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## OBJECTIVE

My interest is in understanding the neurophysiology of the visual system. More specifically, I want to elucidate how cortical networks perform integrative functions such as complex and invariant pattern recognition, feature binding, scene segmentation, and stereo correspondence.

## CAREER EXPERIENCE

**Postdoctoral Fellow**  
**Carnegie Mellon University, Center for the Neural Basis of Cognition**  
**January 2005 – present (supervisor: Tai Sing Lee, PhD)**

Designed and ran experiments exploring single-unit and ensemble representations of depth inference in V1 and V2. Electrophysiological recordings with single electrodes and arrays in visual cortex of awake and alert primates.

Grant Support:  
NIMH IBSC MH64445 (James L McClelland) Interactive processes in perception (Tai Sing Lee & Carl Olson)  
NSF CISE IIS-0413211 Statistical and neural basis of 3D surface inference in vision (Tai Sing Lee)  
NSF CISE IIS-0713206 Computational & Neurophysiological Investigation of Robust Visual Inference (Tai Sing Lee)  
NEI F32 EY017770 Spatial Integration of V1 Horizontal Disparity Signals (Jason Samonds)  
AFOSR FA9550-09-1-0678 Multi-cue surface representation (Tai Sing Lee & Christopher Tyler)

**Postdoctoral Fellow**  
**Vanderbilt University, Department of Electrical Engineering and Computer Science**  
**May 2004 – January 2005 (supervisor: AB Bonds, PhD)**

Designed and ran experiments exploring origins of cortical synchrony, along with cooperative interactions and contour detection in primary visual cortex. Electrophysiological recordings with 10x10 Bionics array in visual cortex of anesthetized cats and somatosensory cortex of anesthetized owl monkeys.

Grant Support:  
NEI RO1 EY014680 Representation of Visual Information in Striate Cortex (AB Bonds)

**Research Assistant**  
**Vanderbilt University, Department of Biomedical Engineering**  
**May 1999 – May 2004 (supervisor: AB Bonds, PhD)**

Designed and maintained stimuli, data collection, and data analysis systems on PC, Sun Microsystems, and custom hardware. Developed and implemented a broad range of neural signal processing tools (emphasis on probabilistic signal processing). Successful formulation and submission of NIH grants (NEI RO1 EY014680). Oral and written presentations to general and neuroscience audiences. Associated surgical procedures, as well as anesthesia and physiological monitoring for electrophysiological recordings from visual cortex of cats. Designed and produced microelectrodes for single-unit and multi-unit recordings, along with multi-barrel electrodes for iontophoresis delivery of neurotransmitter drugs. Implemented and maintained 10x10 and 5x5 Bionics microelectrode arrays for large scale multi-unit recordings.

Grant Support:  
NEI RO1 EY03778 Spatial Characteristics of Cells in the Striate Cortex (AB Bonds)  
NEI RO1 EY014680 Representation of Visual Information in Striate Cortex (AB Bonds)

**Research Technician**  
**Medical College of Wisconsin, Functional Imaging Research Center**  
**May 1998-May 1999 (supervisor: Thomas E Prieto, PhD)**

Mechanical and electrical design, along with maintenance, of subject interface systems for functional magnetic resonance imaging studies. Projects included audio and visual stimuli, feedback and response systems, and head restraint.

Grant Support:  
NIH P01 MH51358 (James S Hyde) Subject Interface Systems (Thomas E Prieto)

## **EDUCATION**

### **Vanderbilt University, Nashville TN**

Doctor of Philosophy in Biomedical Engineering, May 2004  
Vanderbilt University, Nashville TN  
Spatiotemporal analysis of synchronization of neural ensembles for spatial discriminations in cat striate cortex. *Vanderbilt University PhD Dissertation*, 2004.

Master of Science in Biomedical Engineering, May 2002  
Vanderbilt University, Nashville TN  
Spike train analysis of spatial discriminations and functional connectivity of pairs of neurons in cat striate cortex. *Vanderbilt University MS Thesis*, 2002.

