

Jonathan D. Nelson

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Education

- Postdoc Computational Neurobiology Laboratory, Salk Institute for Biological Studies, 2005-2007
Mentor: Terrence J Sejnowski
- Ph.D. Cognitive Science, University of California, San Diego, 2005. Dissertation:
Optimal experimental design as a theory of perceptual and cognitive information acquisition
Committee: Martin I Sereno, Garrison W Cottrell, Javier R Movellan (co-chairs),
Gedeon Deak, Craig McKenzie, Jochen Triesch.
- M.S. Cognitive Science, University of California, San Diego, 2002.
- B.A. Cognitive Science and Statistics (magna cum laude), Wheaton College, 1998

Current research

- statistical foundations of active visual perception: eye movements as hypothesis testing (eye movement experiments)
- neural bases of the value of information for categorization (fMRI experiments)
- use of optimal experimental design principles to design informative behavioral experiments, to characterize the intuitive value of information
- communicative pragmatics of biases (base rate neglect, conservatism) in Bayesian inference
- effective communication of probabilities using experience-based learning and natural sampling
- characterization of helpful and unhelpful strategies for teaching by examples
- Bayesian modeling of learning on probabilistic and deterministic categorization tasks

Publications

- Nelson, JD & McKenzie, CRM (in press). Confirmation bias. In M. Kattan (Ed.), *The Encyclopedia of Medical Decision Making*. London, UK: Sage
- Nelson, JD (in press). Naïve optimality: Subjects' heuristics can be better-motivated than experimenters' optimal models. *Behavioral and Brain Sciences*.
- Nelson, JD (2008). Towards a rational theory of human information acquisition. In Oaksford, M & Chater, N (Eds.), *The Probabilistic Mind: Prospects for Bayesian Cognitive Science* (pp. 143-163). Oxford, UK: Oxford University Press.

- Filimon, F; Nelson, JD; Hagler, DJ; Sereno, MI (2007). Human cortical representations for reaching: mirror neurons for execution, observation, and imagery. *NeuroImage*, 37(4), 1315-1328.
- Nelson, JD; Cottrell, GW (2007). A probabilistic model of eye movements in concept formation. *Neurocomputing*, 70, 2256-2272.
- Nelson, JD (2005). Finding useful questions: on Bayesian diagnosticity, probability, impact and information gain. *Psychological Review*, 112(4), 979-999.
- McKenzie, CRM; Nelson, JD (2003). What a speaker's choice of frame reveals: Reference points, frame selection, and framing effects. *Psychonomic Bulletin and Review*, 10(3), 596-602.
- Movellan, JR; Nelson, JD (2001). Probabilistic functionalism: a unifying paradigm for cognitive science. *Behavioral and Brain Sciences*, 24(4), 690-692.
- Nelson, JD; Tenenbaum, JB; Movellan, JR (2001). Active inference in concept learning. In J. D. Moore & K. Stenning (Eds.), *Proceedings of the 23rd Conference of the Cognitive Science Society*, 692-697. Mahwah, NJ: Erlbaum.
- Nelson, JD; Movellan, JR (2001) Active inference in concept learning. *Advances in Neural Information Processing Systems*, 13, 45-51.

Manuscripts submitted

- Nelson, JD; McKenzie, CRM; Cottrell, GW; Sejnowski, TJ. Experience-based, but not summary statistics-based, human information acquisition optimizes probability gain.
- Nelson, JD; Filimon, F; Cottrell, GW. When do subjects falsify?
- Filimon, F; Nelson, JD; Huang, R.-S.; Sereno, M. I. Multiple parietal reach regions in humans: cortical representations for visual and proprioceptive feedback during online reaching.

Manuscripts in preparation

- Nelson, JD; Shahbazi, R; Sejnowski, TJ. Neglect of subjects' beliefs can lead to the erroneous conclusion that they misweight base rates.
- Filimon, F; Nelson, JD; Tierney, A.; Sereno, MI. Human fMRI of tactile spatial representations.

Published abstracts

- Nelson, JD; McKenzie, CRM; Cottrell, GW; Sejnowski, TJ (2007, Nov). Optimal experimental design principles explain human attention on a probabilistic categorization task. Society for Neuroscience conference, San Diego, CA
- Filimon, F; Nelson, JD; Sereno, MI (2007, Nov). Tactile spatial exploration in humans investigated with fMRI. Society for Neuroscience conference, San Diego, CA
- Filimon, F; Nelson, JD; Sereno, MI (2007, May). Human fMRI of tactile spatial representations. *Journal of Vision*, 7(9):301, 301a, <http://journalofvision.org/7/9/301/>.

