, Princeton University

Wouter Kool (Matthew Botvinick), Program in Applied and Computational Mathematic, Princeton University

Samuel Ritter (Matthew Botvinick), Princeton Neuroscience Institute, Princeton University

Postdoctoral trainees:

Steve Forman, M.D., Ph.D. (1992-1994)

University of Pittsburgh Department of Psychiatry

fMRI studies of prefrontal function

Associate Professor of Psychiatry, University of Pittsburgh

Medical Director of the Center for Treatment of Addictive Disorders, Pittsburgh VA

Marius Usher, Ph.D. (1993-1995)

CMU Department of Psychology

Computational models of catecholaminergic neuromodulation and selective attention

Professor of Psychology and Neuroscience, Tel Aviv University

Deanna Barch, Ph.D. (1993-1995)
University of Pittsburgh Department of Psychiatry
Professor of Psychology and Radiology, Washington University, St. Louis

William Perlstein, Ph.D. (1993-1996)
University of Pittsburgh Department of Psychiatry
Electrophysiological and fMRI studies of working memory in schizophrenia
Associate Professor of Clinical and Health Psychology and Psychiatry, University of Florida,
Gainesville

Gregory Berns, M.D., Ph.D. (1995-1998)
University of Pittsburgh Department of Psychiatry
Functional neuroimaging studies of novelty detection
Professor of Economics, Emory University

Randy Gobbel, Ph.D. (1997-1998)
Carnegie Mellon University Department of Psychology
Computational modeling studies of basal ganglia function in control of sequential action
Computer Scientist, Artificial Intelligence Center, SRI International

James Kroger (1998-2001)
Princeton University Department of Psychology
fMRI studies of prefrontal cortex organization
Professor of Psychology, New Mexico State University

Nicholas Yeung, Ph.D. (1999-2004)
Princeton University Department of Psychology
Modeling, ERP and fMRI studies of conflict monitoring and cognitive control
University Lecturer in Experimental Psychology, University of Oxford

Gesine Dreisbach, Ph.D. (2000-2001)
Princeton University Department of Psychology
fMRI studies of tasking switching
Professor of Psychology, University of Regensburg

Clay Holroyd, Ph.D. (2001-2004)
Princeton University Department of Psychology
Neural network modeling, ERP, and fMRI studies of performance monitoring and reinforcement
learning
Professor of Psychology, University of Victoria

James Rilling, Ph.D. (2001-2003)
Center for the Study of Brain, Mind & Behavior, Princeton University
Neural mechanisms of economic decision making; neural mechanisms in placebo responding.
Associate Professor of Anthropology and Psychiatry and Behavioral Sciences, Emory University

Alan Sanfey, Ph.D. (2001-2003)
Center for the Study of Brain, Mind & Behavior, Princeton University
Neural mechanisms of economic decision making; neural mechanisms in placebo responding.
Associate Professor of Psychology, University of Arizona

Principal Investigator, Donders Institute for Brain, Cognition and Behavior, Radboud University

Rafal Bogacz, Ph.D. (2002-2004)

Princeton University Department of Psychology

Neural network modeling and ERP studies of task switching and performance monitoring.

Associate Professor of Clinical Neuroscience, University of Oxford

Sander Nieuwenhuis, Ph.D. (2002-2003)

Princeton University Department of Psychology

ERP studies and neural network modeling of performance monitoring, task switching and the attentional blink.

Assistant Professor, Cognitive Psychology Unit, Leiden University

Joshua Greene, Ph.D. (2001-2006)

Princeton University Department of Psychology

Neural bases of moral reasoning

Professor of Psychology, Harvard University

Samuel McClure, Ph.D. (2003-2007)

Princeton University Department of Psychology

Neural network modeling and neuroimaging studies of reinforcement learning and decision making

Assistant Professor of Psychology, Stanford University

Jean-Baptiste Pochon, Ph.D. (2003-2005)

Princeton University Department of Psychology

Neuroimaging studies of decision making, conflict monitoring and cognitive control

Postdoctoral Fellow, L'Hôpital de la Salpêtrière in Paris

Patrick Simen, PhD. (2003-present)

Princeton University Program in Applied & Computational Mathematics

Computational modeling, mathematical analysis, behavioral and neuroimaging studies of decision making and cognitive control

Assistant Professor, Oberlin College

Jason Chein, Ph.D. (2004-2005)

Princeton University Department of Psychology

Neuroimaging studies of prefrontal cortex organization and function

Assistant Professor of Psychology, Temple University

Brent Field, Ph.D. (2004-2015)

Center for Study of Brain, Mind and Behavior, and Center for Health and Well-Being, Woodrow Wilson School of Public Policy

Behavioral and neuroimaging studies of attention and emotional regulation among meditation practitioners

Angela Yu, Ph.D. (2004-2008)

Princeton University Department of Psychology

Computational modeling and mathematical analysis studies of decision making and cognitive control

Associate Professor of Cognitive Science, University of California, San Diego

Damon Tomlin, Ph.D. (2006-2013)

