

**EDWARD VUL**

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**Academic positions**

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Assistant Professor, Department of Psychology; University of California, San Diego Starting 2010

**Education**

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Ph.D. Cognitive Science Advisors: Nancy Kanwisher, Josh Tenenbaum	current	MIT	Cambridge, MA
IPAM Summer School: Probabilistic models of cognition	2007	UCLA	Los Angeles, CA
Dartmouth Summer School Institute of Cognitive Neuroscience	2006	Dartmouth	Hanover, NH
B.S. Psychology, with Honors Advisors: Hal Pashler, Don MacLeod	2005	UCSD	La Jolla, CA
B.A. Philosophy	2005	UCSD	La Jolla, CA

**Awards**

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NDSEG Graduate Fellowship	2007-current
APA Early Researcher Award	2008
Cognitive Science Society Conference Travel Award	2009
MIT Graduate Student Counsel Travel Award	2007
Vision Science Society Travel Award	2007
Institute of Humane Studies Travel Grant	2006
ECVP Student Research Travel Grant	2006

**Research Funding**

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2009 BIAL Foundation research grant: Neural and Computational Mechanisms of Conscious and Unconscious Decisions Under Uncertainty (with Nancy Kanwisher and Josh Tenenbaum).

2009 NSF Dissertation grant (DRMS): Boundedly optimal sampling for decisions under uncertainty (with Nancy Kanwisher, Josh Tenenbaum)

2008 MIT Health Science and Technology Catalyst fund: Neural substrates of Bayesian computation;

2008 MIT McGovern Institute Neuro-Technology Program: Fast Relational Clustering for High-Throughput Visual Neuroscience (with Nancy Kanwisher, Jim DiCarlo, Josh Tenenbaum, Vikash Mansinghka, Beau Cronin, Keith Bonawitz)

2007 Russell Sage Behavioral Economics Research Grant: Measuring the crowd within: probabilistic cognition in economic decision making

2007 Sigma Xi Grant in aid of research: How does the brain compensate for vision loss? (with Nancy Kanwisher)

2005 Sigma Xi Ophthalmology Grant in aid of research: From retina to awareness: tracking the stages of processing in the visual system (with Don MacLeod)

2004 University of California Regents Undergraduate Research Scholarship

## **Professional Service**

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*Editorial board:* PLoS One.

*Ad-hoc reviewer (incomplete list):* PNAS; Nature Neuroscience; Psychological Science; Cerebral Cortex; NeuroImage; Cog Sci conference; Euro Cog. Sci; JEP: Human Perception and Performance; PLoS One; NIPS; Psychonomic Bulletin and Review; Cognition; Journal of Autism and Developmental Disorders, Attention Perception & Psychophysics, NeuroReport.

*Conference program committee:* COSYNE 2010

*Workshop organization:*

“Rational Process Models” at 31<sup>st</sup> Annual Cognitive Science Society Conference, 2009

“Bounded-rational analyses of human cognition: Bayesian models, approximate inference, and the brain.” at NIPS 2009

## **Book Chapters**

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**Vul, E., & Kanwisher, N.K.** (in press) Begging the Question: The Non-Independence Error in fMRI Data Analysis

## **Peer-Reviewed Articles**

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### *in press*

Mozer, M.C., Pashler, H., Cepeda, N., Lindsey, R., & **Vul, E.** (in press) Predicting the optimal spacing of study: a multiscale context model of memory. *Advances in Neural Information Processing Systems, 2010.*

Gershman, S., **Vul, E.**, & Tenenbaum, J.B. (in press) Perceptual multistability as Markov Chain Monte Carlo inference. *Advances in Neural Information Processing Systems, 2010.*

**Vul, E.**, Frank, M.C., Alvarez, G.A., & Tenenbaum, J.B. (in press) Explaining human multiple object tracking as resource-constrained approximate inference in a dynamics probabilistic model. *Advances in Neural Information Processing Systems, 2010.*

**Vul, E.**, Hanus, D., & Kanwisher N. (in press) Attention as inference: Selection is probabilistic, Responses are all-or-none samples *Journal of Experimental Psychology: General*

### **2009**

**Vul, E.**, Goodman, N.D., Griffiths, T.L., & Tenenbaum, J.B. (2009) One and Done: Optimal decisions from very few samples. *Proceedings of the 31 Annual Meeting of the Cognitive Science Society*, pp. 148-153.

