Michael J. Seay

255 N Granada Ave, Apt #2059 • Tuscon, AZ 85701 • (504) 319 5224
mikejseay@gmail.com

RESEARCH INTERESTS

- Computational models of neural systems
- Mental representation of temporal structure; expectation; working memory
- Psychophysics of time perception; perception of duration, sequence, and temporal patterns

EDUCATION

University of California, Los Angeles – Los Angeles, CA

Ph.D in Psychology — *May 2022*
GPA: 4.0

Tulane University – New Orleans, LA

Master of Science in Neuroscience — *May 2013*
Bachelor of Science in Neuroscience, *magna cum laude* — *May 2012*
Minor in Psychology, Minor in Mathematics, Coordinate Major in Cognitive Studies

Cumulative GPA: 3.77, *GPA in Major*: 3.91
Relevant Coursework: Cognitive/Systems/Cellular Neuroscience, Univariate Statistics, Scientific Computing, Digital Signal Processing, Linear Algebra, Combinatorics

RESEARCH & ACADEMIC EXPERIENCE

August 2017 – present

Buonomano Lab at UCLA,
University of California, Los Angeles, CA
Ph.D Student (Advisor: Dr. Dean Buonomano)

As a member of Dr. Buonomano's lab, I have learned an array of new research skills. Computational techniques include building and using both spiking and firing-rate models of neural networks in Python and MATLAB, supervised and unsupervised learning rules, and parameter searching. Experimental techniques and supporting skills include patch-clamp electrophysiology, two-photon Ca^{2+} imaging, mouse brain dissection and sectioning, *in vitro* brain slice culturing, viral transfection, and optogenetic stimulation. My broad research goal is to understand how cortical circuit mechanisms support the brain's ability to extract the temporal structure of sensory events, with a focus on the contribution of inhibitory interneurons.

June 2015 – July 2017

Henri Begleiter Neurodynamics Laboratory (HBNL),
State University of New York Downstate Medical Center, New York, NY
Research Scientist (Advisor: Dr. Bernice Porjesz)

At the HBNL, I examined functional brain connectivity quantified by inter-trial and inter-regional synchrony of oscillatory EEG activity measured during cognitive experiments. Most work focused on understanding dynamics of theta-band oscillations during evaluation of gambling outcomes based on their valence (win or loss), implicated in neural systems that support reinforcement learning. Communicating my findings, which helped to support our lab's grant aims, led to experience in scientific presentation and manuscript preparation. I also designed a new experiment to assess neural correlates of individual differences in reinforcement learning behavior. To support my efforts, I created computer software including data processing pipelines, results storage systems, and plotting and statistics tools, which provided widely useful tools capable of performing reproducible scientific analyses – both for my colleagues and the wider scientific community.

December 2010 – May 2015

Tulane Cognitive Neuroscience Laboratory,
Tulane University, New Orleans, LA
Student and Research Assistant (Advisor: Dr. Edward Golob)

My work in Dr. Golob's lab built the foundations of my research skills. After joining as an undergraduate, I designed an experiment to test the hypothesis that memory retrieval accuracy would decrease with the perceptual strength of an encoded stimulus feature (musical pitch). Behavioral results supported my hypothesis, and an ERP component was smaller to the same memory probe depending on encoded percept quality. During a subsequent research assistantship, I continued my work in the lab, becoming more interested in advanced EEG analysis techniques like independent component analysis (ICA) and time-frequency decomposition. As a part of a team, I helped conceive, execute, and write a published study on independent EEG processes supporting auditory spatial attention, creating data analysis methods that were novel to the lab in the process.

January 2015 – May 2015
&
January 2013 – May 2013

Neuroscience Program,
Tulane University, New Orleans, LA
Teaching Assistant

During my master's program and research assistantship, I served as a teaching assistant for a course on Cognitive Neuroscience – first in the classroom component and later in the laboratory component. As a TA for the classroom component, I created and delivered a class lecture on nonverbal memory, and I graded examinations made up of short paragraph and essay answers to open-ended questions regarding experimental design and interpretation. As a TA for the laboratory component, I guided each of 14 students through the process of designing and executing an original research project, including initial conception of the research question, experimental design, implementation of the experiment in presentation software, and statistical analysis.

PUBLICATIONS & PRESENTATIONS

Published

Seay MJ, Natan RG, Geffen MN, Buonomano DV (2020). Differential Short-Term Plasticity of PV and SST Neurons Accounts for Adaptation and Facilitation of Cortical Neurons to Auditory Tones. *Journal of Neuroscience.*

Motanis H*, **Seay MJ***, Buonomano DV (2018). Short-Term Synaptic Plasticity as a Mechanism for Sensory Timing. *Trends in Neurosciences*. *contributed equally

Mock JR, **Seay MJ**, Charney DR, Holmes JL, Golob EJ (2015). Rapid cortical dynamics associated with auditory spatial attention gradients. *Frontiers in Neuroscience*.