Princeton University Department of Psychology and Princeton Neuroscience Institute
Neuroimaging studies of economic and social decision making and cognitive control

KongFatt Wong-Lin, Ph.D. (2006-2009)

Princeton University Department of Mechanical and Aerospace Engineering
Computational modeling and mathematical analysis studies of decision making and cognitive control

Lecturer, Ulster University

Yael Niv, Ph.D. (2007-2008)

Princeton University Department of Psychology
Neuroimaging and computational modeling studies of decision making and cognitive control
Associate Professor of Psychology and Neuroscience, Princeton University

Benjamin Eppinger, Ph.D. (2007-2010)

Princeton University Department of Psychology and Center for Health and Well Being of the
Woodrow Wilson School for Public Policy

Neuroimaging studies of age-related differences in economic decision making and cognitive control

Researcher, MPI for Human Development, Berlin

Marieke van Vugt, Ph.D. (2008-2010)

Princeton University Department of Psychology
Neuroimaging and computational modeling studies of decision making and cognitive control
Assistant Professor, University of Groningen

Fuat Balci, Ph.D. (2008-2010)

Princeton University Department of Psychology
Theoretical and behavioral studies of interval timing and decision making
Assistant Professor, Department of Psychology, Koc University, Istanbul

Robert Wilson, Ph.D. (2009-2014)

Princeton University Department of Psychology and Princeton Neuroscience Institute
Theoretical, behavioral and neuroimaging studies of cognitive control & locus coeruleus function
Assistant Professor, University of Arizona

Michael Schwemmer, Ph.D. (2010-2012)

Princeton Neuroscience Institute
Theoretical analyses of capacity constraints on cognitive control
Postdoctoral Fellow, Mathematical Biosciences Institute, Ohio State University

Jarrod Lewis-Peacock, Ph.D. in Psychology, University of Wisconsin-Madison

Princeton Neuroscience Institute (2011-2013; co-advised with Ken Norman)

Neuroimaging studies of cognitive control and prospective memory

Assistant Professor, University of Texas, Austin

Amitai Shenhav, Ph.D. in Psychology, Harvard University

CV Starr Fellow, PNI (2012-present; co-advised with Matt Botvinick)
Theoretical and neuroimaging studies of the costs of cognitive control
Assistant Professor, Brown University

Aaron Bornstein, Ph.D. in Neuroscience, NYU
Princeton Neuroscience Institute (2013-2019; co-advised with Ken Norman)
Neuroimaging studies of episodic memory and decision making
Assistant Professor, University of California, Irvine

Ida Momennajad, Ph.D.
Princeton Neuroscience Institute (2013-2018; co-advised with Ken Norman & Nathaniel Daw)
Neuroimaging and theoretical modeling studies of prospective memory

Michael Shvartsman, Ph.D. in Cognitive Science, University of Michigan
Princeton Neuroscience Institute (2014-2018)
Theoretical analysis of decision making; Bayesian hierarchical analysis of neuroimaging data
Occulus Research

Hasan Kayhan Ozcimder, Ph.D. in Mechanical Engineering, Boston University
Princeton Neuroscience Institute (2015-2017; co-advised with Naomi Leonard)
Mathematical modeling of capacity constraints in controlled (interactive parallel) processing
Mathworks

Michael Lesnick, Ph.D in Applied Mathematics, Stanford University
Princeton Neuroscience Institute (2016-2018)
Tools for topological data analysis (TDA) and their application to neuroscientific data analysis
Department of Mathematics, SUNY Albany

Biswardip Dey, Ph.D. in Mechanical Engineering, University of Maryland, College Park
Princeton Neuroscience Institute (2015-present; co-advised with Naomi Leonard)
Mathematical modeling of capacity constraints in controlled (interactive parallel) processing.

Marius Cătălin Iordan, Ph.D. in Computer Science, Stanford University
Princeton Neuroscience Institute (2016-present; co-advised with Daniel Osherson)
Theoretical and neuroimaging studies of semantic representations and cognitive control

Simon Cullen, PhD. in Philosophy, Princeton University
Princeton Neuroscience Institute (2017-2018)
Theoretical and experimental studies of moral reasoning
Assistant Professor, Carnegie Mellon University

Greg Henselman, Ph.D. in Applied Mathematics, University of Pennsylvania
Princeton Neuroscience Institute (2017-present)
Tools for topological data analysis (TDA) and their application to neuroscientific data analysis

Steven Frankland, Ph.D. in Psychology, Harvard University
Princeton Neuroscience Institute (2017-present)
Neural network modeling of analogical reasoning

Taylor Webb, Ph.D. in Psychology, Princeton University
Princeton Neuroscience Institute (2018-present)
Neural network modeling of analogical reasoning.