**Vul, E.**, Harris, C., Winkielman, P., & Pashler, H. (2009) Reply to comments on Puzzlingly high correlations in fMRI studies of emotion, personality, and social cognition. *Perspectives on Psychological Science, 4*, 319–324.

**Vul, E.**, Harris, C., Winkielman, P., & Pashler, H. (2009) Puzzlingly high correlations in fMRI studies of emotion, personality, and social cognition (the paper formerly known as Voodoo Correlations in Social Neuroscience). *Perspectives on Psychological Science, 4*, 274–290.

Frank, M. C., **Vul, E.**, & Johnson, S. P. (2009) Development of infants’ face preference during the first year. *Cognition, 110*, 160-170.

### **2008**

- Cepeda, N.J., **Vul, E.**, Rohrer, D., Wixted, J.T., & Pashler, H. (2008) Spacing effects in learning: A temporal ridgeline of optimal retention. *Psychological Science*, *19*, 1095-1102.
- Vul, E.**, Krizay, E., & MacLeod, D. (2008) The McCollough effect reflects permanent and transient adaptation in early visual cortex *Journal of Vision*, *8(12):4*, 1-12.
- Vul, E.**, Hanus, D., & Kanwisher, N. (2008) Delay of Selective Attention During the Attentional Blink *Vision Research*, *48(18)*, 1902-9.
- Lashkari, D., **Vul, E.**, Kanwisher, N., & Golland, P. (2008) Discovering structure in the space of activation profiles in fMRI. *MICCAI, 2008*, 1016-1024.
- Vul, E.** & Pashler, H. (2008) Measuring the crowd within: probabilistic representations within individuals *Psychological Science*, *19(7)*, 645-647.
- Carpenter, S. K., Pashler, H., Wixted, J. T., & **Vul, E.** (2008) The effects of tests on learning and forgetting. *Memory and Cognition*, *36*, 438-448.
- Vul, E.**, Nieuwenstein, M., & Kanwisher N. (2008) Temporal Selection is Suppressed, Delayed, and Diffused During the Attentional Blink. *Psychological Science*, *19*, 55-61.

## 2007

- Vul, E.** & Pashler, H. (2007) Incubation is helpful only when people are misled. *Memory, and Cognition*, *35*, 701-710.

## 2006

- Carpenter, S.K., Pashler, H., & **Vul, E.** (2006) What type of learning is enhanced by a cued recall test? *Psychonomic Bulletin and Review*. *13(5)* 826-830.
- Vul, E.** & MacLeod, D. I. A. (2006) Contingent after-effects distinguish conscious and pre-conscious colour processing. *Nature Neuroscience*, *9(7)*, 873-4.
- Huang, L & **Vul, E.** (2006) Role of a circle's center to visual interpolation. *Vision Research*, *46(15)*, 2311-2314.
- Cepeda, N., Pashler, H., **Vul, E.**, Wixted, J., and Rohrer, D. (2006) Distribution of practice in verbal recall tasks: a review and quantitative synthesis. *Psychological Bulletin*, *132(3)*:354-80.

## Conference Abstracts (incomplete)

- Carpenter, S. K., & **Vul, E.** The delay-of-feedback benefit: Timing vs. duration. Poster presented at the annual meeting of the Psychonomic Society, Boston, MA. Nov, 2009
- Brady, TF., **Vul, E.**, & Tenenbaum, JB. Probabilistic Models of Change Detection and Multiple Object Tracking: How Is Working Memory Allocated in Attentionally Demanding Tasks? Poster presented at the Psychonomic Society Meeting. Boston, MA, Nov 2009.
- Vul, E.**, Frank, MC., Alvarez, GA., & Tenenbaum, JB. Modeling and quantifying tradeoffs in multiple object tracking. Paper presented at the OPAM meeting. Boston, MA. Nov, 2009.
- Vul, E.**, Lashkari, D., Hsieh, P.-J., Golland, P., and Kanwisher, N.G. (2009). Discovering the structure of object representation through fMRI clustering. Paper presented at the SfN meeting, Chicago, IL, Oct, 2009.
- Vul E.**, Frank, MC, Alvarez, GA, & Tenenbaum, JB. What can we learn from failures in multiple object tracking? Poster presented at the ECVF meeting, Regensburg, Germany, August 2009.