G.P.A. 3.44(4.0)  
Curriculum: Real-time Systems, Bioelectrical Signals, DSP, Artificial Intelligence, Neural Networks, Morphological Image Processing, Medical Imaging, Excitable Membranes, Visual System.  
Workshops: *NIPS* Spike Train Analysis, UC-Berkeley BioMEMS

Research Assistantship, Academic Scholarship, Graduate School Travel Awards, Student Paper Award

### **Milwaukee School of Engineering, Milwaukee WI**

Bachelor of Science in Biomedical Engineering, May 1999  
Senior Design: Heart Sound Simulator, Design Team Associate Project Manager

G.P.A. 3.69(4.0) Major G.P.A. 3.70(4.0)  
Curriculum: Instrumentation, Imaging, Signals, Control Systems, Thermo/Fluids, Biomedical Design, Biomaterials.  
Workshops: MCW fMRI Experiment Design & Issues

Alumni Association Student Achievement Award  
M.S.O.E., Walton Foundation, and Pearl Noren Scholarships

## **PUBLICATIONS**

### **Invited Talks:**

Spatiotemporal analysis of synchronization of neural ensembles for spatial discriminations in cat striate cortex. *Sloan-Swartz Center*, Salk Institute for Biological Studies. La Jolla, CA. April 26, 2004.

Neuronal Ensemble Recording in the Cat Primary Visual Cortex. *Center for the Neural Basis of Cognition*. Carnegie Mellon University. Pittsburgh, PA. July 23, 2004.

Evidence of cooperative and competitive mechanisms for stereo computation in macaque V1.  
Workshop: What role does spike synchrony or correlation play in sensory processing? Cosyne, The Canyons, Utah. February 26-27, 2007.

Representations of scene statistics in the primary visual cortex for inferring binocular disparity. *Brain Corporation*. La Jolla, CA November 1, 2011

### **Workshops Organized:**

Samonds JM, Smith MA. What role does spike synchrony or correlation play in sensory processing?  
*Cosyne, The Canyons, Utah*. February 26-27, 2007

## Presentations:

Allison JD, Smith KR, Atherton ME, Samonds JM, Bonds AB. Temporal frequency tuning of cross orientation inhibition in the striate cortex of cats. [ARVO abstr] *Invest Ophthalmol Vis Sci*, 2000.

Brown HA, Allison JD, Samonds JM, Bonds AB. Nonlocal origin of response suppression from stimulation outside the Classic Receptive Field in Area 17 of the cat. [VSS abstr] *J Vision* 1(3):200a, 2001.

Brown HA, Allison JD, Samonds JM, Bonds AB. Area 18 contribution to spatial integration of receptive fields of area 17 cells in the cat. [VSS abstr] *J Vision* 2(7):582a, 2002.

Samonds JM, Allison JD, Brown HA, Bonds AB. Spike train analysis reveals cooperation between Area 17 neuron pairs that enhances fine discrimination of orientation. [VSS abstr] *J Vision* 2(7):196a, 2002.

Bonds AB, Samonds JM, Allison JD. Spike train analysis reveals cooperation between Area 17 neuron pairs that enhances fine discrimination of orientation. *Annual Meeting of the Society for Mathematical Psychology*, 2002.

Brown HA, Allison JD, Samonds JM, Thomas AM, Bonds AB. Characterization of area 18 modulation from stimulation outside the receptive field of area 17 cells in the cat. [VSS abstr] *J Vision* 3(9):373a, 2003.

Samonds JM, Allison JD, Brown HA, Bonds AB. Cooperative Synchronized Assemblies and Orientation Discrimination. [VSS abstr] *J Vision* 3(9):152a, 2003.

Brown HA, Samonds JM, Bonds AB. Area 18 contributes to contrast adaptation of Area 17 cells in the cat. [VSS abstr] *J Vision* 4(8):224a, 2004.

Samonds JM\*, Brown HA, Bonds AB. Relationships between the spatiotemporal spike train structure and cortical synchronization. [VSS abstr] *J Vision* 4(8):17a, 2004.

### \*Student Travel Award

Samonds JM, Bonds AB. Quantitative analysis of cooperation and structure in the cat striate cortex. *Workshop on Coding of Visual Information in the Brain, Isle of Skye, Scotland*, 2004.