RESEARCH and PROFESSIONAL ACTIVITIES:

1. Scientific Interests

Research in my laboratory focuses on the neurobiological mechanisms underlying cognitive control, and their disturbance in psychiatric disorders such as schizophrenia and depression. Cognitive control is the ability to guide attention, thought and action in accord with internally represented goals or intentions. One of the fundamental mysteries of neuroscience is how this capacity for coordinated, purposeful behavior arises from the distributed activity of many billions of neurons in the brain. Several decades of cognitive and neuroscientific research have focused on the mechanisms by which control influences processing (e.g., attentional effects in sensory processing, goal directed sequencing of motor output, etc.), and the brain structures upon which these functions depend, such as the prefrontal cortex, anterior cingulate cortex, basal ganglia and brainstem neuromodulatory systems. However, we still have a poor understanding of *how* these systems give rise to cognitive control. Our work seeks to develop mechanistically explicit hypotheses about the functioning of these systems, and to test these hypotheses in empirical studies. An important motivation for this work is the development of a theoretically sound foundation for research on the relationship between disturbances of brain function and their manifestation as disorders of thought and behavior in psychiatric illness.

Theoretical work. Neural network models are developed as a way of articulating precise hypotheses about the function of particular brain systems, and their role in cognitive control. This work seeks to bridge between the traditionally disparate levels of analysis of neurophysiology, systems neuroscience, and cognitive psychology. Projects focus on the function of systems considered to be critical for cognitive control, including: a) the role of prefrontal cortex in biasing attention and response selection in posterior structures; b) the role of brainstem dopamine systems in regulating learning and updating of representations in prefrontal cortex; c) the role of the anterior cingulate cortex in monitoring performance, and its influence on adaptations in control; and d) the influence of locus coeruleus and norepinephrine on attentional state and the balance between exploration and exploitation. In many cases, modeling work has led to novel predictions about neurophysiological mechanisms underlying systems-level function, such as: a) gain control as a mechanism for dopaminergic and noradrenergic neuromodulation; b) the role of dopamine in coordinating reinforcement learning and the gating of information into prefrontal cortex; c) the influence of electrotonic coupling on population dynamics within the locus coeruleus; and d) the effects of changes in locus coeruleus physiological state on attentional mode. In other cases, this work has led to novel hypotheses about system level function, such as the response of anterior cingulate cortex to conflict in processing and its influence on adaptive changes in cognitive control, and the role of locus coeruleus in regulating the balance between exploration and exploitation. This work has also predicted, and led to the discovery of new anatomic relationships, such as projections from the anterior cingulate cortex to locus coeruleus. More recent work has examined

the relationship between neural network models and simpler, but analytically tractable mathematical models (such as the drift diffusion model) that have been developed for understanding simple forms of decision making at both the neural and behavioral levels, and the role of cognitive control in optimizing these processes to maximize reward rate.

Empirical work. Experimental studies within the laboratory make use of behavioral testing and neuroimaging (using functional magnetic resonance imaging and scalp electrical recordings) in humans. Collaborations with neurophysiologists also involve direct neuronal recordings in non-human species performing cognitive tasks, and detailed anatomic studies. Experiments are designed to test predictions made by neural network models, and to provide data needed to guide their further development. An important motivation for this work is the generation and testing of hypotheses about the neurobiological mechanisms underlying disturbances of behavior in psychiatric disorders. By manipulating variables of biological interest in our models, we are able to explore the effects that disturbances in these variables have on behavior, and then test these in empirical studies. Empirical findings emerging from this work include: a) the first demonstration in humans of sustained activity in prefrontal cortex associated with working memory performance; b) the correlation of prefrontal cortex activity with parametric manipulations of working memory load; c) the dissociation of frontal responses to working memory load from task difficulty; d) the effects of dopamine manipulation on performance in selective attention and working memory tasks; e) selective deficits both in behavior and prefrontal activity among patients with schizophrenia in these tasks; f) the response of the anterior cingulate cortex to processing conflict in the absence of performance errors; g) the co-localization of event-related potentials associated with errors (ERN) and processing conflict (N₂C); g) behavioral evidence consistent with predictions of reward rate optimization in accumulation-to-bound models of decision making; h) the first behavioral evidence of information seeking (“novelty bonus”) in human exploratory behavior; and i) the first demonstration of responses in the human ventral tegmental area to reward prediction errors.

New directions. A focus of increasing interest within the laboratory is the interaction between cognitive control and emotional processing in decision making. This stems from an appreciation of the close interactions between executive (e.g. prefrontal) and evaluative (e.g., anterior cingulate) functions evident in our work on cognitive control, and an equal appreciation of the fact that few, if any, aspects of real world behavior are devoid of such interactions. Studies in the laboratory have explored interactions between cognitive and emotional processes in a variety of behavioral domains, including economic choice (e.g., gambling tasks and intertemporal choice), social interaction (e.g., ultimatum and bargaining games), and moral decision making. Initial findings, using both behavioral and neuroimaging methods, have provided clear evidence for the prevalent engagement of emotional systems in tasks traditionally considered to be predominantly cognitive. This work has set the stage for more detailed studies that examine the interaction between the systems involved in such decision making tasks, with the goal of developing a more accurate understanding of real world behavior. It is also likely to have direct relevance to our understanding of psychiatric disorders, which invariably involve complex interactions between disturbances of thought and feeling.