- Vul, E.** Rational resource allocation. Talk at the “Rational Process Models” symposium at the 31<sup>st</sup> Annual Cognitive Science Society meeting; Amsterdam, Netherlands, July, 2009.
- Vul, E.** One and Done. Talk at the Annual Summer Interdisciplinary Conference, Italy, July, 2009
- Vul, E.,** Lashkari, D., Golland, P., Hsieh, P.-J., and Kanwisher, N.G. (2009). Discovering the structure of object representation through fMRI clustering. Poster presented at the VSS meeting, Naples, FL, May, 2009.
- Hsieh, P.-J., **Vul, E.**, and Kanwisher, N.G. (2009). Top-down interpretation alters low-level visual processing. Paper presented at the VSS meeting, Naples, FL, May, 2009.
- Vul E.,** Frank, MC, Alvarez, GA, & Tenenbaum, JB. Statistical decision theory and the allocation of cognitive resources in multiple object tracking. Paper presented at the COSYNE meeting, Salt Lake City, UT, February, 2009.
- Rich, A. & **Vul, E.** Can feature binding be explained by certainty in space and time? EPC meeting, Australia.
- Vul, E.** Uncertainty in visual selective attention. Poster at the Object Perception Attention, and Memory meeting, Chicago, IL; November, 2008.
- Vul, E. &** Kanwisher, N. Uncertainty and selective attention. Paper at the European Conference on Visual Perception, Utrecht, Netherlands, August, 2008.
- Rich, A & **Vul, E.** Can feature binding be explained by certainty in space and time? Poster at the European Conference on Visual Perception, Utrecht, Netherlands, August, 2008.
- Vul, E.,** Hanus, D., & Kanwisher, N. Selective attention and uncertainty. Poster at the Vision Science Society meeting, Naples, FL, May 2008.
- Hanus, D., **Vul, E.,** & Kanwisher, N. Delay of selective attention during the attentional blink. Poster at the Vision Science Society meeting, Naples, FL, May 2008.
- Frank, D., **Vul, E.,** Mansinghka, V.K., & Alvarez, G. What limits performance in multiple object tracking? Poster at the Vision Science Society meeting, Naples, FL, May 2008.
- Vul, E.** Dynamics of the McCollough Effect. Paper at the Rank Prize Symposium on Self-Calibrating Systems, Windermere, UK; 2007.
- Vul, E.,** Krizay, E. & MacLeod, DIA. Two linearly-summed timescales of learning in early visual cortex. Paper at the Society for Neuroscience meeting, San Diego, CA, 2007.
- Pashler, H., **Vul, E.** & Rickard, T. What Does It Take to Link a Cue with a Behavior in Human Skill Acquisition? Paper at the Psychonomic Society meeting, Long Beach, CA, 2007.
- Falconbridge, M., **Vul, E.** & MacLeod, DIA. Dynamics of adaptation to counterphasing gratings. Paper at the OSA Fall Vision Meeting, Berkeley, CA, 2007.
- Vul, E. &** Kanwisher, N. Temporal selection is continuous and deterministic; responses are probabilistic. Paper at Mathematical Psychology Society meeting, Irvine, CA, 2007.
- Vul, E.,** Coffey, B., Nieuwenstein, M.R. & Kanwisher, N. The Attentional Blink affects three aspects of selection: Delay, duration, and suppression. Paper at the Vision Science Society Meeting, Sarasota, FL, 2007.
- Frank, M.C., **Vul, E.,** & Johnson, S. P. Infants’ eye movements during free-viewing as a window into the development of attention. Paper at the Vision Science Society meeting, Sarasota, FL, 2007.