Unpublished and theses

Zhou S*, **Seay MJ***, Taxidis J, Golshani P, Buonomano DV (under review). Multiplexing working memory and timing: encoding retrospective and prospective information in neural trajectories.

Soldado-Magraner S, **Seay MJ**, Laje R, Buonomano DV (under review). Orchestrated Excitatory and Inhibitory Learning Rules Lead to the Unsupervised Emergence of Up-states and Balanced Network Dynamics.

Liu B, **Seay MJ**, Buonomano DV (under review). Creation of neuronal ensembles and cell-specific homeostatic plasticity through chronic sparse optogenetic stimulation.

Seay MJ (2022). Neurocomputational mechanisms of timing, temporal context, and working memory. Ph.D thesis.

Seay MJ (2012). The effect of encoded stimulus strength on auditory cortical responses during short-term memory retrieval of pitch. Honor's Thesis.

Talks

Seay MJ, Buonomano DV (2022). Testing the relationship between timing and working memory with two complementary tasks. For: Joint Buonomano-Golshani Lab Meeting. Los Angeles, CA.

Seay MJ, Buonomano DV (2021). Orchestrated excitatory and inhibitory plasticity in a large spiking model: quantifying convergence, stability, and robustness. For: UCLA Neuroscience Lab Meeting. Los Angeles, CA.

Seay MJ, Buonomano DV (2020). Characterizing Up and Down states within 80 minutes of spontaneous activity in a single 40-DIV organotypic cortical culture. For: UCLA Neuroscience Lab Meeting. Los Angeles, CA.

Seay MJ, Buonomano DV (2019). Modeling short-term adaptation with differential inhibitory dynamics: replicating optogenetic inactivation studies *in silico*. For: UCLA Neuroscience Lab Meeting. Los Angeles, CA.

Seay MJ, Buonomano DV (2018). Temporal processing in circuits with dynamic synapses. For: UCLA Neuroscience Lab Meeting. Los Angeles, CA.

Seay MJ, Porjesz B (2016). Local and inter-regional synchrony of brain oscillations – a novel phenotype. For: Collaborative Study on the Genetics of Alcoholism – National Institute on Alcohol Abuse and Alcoholism Annual Meeting. New Brunswick, NJ.

Seay MJ, Golob EJ (2013). Nonverbal memory. For: Tulane Psychology Department Cognitive Neuroscience Course. New Orleans, LA.

Poster Presentations

Seay MJ, Natan RG, Geffen MN, Buonomano DV (2019). A cortical spiking model with differential short-term plasticity onto parvalbumin and somatostatin interneurons reproduces in vivo results of sensory adaptation in auditory cortex. Society for Neuroscience. Chicago, IL.

Seay MJ., Mock JR., Golob EJ (2014). Cortical representations of absolute and relative sound locations during an auditory spatial attention task. Society for Neuroscience. Washington, D.C.

Seay MJ., Turner S, Golob EJ (2011). Human brain dynamics in auditory processing. Tulane Neuroscience Program Research Poster Session. New Orleans, LA.

SKILLS

Computer programming and literacy:

- MATLAB – strong proficiency
- Python – strong proficiency
- R – basic proficiency
- Unix-like operating systems – proficient

Software:

- NEURON
- Brian2
- RStudio
- SPSS
- EEGLab Toolbox (for MATLAB)
- SCAN EEG Acquisition & Presentation
- Adobe Photoshop & Illustrator
- Microsoft Office Suite

Neuroscience Techniques:

- Mouse brain dissection and sectioning
- Patch clamp electrophysiology
- Viral transfection of *in vitro* brain slices
- Optogenetic stimulation
- Two-photon Ca^{2+} imaging
- Electroencephalography (EEG)

REFERENCES

Excellent references can be provided upon request by:

Dean Buonomano
Professor, Department of Neurobiology, UCLA
dbuono@ucla.edu
(310) 794-5009

Ed Golob
Professor, Department of Psychology, University of Texas at San Antonio
edward.golob@utsa.edu
(210) 458-8055

Bernice Porjesz
Professor, Psychiatry and Behavioral Sciences, SUNY Downstate Medical Center
Director, Henri Begleiter Neurodynamics Laboratory
bernice.porjesz@downstate.edu
(718) 270-2911