2. Grants

Scottish Rite Foundation	Context Disturbance in Schizophrenia	PI	1986-88	
NIMH Physician Scientist Award	Context Disturbance in Schizophrenia: Models and Measures	PI	1987-92	MH00673
NIMH P50	Cortical Circuitry and Cognition in Schizophrenia (Edward Stricker, PI) Project 4 (1990-96), Project 7 (1997-02): The Role of Prefrontal Cortex in the Cognitive Dysfunctions of Schizophrenia; Project ?? (2003-07): Neuroendophenotypes and the expression of illness liability in schizophrenia	PI, Project 4,7	1990-07	MH45156
NIMH FIRST Award; RO1	Mechanisms of Context Processing in Schizophrenia	PI	1991-2012	MH47073
NIMH Program Project	Toward Models of Normal and Disordered Cognition (James L. McClelland, PI) Project 2 (1991-96): Neuromodulation and the Processing of Context in Schizophrenia; Project 4 (1997-02): Mechanisms of Cognitive Control	PI, Project 2,4	1991-2002	MH47566
NIMH P50	Center for Functional Brain Imaging (Robert Moore & Mark Mintun, Co-PIs) Cognitive Studies Core	Co-Direct., Cognitive Core	1992-97	MH49815
McDonnell Foundation	Neural Bases of Rehearsal and Maintenance in Working Memory	PI	1994-96	JSMF 94-32
NSF CRI	Computational and Statistical Methods for the Analysis of Neuroimaging Datasets	PI	1995-96	IBN9418982
NIMH RO1	fMRI Studies of Prefrontal Cortex	PI	1996-2009	MH52864
NIMH Program Project	Toward Models of Normal and Disordered Cognition (James L. McClelland, PI)	PI, Project 4	1997-02	MH47566
NIDA/HBP RO1	Advanced Methods for Neuroimaging Data Analysis	PI	1997-99	DA11469

NSF ESI	Tracking the Human Brain: An Interactive Planetarium Exposition (Bryan Rogers, PI)	Co-Invest.	1997-99	ESI9705491
NARSAD Independent Investigator Award	An fMRI Study of the Role of Anterior Cingulate in Working Memory Dysfunction in Schizophrenia	PI	1997-99	
NIMH RO1	Neurophysiological and Modeling Studies of Locus Coeruleus (Gary Aston-Jones, Co-PI)	Co-PI	1998-2001	MH33194
NSF MRI	Acquisition of Core Equipment for Princeton Cognitive and Behavioral Neuroscience Initiative (Marcia Johnson and Charles Gross, Co-PIs)	Co-PI	1998-2001	MRI/OSTI9871186
NJCST	New Jersey Brain Imaging Consortium: Acquisition of high field MRI scanner	PI	1999	
NIMH/HBP RO1	Usability and Interoperability of Neuroimaging Software	PI	2000-03	MH62006
NIMH RO1	Pathophysiology of Cognitive Disability in Schizophrenia (Cameron Carter, PI)	Co-Invest.	2000-04	MH59883
NIMH P50	Conte Center for Neuroscience Research: Cognitive and Neural Mechanisms of Conflict and Control	PI	2000-10	MH62196
Seaver Institute	Neural Economics: Understanding the brain mechanisms underlying cognitive-emotional interactions in decision making	PI	2001-02	
NIDA R21	Hyperscan: Simultaneous fMRI Across the Internet (Emory University; Greg Berns, PI)	Co-Invest.	2001-03	DA014883
MacArthur Foundation	Neural Bases of Placebo Effect and the Expectation of Pain	PI	2001-03	
NIMH P50	IBSC: Toward a Neurobiologically Constrained Framework for Modeling Human Cognition (James L. McClelland, PI). Project 4: Mechanisms of Cognitive Control	PI Project 4	2002-07	MH64445
NIMH RO1	New Wavelet-Based and Source Separation Methods for fMRI (Ingrid Daubechies, PI)	Co-Invest.	2002-07	MH067204
NIMH T32	Training Program in Quantitative Neuroscience	PI	2002-present	MH65214
NJCST	Center for Molecular and Biomolecular Imaging (Warren Warren, PI)	Co-Invest.	2002-09	