- Nelson, JD; McKenzie, CRM; Cottrell, GW; Sejnowski, TJ (2007, May). Towards a descriptive theory of value of information in categorization tasks: implications for theories of eye movement and information search. *Journal of Vision*, 7(9):960, <http://www.journalofvision.org/7/9/960/>.
- Nelson, JD; Cottrell, GW (2006, May). An optimal experimental design model of information acquisition on a classic concept learning task. *Journal of Vision*, 6(6), 489a, <http://journalofvision.org/6/6/489/>.
- Filimon, F; Nelson, JD; Sereno, MI (2006, May). Egocentric and allocentric reference frames for eye movements - an fMRI study. *Journal of Vision*, 6(6), 979a, <http://journalofvision.org/6/6/979/>
- Nelson, JD; Cottrell, GW; Filimon, F; Sejnowski, T (2005, Dec). Optimal experimental design models of naive human information acquisition. NIPS 2005, Whistler, Canada.
- Nelson, JD (2005, July). Intuitive experimental design: Toward a theory of questions' usefulness. ASIC, Briançon, France.
- Filimon, F; Nelson, JD; Sereno, MI (2005, May). Parietal cortex involvement in visually guided, non-visually guided, observed, and imagined reaching, compared to saccades. *Journal of Vision*, 5(8), 629a, <http://journalofvision.org/5/8/629/>.
- Nelson, JD; Cottrell, GW; Movellan, JR (2004, Oct). Explaining eye movements during learning as an active sampling process. International Conference on Development and Learning, Salk Institute.
- Nelson, JD (2004, August). Finding useful questions in a natural environment. Cognitive Science Society Conference, Chicago. <http://www.cogsci.northwestern.edu/cogsci2004/ma/ma204.pdf>
- Nelson, JD; Cottrell, GW; Movellan, JR; Sereno, MI (2004, May). Yarbus lives: a foveated exploration of saccadic eye movement. *Journal of Vision*, 4(8), 741a, <http://journalofvision.org/4/8/741/>.
- Nelson, JD (2003, May). When the ideal observer meets the brain: A new approach to modeling saccadic eye movement. 10th Joint Symposium on Neural Computation, UC Irvine.
- Nelson, JD; Movellan, JR (2001, May). Inference by means of uncertainty. 8th Joint Symposium on Neural Computation, Salk Institute.
- Nelson, JD; Movellan, JR (2000, May). Concept induction in the presence of uncertainty. 7th Joint Symposium on Neural Computation, University of Southern California.

Other presentations

- Nelson, JD (2008, Apr). Beyond biases: human inference and information search. Psychology Department, University of California, Riverside, California
- Nelson, JD (2008, Mar). Optimal experimental design and the value of information in the mind and brain. Human Neuroscience Lab, Baylor College of Medicine, Houston, Texas
- Nelson, JD (2008, Mar). Debiasing the literature on human inference and information search. ABC Group, Max Planck Institute for Human Development, Berlin, Germany
- Nelson, JD (2008, Feb). Use of optimal experimental design principles to design experiments on the intuitive value of information. Auburn University Psychology Department, Auburn, Alabama

- Nelson, JD; Shahbazi, R; Sejnowski, TJ (2008, Jan). Neglect of subjects' beliefs can lead to the false conclusion that they neglect base rates. UCSD Psychology Department, Cognitive Brownbag
- Nelson, JD (2008, Jan). Use of optimal experimental design principles to design experiments on the intuitive value of information. University of California, Irvine, Institute for Mathematical Behavioral Sciences
- Nelson, JD (2007, Nov). Human learning and information search: Bayesian models and optimal experimental design principles. Ohio University Psychology Department, Athens, Ohio
- Nelson, JD; Cottrell, GW; Filimon, F; McKenzie, CRM; Movellan, JR; Sejnowski, TJ; Sereno, MI (2006, Oct). Using optimal experimental design to uncover human intuition: Probability gain explains information search better than information gain, impact, or Bayesian diagnosticity. Perceptual Expertise Network (PEN) XIII, University of Arizona, Tucson
- Nelson, JD; Cottrell, GW; Filimon, F; McKenzie, CRM; Movellan, JR; Sejnowski, TJ; Sereno, MI (2006, Oct). Optimal experimental design, probability learning, and information search. NSF Science of Learning Centers meeting, Washington, DC
- Nelson, JD (2006, Jun). Towards a rational theory of human information acquisition. Invited talk, Rational Models conference, Gatsby Computational Neuroscience Unit, University College, London.
- Nelson, JD (2006, Jan). Optimal experimental design and human information acquisition. UCLA Psychology Department
- Nelson, JD; Cottrell, GW (2005, Oct). A probabilistic model of eye movements in concept formation. PEN XI, McGill University, Montreal, Canada.
- McKenzie, CRM; Sher, S; Nelson, JD (2004, May). Framing effects and information leakage. Conference on individual decisions, Institute for Mathematical Behavioral Sciences, UC Irvine.
- Nelson, JD. (2003, Feb). When the ideal observer meets the brain: A new approach to modeling saccadic eye movement. Perceptual Expertise Network 6, Boulder, Colorado.
- McKenzie, CRM; Nelson, JD (2001, Nov). What a speaker's choice of frame reveals: Reference points, frame selection, and framing effects. Psychonomic Society annual meeting, Orlando, FL.