Zhou Z\*, Samonds JM, Bernard MR, Bonds AB. Synchronous activity in cat visual cortex encodes collinear and cocircular contours. [VSS abstr] *J Vision* 5(8):675a, 2005.

### \*Student Travel Award

Bernard MR, Samonds JM, Zhou Z, Bonds AB. An integration model of detection and quantification of synchronous firing within cell groups. [VSS abstr] *J Vision* 5(8):676a, 2005.

Samonds JM\*, Potetz B, Lee TS. Cooperative processing of spatially distributed disparity signals in macaque V1. [VSS abstr] *J Vision* 6(6):831a, 2006.

### \*Student Travel Award

Potetz BR, Samonds JM, Lee TS. Disparity and luminance preference are correlated in macaque V1, matching natural scene statistics. [*Soc Neurosci abstr*], 2006.

Samonds JM, Potetz BR, Lee TS. Evidence of cooperative and competitive mechanisms for stereo computation in macaque V1. [*Soc Neurosci abstr*], 2006.

Samonds JM, Potetz BR, Lee TS. Neurophysiological Evidence of Cooperative Mechanisms for Stereo Computation. [*NIPS*], 2006.

Samonds JM, Potetz BR, Lee TS. Evidence of cooperative and competitive mechanisms for stereo computation in macaque V1. OIST Workshop on Cognitive Neurobiology, Onna Village, Okinawa, Japan, 2007.

Samonds JM, Potetz BR, Lee TS. Implications of neuronal interactions on disparity tuning in V1. [*Soc Neurosci abstr*], 2007.

Samonds JM, Potetz BR, Poplin RE, Lee TS. Neuronal interactions reduce local feature uncertainty. [*Soc Neurosci abstr*], 2008.

Samonds JM, Poplin RE, Lee TS. Binocular disparity in the surround biases V1 responses to ambiguous binocular stimuli within the classical receptive field. [*Soc Neurosci abstr*], 2009.

Poole B, Lenz I, Lindsay G, Samonds JM, Lee TS. Connecting scene statistics to probabilistic population codes and tuning properties of V1 neurons. [*Soc Neurosci abstr*], 2010.

Samonds JM, Poole B, Lee TS. V1 interactions reduce local uncertainty about binocular disparity over time. [Soc Neurosci abstr], 2010.

Lindsay G, Poole B, Doiron B, Samonds JM, Lee TS. Quality of tuning curves and their effect on population coding. [Cosyne], 2011.

Samonds JM, Potetz BR, Tyler CW, Lee TS. Dynamics of binocular disparity tuning explained by a neural network model with recurrent interactions. [Soc Neurosci abstr], 2011.

Samonds JM, Li X, Tyler CW, Lee TS. Neuronal interactions in area V2 and their role in stereoscopic three-dimensional shape processing. [Soc Neurosci abstr], 2012.

Li X, Samonds JM, Lui Y, Lee TS. Pairwise interaction of V1 disparity neurons depends on spatial configural relationship between receptive fields as predicted by 3D scene statistics. [Soc Neurosci abstr], 2012.

#### **Peer-reviewed Articles:**

Brown HA, Allison JD, Samonds JM, Bonds AB. Nonlocal origin of response suppression outside of the classical receptive field in Area 17 of the cat. *Vis Neurosci* 20(1):85-96, 2003.

Samonds JM, Allison JD, Brown HA, Bonds AB. Cooperation between Area 17 neuron pairs enhances fine discrimination of orientation. *J Neurosci* 23(6):2416-2425, 2003.

**\*Reviewed by the Faculty of 1000**

Samonds JM, Allison JD, Brown HA, Bonds AB. Cooperative synchronized assemblies enhance orientation discrimination. *Proc Nat Acad Sci USA* 101(17):6722-6727, 2004.

Samonds JM, Bonds AB. From another angle: Differences in cortical coding between fine and coarse discrimination of orientation. *J Neurophysiol* 91(3):1193-1202, 2004.

Samonds JM, Bonds AB. Real-time visualization of neural synchrony for identifying coordinated cell assemblies. *J Neurosci Meth* 139(1):51-60, 2004.