DURIP-ONR	Computing Environment for Computational Modeling of Brain Functions	PI	2003	
NSF BCS	Social Cognitive Neuroscience of Category-based Responses (Susan Fiske, PI)	Co-Invest.	2004-05	
NIDA RO1	Neural Mechanisms and Social Influence in Delay Discounting and Impulsive Behavior	PI	2006-11	DA022564
NIDA T90	Training Program in Quantitative and Computational Neuroscience (David Tank, Co-PI)	Co-PI	2006-11	DA022770
MURI	Dynamic Decision Making in Complex Task Environments: Principles and Neural Mechanisms (James L. McClelland, PI)	Co-Invest.	2006-11	AFOSR
MURI	Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (John Baillieul, PI)	Co-Invest.	2006-11	AFOSR
DURIP	A Second Generation Flexible Computing Environment for Computational Modeling of Brain Function and Neuroimaging Data Analysis	PI	2008	AFOSR
NCRR	Expansion of a Computing Facility for fMRI and Neuroimaging Analysis	PI	2008	RR023532
NSF MRI	Acquisition of High Performance Compute Cluster for Multivariate Realtime.	PI	2012	BCS1229597
John Templeton Foundation	Toward a Scientific Understanding of the Human Capacity for Cognitive Control	PI	2012-2018	
Intel Corporation	Advanced Methods for Realtime Analysis of Human Brain Imaging Data	PI	2014-2019	

3. Invited Lectureships

American Association for the Advancement of Science (2002)
 American Association of Directors of Psychiatry Residency Training (AADPRT), Annual Meeting, Schein Lecture (2012)
 American College of Neuropsychopharmacology, Panels (1994, 1995, 1997, 1998, 1999, 2005)
 American Economic Association, Symposia (2003, 2005, 2006)
 American Psychological Association, Distinguished Scientific Contribution Award Lecture (2010)
 American Psychological Society (1994, 1998)
 ARVO (2000)

Association for Research in Nervous and Mental Disease, Annual Conference Special Lecture (2006)

Association for Psychological Science, William James Award Public Address (2018)

Attention and Performance XV, XVIII (1992, 1998)

Baylor College of Medicine, Neuroscience Colloquium (1999); Keynote speaker, Annual Neuroscience Retreat and Rush and Helen Record Forum (2008)

Beckman Institute for Advanced Science and Technology, University of Illinois, Smith, Hinchman & Grills Distinguished Lecture (2003)

Behavioral Neurology Society, Keynote Address (1998)

Biological Psychiatry Society, Presidential Symposium (2002, 2008)

Boston University, Department of Cognitive and Neural Systems Colloquium (2001)

Brandeis University, Department of Biology, Colloquium (1997, 2003)

Brown University, Shlossberg Colloquium (2017)

California Institute of Technology 2nd Annual Chen Center Distinguished Lecture (2018)

Cambridge University and the Royal Society, Symposium on Executive and Cognitive Functions of Prefrontal Cortex (1996)

Cardiff University, Cardiff Cognitive Neuroscience Seminar Series (2005)

Carmel Conference XV (1997)

Carnegie Mellon University, Psychology Department Colloquium (1994, 2009)

Cognitive Neuroscience Society (1995, 1996, 2000, 2002, 2006)

Cognitive Neuroscience Treatment Research to Improve Cognition in Schizophrenia Meeting, Invited Talk (2007)

Cold Spring Harbor Laboratory, Computational and Systems Neuroscience Workshop (2004)

College de France, Colloque de Rentrée, Invited Talk (2007)

Columbia Presbyterian Hospital, Joseph Zubin Memorial Fund Award Lecture (1994)

Columbia University, College of Physicians and Surgeons, Department of Psychiatry, Grand Rounds (1990)

Columbia University, College of Physicians and Surgeons, Department of Economics, Cognition and Decision Seminar Series (2016)

Computational Psychiatry 2017 Keynote Address (2017)

Computational Psychiatry 2018 Keynote Address (2018)

Cornell Medical School, Sackler Institute Colloquium (2002)

CUNY, Department of Psychology Colloquium (2000)

DARPA ISAT Toward Optimal Learning Workshop, Invited Address (2014)

Dynamical Systems in Neuroscience, Annual Meeting (1999)

Eden Institute Foundation, Lecture Series Fellow (2001)

Emory School of Medicine, Department of Psychiatry, Grand Rounds (1999)

Ellison Medical Foundation, Workshop of the Biological Assessment of Mental Processes (2006)

Eunice Kennedy Shriver Center for Developmental Cognitive Neuroscience, Colloquium (2000)

FENS and The Brain Prize, Brain Conference on New Insights into Psychiatric Disorders through Computational, Biological and Developmental Approaches, Keynote Address (2016)

Florida State University, Department of Psychology, Colloquium (1998)

Frankfurt Institute for Advanced Studies, Ernst Strüngmann Forum (2007)

Future Science Prize Ceremony and Future Forum Science Symposium Keynote Address (2018)

Harvard University, Department of Psychology, Colloquium (1996, 2002)

Harvard University, Department of Economics, Labor Economics Seminar (2003)

