Thomas Donoghue, PhD

Postdoctoral Scholar
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Languages: English (native), French (proficient), Spanish (intermediate)

Areas of Specialization

Cognitive Neuroscience - Electrophysiology - Neural Oscillations - Data Science

Education

2014 - 2020 **PhD, Cognitive Science - Advisor: Prof. Bradley Voytek**
UC San Diego, La Jolla, California, USA
Thesis: Measuring and Investigating Periodic and Aperiodic Neural Activity

2011- 2014 **Bachelors of Arts and Sciences (BA&Sc) Honours Cognitive Science**
McGill University, Montreal, Quebec, Canada
Major: Cognitive Science. Minor: Philosophy. Graduated First Class Honours with Distinction.

Research Experience

3/2021 - **Postdoctoral Scholar - Advisor: Dr. Joshua Jacobs**
Columbia University, Department of Biomedical Engineering
Investigations of human electrophysiology, with intracranial recordings and single units.

10/2020 - 2/2021 **Postdoctoral Scholar - Advisor: Dr. Bradley Voytek**
UC San Diego, Department of Cognitive Science, Cognitive & Neural Dynamics Lab
Developing software tools for the analysis of electrophysiological recordings.

9/2014 - 9/2020 **Graduate Student Researcher - Advisor: Dr. Bradley Voytek**
UC San Diego, Department of Cognitive Science, Cognitive & Neural Dynamics Lab
Mechanisms of neural communication using human electrophysiological recordings.

5/2013 - 6/2014 **Research Assistant - Advisor: Dr. Sylvain Baillet**
Montreal Neurological Institute, Department of Neurology & Neurosurgery
Functional connectivity during sleep, using magnetoencephalography and polysomnography.

9/2012 - 9/2014 **Research Assistant - Advisor: Dr. Kris Onishi**
McGill University, Department of Psychology - McGill Infant Development Cluster (MIDC)
Psycholinguistics & Developmental Psychology: language perception & statistical learning.

Additional Training

2018 **Methods In Neuroscience at Dartmouth (MIND)**, *Dartmouth College*, Hanover, NH, USA
Short course.Topic: Narratives & Natural Contexts. Competitive application (~20% acceptance).

2017 **Neurohackweek,** *eScience Institute*, University of Washington, Seattle, WA, USA
Project-based course on neuro- & data science. Competitive application (~25% acceptance).

2016 **Advanced Scientific Programming in Python**, *G-Node & CINN*, Reading, England, UK
Short course on scientific programming. Competitive application (9.9% acceptance).

Preprints & Articles Currently Under Review

Underlined are research assistants under my direct supervision.

preprint He W, **Donoghue T**, Sowman PF, Seymour RA, Brock J, Crain S, Voytek B, & Hillebrand A. Co-Increasing Neuronal Noise and Beta Power in the Developing Brain. *eNeuro.* (*in revision*) Preprint: *biorxiv.* DOI: 10.1101/839258. LINK

Journal Articles (Peer Reviewed)

Underlined are research assistants under my direct supervision.

2020 **Donoghue T**, Voytek B, & Ellis S. Teaching Creative and Practical Data Science at Scale. *Journal of Statistics Education.* DOI: 10.1080/10691898.2020.1860725. LINK

2020 **Donoghue T**, Haller M, Peterson EJ, Varma P, Sebastian P, Gao R, Noto T, Lara AH, Wallis JD, Knight RT, Shestyuk A & Voytek B. Parameterizing Neural Power Spectra. *Nature Neuroscience.* DOI: 10.1038/s41593-020-00744-x. LINK

2020 **Donoghue T**, Dominguez J & Voytek B. Electrophysiological Band Ratio Measures Conflate Periodic and Aperiodic Activity. *eNeuro.* DOI: 10.1523/eneuro.0192-20.2020. LINK

2019 Robertson MM, Furlong S, Voytek B, **Donoghue T**, Boettiger CA, & Sheridan MA. EEG Power Spectral Slope Differs by ADHD Status and Stimulant Medication Exposure in Early Childhood. *Journal of Neurophysiology.* DOI: 10.1152/jn.00388.2019. LINK

2019 **Donoghue T**. LISC: A Python Package for Scientific Literature Collection and Analysis. *Journal of Open Source Software,* 4(41), 1674. DOI: 10.21105/joss.01674. LINK

2019 Cole S, **Donoghue T**, Gao R & Voytek B. NeuroDSP: A Package for Neural Digital Signal Processing. *Journal of Open Source Software,* 4(36), 1272. DOI: 10.21105/joss.01272. LINK

Conference Proceedings (Peer Reviewed Papers)

Underlined are research assistants under my direct supervision.

2019 **Donoghue T**, Gao R, Waschke L & Voytek B. A Simulation-Based Comparison of Methods for Analyzing Aperiodic Neural Activity. DOI: 10.32470/CCN.2019.1394-0. LINK
Conference on Cognitive Computational Neuroscience

2019 Gao R, Christiano D, **Donoghue T**, & Voytek B. The Structure of Cognition Across Computational Cognitive Neuroscience. DOI: 10.32470/CCN.2019.1426-0. LINK
Conference on Cognitive Computational Neuroscience

2019 Waschke L , **Donoghue T**, Smith S, Voytek B, & Obleser J. Aperiodic EEG Activity Tracks 1/f Stimulus Characteristics and the Allocation of Cognitive Resources.
DOI: 10.32470/CCN.2019.1111-0. LINK
Conference on Cognitive Computational Neuroscience

2018 Fox W, **Donoghue T**. Confidence Levels in Scientific Writing: Automated Mining of Primary Literature and Press Releases. LINK
Proceedings of the 40th Annual Conference of the Cognitive Science Society.