Samonds JM, Bonds AB. Gamma oscillation maintains stimulus structure-dependent synchronization in cat visual cortex. *J Neurophysiol* 93(1):223-236, 2005.

Samonds JM, Zhou Z, Bernard MR, Bonds AB. Synchronous activity in cat visual cortex encodes collinear and cocircular contours. *J Neurophysiol* 95(4):2602-2616, 2006.

**\*Reviewed by the Faculty of 1000**

Samonds JM, Potetz BR, Lee TS. Neurophysiological Evidence of Cooperative Mechanisms for Stereo Computation. *Advances in Neural Information Processing Systems* 19, MIT Press, 2007.

Samonds JM, Potetz BR, Lee TS. Cooperative and competitive interactions facilitate stereo computations in macaque primary visual cortex. *J Neurosci* 29(50):15780-15795, 2009.

Samonds JM, Potetz BR, Lee TS. Relative luminance and binocular disparity preferences are correlated in macaque V1, matching natural scene statistics. *Proc Nat Acad Sci USA* 109(16):6313-6318, 2012.

Samonds JM, Potetz BR, Tyler CW, Lee TS. Recurrent connectivity can account for the dynamics of disparity processing in V1. (submitted) 2012.

Samonds JM, Potetz BR, Lee TS. Quantifying sharpening of neuronal tuning using the statistical measurement of the sample skewness. (in preparation) 2012.

Li X, Samonds JM, Lui Y, Lee TS. Pairwise interaction of V1 disparity neurons depends on spatial configural relationship between receptive fields as predicted by 3D scene statistics. (in preparation) 2012.

Samonds JM, Tyler CW, Lee TS. Binocular disparity in the surround biases V1 responses to ambiguous binocular stimuli within the classical receptive field. (in preparation) 2012.

Poole B, Samonds JM, Lee TS. Neural encoding of scene statistical priors. (in preparation) 2012.

#### **Reviews and Commentary:**

Samonds JM and Bonds AB. Cooperative and temporally structured information in the visual cortex. *Signal Processing*, 85(11):2124-2136, 2005.

Samonds JM. Feature configuration modulates effective connectivity. *J Neurosci* 26(14):3621-3623, 2006.

Kelly RC, Smith MA, Samonds JM, Kohn A, Bonds AB, Movshon JA, Lee TS. Comparison of recordings from microelectrode arrays and single electrodes in visual cortex. *J Neurosci* 27(2):261-264, 2007.

#### **Book Chapters:**

Lee TS, Stepleton T, Potetz B, Samonds JM. Neural coding of scene statistics for surface and object inference, In *Object Categorization: perspectives from human and machine vision*, Ed. Sven Dickinson, Ales Leonardis, Bernt Schiele, Michael Tarr, Cambridge University Press, 2008.

Samonds JM, Lee TS. Neuronal interactions and their role in solving the stereo correspondence problem, In *Vision in 3D Environments*, Ed. Laurence Harris, Michael Jenkin, Cambridge University Press, 2011.

#### **Invited Reviewer:**

Journal of Neuroscience  
Journal of Neurophysiology  
Journal of Computational Neuroscience  
Network: Computation in Neural Systems  
Journal of Neuroscience Methods  
Journal of Vision  
Vision Research  
Behavioral and Brain Functions  
Signal Processing

## **AFFILIATIONS**

Society for Neuroscience 2006-present  
American Physiological Society 2003-present  
Visual Sciences Society 2001-present  
Association for Research in Vision & Ophthalmology 2000-2001  
Institute for Electrical and Electronics Engineers 1997-present  
Engineering in Medicine and Biology Society 1997-present  
Biomedical Engineering Society 1995-present  
Tau Omega Mu Honor Society 1998

## **COMPUTER SKILLS**

C, ADA, Fortran programming languages  
Matlab (Windows, Mac, and Linux)  
Cadkey  
Solidworks and Rapid Prototype design  
DOS, Windows, Mac, and Unix environments (also cluster systems)  
Microsoft and Corel Office programs  
Pspice

## **INTERESTS**

Mountain biking, cycling, hiking, photography, football, music, literature