Human Brain Project, Annual Conference (1998, 1999)
Indiana University, William Lowe Bryan Memorial Lecture on Cognitive Science (1992)
Institute for Advanced Studies, Department of Mathematics, Symposium (2003)
Institute of Psychiatry, King's College, London, Paul Janssen Lecture (2010)
Intel Corporation Annual Developers' Conference, Keynote Address (2016)
Intel Corporation, 2018 Consumer Electronics Show Spotlight Presentation (2018)
Intel Corporation Technology Strategy and Leadership Meeting: Outsider Perspective (2018)
Intel Labs Open Innovation Leadership Forum, Invited Address (2105)
Intel Labs, Mini-Symposium: The Mind's Eye Project (2106)
Interface 95 - The 27th Symposium on the Interface: Computing Science and Statistics (1995)
International Conference on Cognitive and Neural Systems, 10th Annual Meeting (2006), Invited Address
International Conference on Cognitive Neuroscience, Keynote Address (1996)
International Congress on Schizophrenia Research (1997), Invited Address
International Meeting on Fully Three-Dimensional Image Reconstruction in Radiology and Nuclear Medicine (1997)
International Neuropsychological Society (1992), Invited Address
James S. McDonnell Summer Institute in Cognitive Neuroscience (1995, 1997, 2001)
Japanese Neuropsychological Association, Keynote Address (1997)
Jena International Workshop on Executive Functions and the Brain (2000)
Kern Medina Seminar on Humanities and Science for State and Federal Judges (2014)
Lehigh University, Annual Neuroscience Retreat, Keynote Address (2015)
Library of Congress / NIMH Annual Decade of the Brain Public Program (1999)
Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Distinguished Guest Lecture Series (2011)
McGill University, Department of Psychiatry, Grand Rounds (1991)
Memory Disorders Research Society (1994, 1997, 1999)
Mind-Life Institute / M.I.T. (2003)
National Foundation for Functional Brain Imaging 1st Annual Meeting (1999)
New York Academy of Medicine, Annual Salmon Lecture (2006)
New York Academy of Sciences, Imaging Discussion Group Meeting (2005)
NIDA, Invited Seminar (2011)
NINDS, Cognitive Neuroscience Section, Grand Rounds (1993)
NIMH, St. Elizabeth's Hospital, Grand Rounds (1997)
NIMH Extramural program, Colloquia and Workshops (1999, 2000, 2001)
NIMH Intramural program, Neuroscience Colloquium (1999)
Nordic Center of Excellence and the Stockholm Brain Institute, Invited Talk (2007)
Northern California Psychiatric Society, Award Address (1986)
Northwestern University, Department of Psychology, Colloquium (1998)
NYU, Departments of Psychology and Neuroscience, Colloquia (1999, 2000)
Ohio State University, Mathematical Biosciences Institute Workshop on Systems Level Modeling (2002)
President's Council on Bioethics (2004)
Princeton Conference on Cerebral Vascular Disease (1994)
Princeton Plasma Physics Laboratory, Colloquium (2004)
Princeton University, Department of Psychology, Colloquium (1996)

Princeton University, Council on Science and Technology Public Lecture Series (2000)
Psychonomic Society, Invited Symposium Lectures (1996, 2002)
Queens College, CUNY, Annual Neuropsychology Symposium, Keynote Address (2007)
Reinforcement Learning and Decision Making, First Annual Meeting, Invited Address (2013)
Research Society on Alcoholism, Plenary Address (2002)
Rockefeller University, Neuroscience Colloquium (1999)
Rotman Research Institute, 10th Annual Conference on the Frontal Lobes (2000)
Royal Society, UK, Mental Processes in the Human Brain (2006)
Rutgers University, Department of Psychology & Center for Molecular and Behavioral
Neuroscience Colloquium (1999, 2000)
Rutgers University Brain Health Institute, Invited Colloquium Address (2015)
Sierra Ventures 13th Annual CXO Summit Keynote Address (2018)
Simons Foundation SFARI Annual Scientific Meeting Keynote Address (2018)
SISA, Trieste Encounters in Cognition (1992)
Smithsonian Institute Public Lecture Series (1999)
Society for Psychophysiological Research, Invited Address (2006)
Society for Research on Psychopathology (1993)
Stanford University, Neurobiology Department, Frontiers in Neuroscience Lecture Series (2009)
Templeton Foundation, Annual Members Meeting Keynote Address (2016)
Templeton World Charities Fund Diverse Intelligences Grantee Meeting (2018)
TPG Annual Retreat, Featured Speaker (2007)
University of California, Berkeley, Helen Wills Neuroscience Institute Inaugural Lecture (2000)
University of California, Berkeley, Neuroscience Student Seminar Series (2010, 2016)
University of California, Davis, Keynote Address, Opening of Brain Imaging Center (2005)
University of California, Davis, Department of Psychiatry Grand Rounds (2005)
University of California, San Francisco, Department of Psychiatry Grand Rounds (2001)
University College London and Wellcome Functional Imaging Laboratory (1997, 2000)
University of Colorado Boulder, Department of Psychology, Symposium (1997, 2002)
University of Colorado Boulder, Determinants of Executive Function & Dysfunction Conference
(2013)
University of Illinois, Program in Neuroscience, Colloquium (1998)
University of Michigan, Departments of Psychology and Psychiatry Colloquia (1994, 2000)
University of Michigan, Marshall Weinberg Cognitive Science Symposium (2013)
University of Maryland, Psychiatric Research Center, 25th Anniversary Symposium (2002)
University of Maryland, Cognitive Science Colloquium (2016)
University of Medicine and Dentistry of New Jersey, Graduate Program in Physiology and
Neurobiology, Special Lecture (1999)
University of Medicine and Dentistry of New Jersey, Dept. of Neurology Grand Rounds (2002)
University of North Carolina at Greensboro, Kendon Smith Annual Lecture Series (2004)
University of Oregon, Institute of Cognitive and Decision Sciences, Symposia (1990, 1996)
University of Pennsylvania, Department of Psychology, Cognitive Science Program, and
Institute for Neural Sciences Colloquia (1996, 2001)
University of Pennsylvania, Institute of Neurological Sciences, James M. Sprague Annual
Lecture (2006)
University of Pennsylvania and Philadelphia Psychoanalytic Center, Evening Program (2006)
University of Rochester, Department of Brain and Cognitive Sciences, Colloquium (2006)