- Vul, E.** & MacLeod, D.I.A. Functional Adaptive Sequential Testing (FAST). Poster at the European Conference on Visual Perception, Arezzo, Italy, 2007.
- Vul, E.** & Kanwisher, N. Temporal selection is continuous and deterministic; responses are probabilistic. Poster at Cognitive Science Society meeting, Nashville, TN, 2007.
- Carpenter, S.K., Pashler, H., Wixted, J., & **Vul, E.** Item Characteristics and Task Conditions that Predict Forgetting. Poster at the Institute of Education Sciences, Washington, DC, 2007.
- Carpenter, S.K., Pashler, H., Wixted, J., & **Vul, E.** Facts, Faces, and Obscure Places: Item Characteristics That Predict Rate of Forgetting. Poster at the annual meeting of the American Psychological Society, Washington, DC., 2007.
- Vul, E.** Temporal selection is continuous and deterministic; responses are discrete and probabilistic. Poster at the International Conference on Cognitive and Neural Systems, Boston, MA, 2007.
- Krizay, E., **Vul, E.**, Shubel, E., & MacLeod, D.I.A. Two timescales of orientation contingent color adaptation. Poster at the Vision Science Society meeting, Sarasota, FL, 2007.
- Vul, E.**, & MacLeod, D.I.A. Color without consciousness: Dynamics of the McCollough effect. Paper at the Vision Science Society Meeting, Sarasota, FL; May, 2006.
- Carpenter, S.K., Pashler, H., Wixted, J.T., & **Vul, E.** Are tests effective at enhancing learning? Paper at the Cognition and Student Learning symposium; Annual Meeting of the American Educational Research Association; San Francisco, CA; April, 2006.
- Carpenter, S. K., Pashler, H., & **Vul, E.** The effects of test timing and feedback timing on the learning of obscure facts. Poster at the annual meeting of the Psychonomic Society, Houston, TX; November, 2006.
- Vul, E.**, Konkle, T., Love, A., Williams, A., & Nieuwenstein, M. Quantitative prediction of errors in RSVP: modeling the time course of suppression during the attentional blink. Poster at the European Conference on Visual Perception, St Peterburg, Russia, August, 2006.
- Carpenter, S.K., Pashler, H., & **Vul, E.** What types of learning are enhanced by a cued recall test? Poster at the Association for Psychological Science Meeting, New York, NY; May, 2006.
- Vul, E.** & MacLeod, D.I.A. Contingent aftereffects distinguish conscious from preconscious color processing. Poster at the Cognitive Neuroscience Society Meeting, San Fransisco, CA; April, 2006.
- Cepeda, N.J., Pashler, H., & **Vul, E.** Distributed Practice and Long-Term Retention: Joint Effects of Inter-Study Interval and Retention Interval. Poster at the Psychonomic Society Meeting, Toronto, Canada: November, 2005.
- Carpenter, S.K., Pashler, H, Wixted, J.T, & **Vul, E.** Testing Effect: Enhanced Retention or Attenuated Forgetting? Poster at the Psychonomic Society Meeting, Toronto, Canada: November, 2005.
- Vul, E.** & Pashler, H. Incubation benefits verbal problem solving only when subjects are misguided. Poster at the American Psychological Society Meeting, Los Angeles, CA: May, 2005.

### **Invited Talks (incomplete)**

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| “One and Done” NIPS workshop on rational process models.                     | 2009 |
| “What limits human multiple object tracking?” Search Lab, Harvard            | 2009 |
| “Optimal computations with cognitive limitations” Princeton Psychology Dept. | 2009 |
| “Optimal computations with cognitive limitations” UCSD Psychology Dept.      | 2009 |
| “Rational process models” Rochester Brain and Cognitive Sciences             | 2009 |

November, 2009

“Varieties of Voodoo” Guelph workshop on issues in fMRI interpretation	2009
“Varieties of Voodoo” Columbia workshop on statistics and Neuroscience.	2009
“Varieties of Voodoo” Massachusetts General Hospital	2009
“The Non-Independence Error in fMRI analysis” Berenson-Allen Center for Non-Invasive Brain Stimulation	2009
“Probability distributions in the head” MIT Cognitive Group	2008
“Probability distributions in the head” University of Sydney, Psychology Department Colloquium	2008
“Probability distributions in the head” MACCS Attention Seminar, Macquarie University	2008
“Sampling in attention” UCSD Psychology Cognitive Brown Bag	2007
“Probability distributions in the head” Yale Psychology Cognitive Group	2007
“Functional Adaptive Sequential testing” MIT Cognitive Group	2007
“Delay of selection in the Attentional Blink” MIT Cognitive Group	2006
“Color without consciousness” Harvard Visual Attention Laboratory Seminar Series	2005
“Color without consciousness” MIT Cognitive Group	2005

### **Association Membership**

American Academy for the Advancement of Science; American Psychological Association; Cognitive Science Society; Society for Neuroscience; Cognitive Neuroscience Society; Vision Sciences Society; Association for Psychological Science; Psi Chi; Brain and Cognitive Science Triathlon Team

### **Department and University Service**

Cognitive job search committee; MIT	2008
Martinos Imaging Center Committee; MIT	2007
Cognitive Graduate Representative; MIT	2006-2007