Teaching experience, mentoring

As Instructor with full responsibility for course

- Cognitive and Neuroscience Seminar (COGS 91), 2003. Taught seminar course to introduce undergraduates to a variety of research areas, and applications of research, in cognitive science.

As Teaching Assistant

- IGERT Vision and Learning in Humans and Machines Bootcamp, 2007. Aided design and execution of fMRI brain reading project.
- IGERT Vision and Learning in Humans and Machines Bootcamp, 2004. Designed and mentored project using gaze-contingent eye tracking experiment to study concept learning.

- Introduction to Human Development, 2000-2002. Developed new content to introduce MedLine and PsychInfo, and a new research component of the course.
- Introduction to Computing, 1999-2001. Designed new course components, including lectures and assignments, to introduce DHTML technologies, and assistive technologies for the disabled. Received teaching award.
- Multimedia Design, 1999. Mentored student projects in Web design. Received teaching award.
- Probability and Statistics, Wheaton College, 1998. Lectured, led study sections, and graded student work in upper division, calculus-based mathematical statistics course.

Guest Lectures

- “Optimal experimental design, Bayesian decision theory, and the value of information in the mind and brain.” Cognitive Science Core Graduate Computation Course (COGS 202), UCSD (2008, May)
- “Using optimal experimental design principles to identify the value of information in the mind and brain.” Cognitive Science Undergraduate Seminar (COGS 91), UCSD (2007, Oct)
- “Optimal experimental design as a theory of perceptual and cognitive information acquisition.” Cognitive Science Graduate Seminar (COGS 200), UCSD (2007, Oct)
- “Intuitive experimental design: eye movement, plankton, and planet Vuma.” Introduction to Cognitive Science (COGS 1), UCSD (2006, May)
- “Using principles of optimal experimental design to understand human information search.” Cognitive Science Seminar (COGS 91), UCSD (2006, Nov)
- “Finding useful questions: on Bayesian diagnosticity, probability gain, information gain, and impact.” Graduate Seminar on Human Rationality (PSY 209), UCSD Psychology (2006, Nov).
- “Active vision.” Graduate Seminar on Vision in Humans and Machines (CSE 291), UCSD Computer Science and Engineering (2005, May).
- “Eye movements for concept learning.” Graduate Interdisciplinary Seminar on Probabilistic Models of Cognition, UCSD Cognitive Science Dept. (2005, Apr).

Students Mentored

- Reza Shahbazi (2007), research on base rate neglect
- Kent Wu (2000), research on Bayesian models of concept learning, and information search

Honors and awards; professional service

Grant

- “Discovering the neural bases of the value of information using fMRI” (co-PI with Garrison W Cottrell). UCSD Academic Senate, January 2, 2008-January 1, 2009, \$14,940.

Fellowships awarded competitively

- NIH Postdoctoral Fellowship, 2005-2007 (NIH T32 MH020002-04)
- NSF IGERT Predoctoral Fellowship, 2004-2005 (NSF DGE-0333451)

- NIH Predoctoral Fellowship, 2002-2004 (NIH T32 MH020002-04)
- Pew Graduate Fellowship, 1998-2000

Other

- Probabilistic Models of Cognition Summer School participant, Institute for Pure and Applied Mathematics, UCLA, July, 2007
- Stanford Neuroeconomics Summer School participant, July, 2006
- Rational Models of Cognition workshop invited speaker, Gatsby Computational Neuroscience Unit, University College London, June, 2006
- Okinawa Computational Neuroscience Course participant, Japan, July, 2005
- Scholastic Honor Society, Wheaton College, 1998
- Chair, Cognitive Science Society of Wheaton College, 1997-1998

Professional association memberships

- Psychonomic society (full member, 2007); Society for Neuroscience; Cognitive Science Society; Vision Sciences Society

Professional service

- Referee (ad hoc), *Psychological Review*; *Journal of Experimental Psychology: Learning, Memory, and Cognition*; *IEEE Transactions on Systems, Man and Cybernetics*; Neural Information Processing Systems conference; Cognitive Science Society conference