University of Texas Austin, Cognitive Neuroscience & Imaging Research Center Seminar, Invited talk (2016)
University of Texas Southwestern Medical Center, Dept. of Psychiatry, Colloquium (2003)
University of Vermont, Department of Psychiatry, Grand Rounds (1992)
University of Waterloo, Centre for Theoretical Neuroscience, 5th Annual Brain Day (2011)
University of Wisconsin, Department of Psychology, Colloquium (1987, 2002)
University of Wisconsin Medical School, 5th Annual Symposium on Emotion (1999)
Vanderbilt University, Annual Neuroscience Retreat Keynote Address (2001)
Vanderbilt University, Stroopfest (2002)
Virginia Tech Carilion Research Institute Maury Strauss Distinguished Public Lecture (2018)
Washington University, Department of Psychiatry, Grand Rounds (2003)
Winter Conference on Brain Research (1993, 1996, 1997, 1998)
Workshop on Neural Modeling of Brain and Cognitive Disorders (1995, 1998)
Yale University School of Medicine, Department of Neurobiology, Colloquium (2002)
Yale University School of Medicine, Department of Psychiatry, Abraham Ribicoff Annual Lecture (2004)

4. Other research-related activities

Advisory Boards and Councils

Allegheny County Neuropsychiatric Survey, Executive Advisory Board (1996-8)
University of Michigan, Department of Psychology, External Advisory Board (1997)
National Alliance for Research on Schizophrenia and Depression (NARSAD), Scientific Council (1998-present)
NIMH Board of Scientific Counselors, Advisory Panel on Intramural Research Program (1999)
Yale-New Haven VAMC Schizophrenia Research Center, Scientific Advisory Board (1999)
International Organization of Human Brain Mapping, Governing Council (1998-2002), Treasurer (2000-2001), Chair of Neuroinformatics Committee (1998-2001), Chair, Nominations Committee (2001)
National Foundation for Functional Brain Imaging, Advisory Board (1999-2004)
Center for Magnetic Resonance Research, University of Minnesota, Advisory Board (2000)
Harvard Initiative in Systems Neuroscience, Advisory Board (2000)
American Psychiatric Association / NIMH DSM-V Workgroup on Neuroscience (2000-2002)
NIMH Workgroup on Strategic Plan for Mood Disorders (2000-2002).
International Association for the Study of Attention and Performance, Advisory Council (2001-present)
University of Pennsylvania NIMH Silvio O. Conte Center for Neuroscience Research, “The Neurobiology of Stimulus Encoding in Schizophrenia,” External Advisory Board (2003, 2008)
Harvard University, Department of Psychology, External Review Committee (2003)
NIMH Measurement and Treatment Development Activities on Cognition in Schizophrenia (MATRICS), Neurocognition Committee (2002-2006)
Council of Princeton University, Executive Committee (2004-5)
National Advisory Mental Health Council (NAMHC) (2004-8)
The Society for Neuroeconomics, Board of Directors (2004-2005)
Gatsby Computational Neuroscience Unit, UCL, Quinquennial Review Panel (2005)

National Advisory Mental Health Council Workgroup on MRI Safety (2005-2007)
Brookhaven National Laboratory, Science and Technology Steering Committee (2005-2014)
Institute for Advanced Studies, Princeton, Decadal Visiting Committee for School of Social Sciences (2007)
National Advisory Mental Health Council Workgroup on Neuroscience Training (2007-2008)
University of Colorado, Boulder NIMH Interdisciplinary Behavioral Science Center, “Executive Function and Dysfunction,” External Advisory Board (2009)
Johns Hopkins University, Psychological Brain Sciences Department and Mind Brain Institute External Review Committee (2011)
Princeton University, Research Computing Advisory Council, Member (2011-present)
Harvard University, Mind, Brain and Behavior Initiative, External Review Committee (2013)
Ecole Normale Supérieure, Scientific Advisory Committee of the Département d'Etudes Cognitives (2014-present)
National Academy of Medicine, Forum on Neuroscience (2015-present)

Editorial Boards

American Journal of Psychiatry, Consulting Editor (2001-2006)
Biological Psychiatry, Board of Editors (1999-2009)
Brain Research, Senior Editor for Computational Neuroscience (2005-2010)
Cognitive Neuropsychology, Advisory editor (1997-2002)
Journal of Experimental Psychology: General, Consulting Editor (1996-2005)
Journal of Neurophysiology (2003-2004)
Neuroimage, Board of Editors (2002-2003)
Neuroinformatics, Board of Editors (2002-present)
Neuropsychopharmacology, Board of Editors (1999-2008)
Neuroscience, Board of Editors (1999-2003)
NMR in Biomedicine, Board of Editors (2003-2006)
Proceedings of the Royal Society, Biological Sciences, Board of Editors (2003-2008)
Science, Board of Reviewing Editors (1998-2014)
Trends in Cognitive Science, Advisory Editorial Board (2004-present)
Computational Psychiatry, Editorial Board (forthcoming)

Grant Review

Member, Integrative Cognitive Functional Neuroscience (IFCN-8), NIH Study Section (1998-2003)

Ad hoc reviews for:

Behavioral Science Division, NSF
Clinical Psychopathology Study Section, NIMH
Human Development and Aging Study Section, NIH
Human Frontier Science Program
Medical Research Council (MRC), UK
National Center for Research Resources, NIH
NIMH Intramural Research Program, NIH
Wellcome Trust

Conference Organization

New Directions in Health Care and Education Annual Colloquium. University of Pennsylvania Medical School, May, 1980. Founder and Co-organizer.
25th Annual Carnegie Symposium on Cognition: Scientific Approaches to the Question of Consciousness. Carnegie Mellon University, May, 1993. Co-organizer.
Center for Neuroscience and Mental Disorders bi-annual workshop: Cognitive Neuroscience Approaches to Schizophrenia. University of Pittsburgh, May, 1994. Organizer.
International Congress on Schizophrenia Research. Colorado Springs, April, 1997. Program Consultant.
Society for Research in Psychopathology. Palm Springs, October, 1997. Program Committee.
Neural Processes and Economics Workshop, Woodrow Wilson School, Princeton University. Co-organizer, 2000.
Organization for Human Brain Mapping, New York City, 2003, Chair, Local Organizing Committee.
Computational Cognitive Neuroscience Conference, Co-Founder (with Randall O'Reilly); 2005-2008, Program Committee.

Membership in Professional Organizations

American Association for the Advancement of Science
American Psychological Society
Organization for Human Brain Mapping
Psychonomic Society
Society for Neuroscience

Software Development

PsyScope, Designer and Co-Producer (<https://en.wikipedia.org/wiki/PsyScope>) — this is a graphical, interactive program for the design and implementation of cognitive experimental tasks on Macintosh computers. It provides the ability to present stimuli in text, graphic, and acoustic form, and can be used to record manual or voice responses with millisecond accuracy. It incorporates a fully general scripting language, as well as a graphic interface, and is extensible through the use of plug-and-play add-on modules. PsyScope was originally designed for Mac OS prior to and through System 9. It was independently ported to MacOS X, and continues to be supported by the community, freely available, and widely used (with over 3,000 downloads) for experimental research and as a teaching instrument in research centers throughout the world. The design of PsyScope also provided one of the foundations for E-Prime, a PC/Windows-based commercially supported package that was developed in collaboration with Psychology Software Tools (PST) Inc. and is also in widespread use.

Brain Image Analysis Kit, Project Director (BrainIAK.org) — this is a Python-based, open source software package, developed in collaboration with Intel Labs, that supports the application of advanced methods from machine learning and multivariate statistics to the analysis of neuroimaging data. It is tightly integrated with SciKit-Learn (<http://scikit-learn.org/>), and includes modules for Full Correlation Matrix Analysis (FCMA; Wang et al. 2015), Multi-voxel Pattern

Analysis (MVPA), a suite of methods for Shared Response Modeling (SRM) (including hyper alignment and Inter-Subject Functional Correlation [IFSC]), Topographic Factor Analysis (TFA), and Bayesian-derived methods for Representational Similarity Analysis (RSA). Within the first year and half of its development it has attracted over 9,000 downloads.

PsyNeuLink, Designer, Lead Author (PsyNeuLink.org) — this is a "block modeling environment" designed for use by neuroscientists, psychologists and others interested in building system-level models of the computational mechanisms underlying brain function and its expression in psychological processes and behavior, and in exploring their relationship to developments in research on machine learning and artificial intelligence. It allows components to be constructed that implement various, possibly disparate functions, at potentially different levels of analysis and/or timescale of operation, and integrate these into a coherent modeling environment that can be used to simulate and study their interaction. *PsyNeuLink* is written in Python, is open source, and meant to be extended. Its goal is to provide an environment for implementing models that are expressed in a concise and easy to read form, that can be executed, shared, compared, and integrated with one another. *PsyNeuLink* maintains an open, publicly accessible library of its components and models, to which users can contribute, providing a common repository for model-sharing in a manner paralleling data-sharing efforts in empirical research.