2017 Gao R, **Donoghue T** & Voytek B. Automated Generation of Cognitive Ontology via Web Text-Mining. LINK
Proceedings of the 39th Annual Conference of the Cognitive Science Society.

Conference Presentations

11/2018 **Parameterizing Neural Power Spectra** (NanoSymposium Presentation)
Society for Neuroscience Conference, San Diego, CA, USA.

1/2016 **The Effect of Oscillatory Phase on Perception and Cognition** (Research Talk)
Temporal Dynamics of Learning Centre - All Hands Meeting, San Diego, CA, USA.

Conference Workshops

3/2019 **New Methods for Analyzing Periodic Oscillations and Aperiodic 1/f in Electrophysiology**
Cognitive Neuroscience Society Conference, San Francisco, CA, USA.
Developed & lead an interactive workshop covering software tools for neural data analysis.

Research Presentations (invited)

11/2018 **Simulation-Driven Methods Development** (Seminar Talk)
Cognition at the Shore Talk Series, Dept. of Cognitive Science, UC San Diego

08/2018 **Fitting Oscillations & One-Over F and Other Things** (Invited Seminar)
Interaxon, Toronto, Canada

Conference Abstracts & Posters (Selected)

Underlined are research assistants under my direct supervision.

2020 **Donoghue T** & Voytek B. Considerations for Detecting & Measuring Neural Oscillations. LINK
LiveM/EEG (Cutting EEG), Online Conference.

2019 Farnan T, **Donoghue T**, & Voytek B. Evaluating Spectral Estimation Methods for Time-Resolved Measurement of Aperiodic Activity. LINK
Society for Neuroscience, Chicago, IL, USA.

2019 Zhang F, **Donoghue T**, & Voytek B. Comparing the Effects of Pre-Stimulus Periodic and Aperiodic Activity on Post-Stimulus Event Related Potentials. LINK
Society for Neuroscience, Chicago, IL, USA.

2019 Waschke L, **Donoghue T**, Smith S, Voytek B & Obleser J. Tracking of 1/f Stimulus Characteristics in the Human EEG.
Society for Neuroscience, Chicago, IL, USA.

2019 Dominguez J, **Donoghue T**, & Voytek B. Electrophysiological Frequency Band-Ratio Measures Conflate Changes in Periodic and Aperiodic Features. LINK
Cognitive Neuroscience Society, San Francisco, CA, USA.

2018 Mdanda L, **Donoghue T**, & Voytek B. Parameterization of Periodic and Aperiodic Human Electrophysiology Reveals Greater Between- Than Within-Subject Variability. LINK
Society for Neuroscience, San Diego, CA, USA.

2018 **Donoghue T**, Sebastian P, & Voytek B. Large-Scale Topographical Analysis of Oscillations and 1/f Background Reveals Patterns of Spatial Variation Within and Between Subjects. LINK
International Conference on Biomagnetism, Philadelphia, PA , USA.

2018 **Donoghue T**, Sebastian P, Noto T, Haxby S & Voytek B. Integrating Human Electrophysiology, Gene Expression and Functional Data. LINK
Neuroinformatics, Montreal, QC, Canada.

2018 Fox W, **Donoghue T**. Confidence Levels in Scientific Writing: Automated Mining of Primary Literature and Press Releases. LINK
Cognitive Science, Madison, WI, USA.

2018 **Donoghue T** & Voytek B. Alpha Power and 1/f Slope Provide Independent Decoding of Visual Spatial Attention. LINK
Cognitive Neuroscience Society, Boston, MA, USA.

2018 Gao R, **Donoghue T** & Voytek B. Defining Cognition: Automated Generation of Cognitive Ontology by Text-Mining Literature.
Cognitive Neuroscience Society, Boston, MA, USA.

2017 Waschke L, **Donoghue T,** Obleser J & Voytek B. Attention-Modulated Tracking of 1/f Stimulus Characteristics in Human EEG.
Signals & Noise in the Auditory Pathway, Lübeck, Germany.

2017 **Donoghue T** & Voytek B. Assessing approaches for estimating the electrophysiological 1/f background spectrum. LINK
Society for Neuroscience, Washington DC, USA.

2017 **Donoghue T** & Voytek B. Automated meta-analysis of event-related potentials and their correlates through text-mining. LINK
Cognitive Neuroscience Society, San Francisco, CA, USA.

2016 **Donoghue T**, Fox W, Kim A, & Voytek B. The relation of oscillatory-phase to visual perception is dependent on attention & location of stimuli. LINK
Society for Neuroscience, San Diego, CA.

2016 Sebastian P, **Donoghue T**, Noto T, Haxby S, & Voytek B. Data mining to generate novel hypotheses for the genetic underpinnings and functional roles of cortical oscillations. LINK
Society for Neuroscience, San Diego, CA, USA.

2016 **Donoghue T**, Sebastian P, & Voytek B. Automated Analysis of Resting State Cortical Oscillatory Characteristics using MEG. LINK
International Conference on Biomagnetism, Seoul, South Korea.

2015 Gougelet R, **Donoghue T,** Piper M, Althoff A, Urbach TP, & Voytek B. Influencing Visual Target Detection with Oscillatory Phase-Specific Stimulus Presentation. LINK
Society for Neuroscience, Chicago, IL, USA.

Honours & Awards

03/2017 **Graduate Student Award** - Cognitive Neuroscience Society Conference
$500 travel award with recognition of a graduate student award winning poster.

1/2016 **Small Grants Award, Temporal Dynamics of Learning Centre (TDLC)**
2 200$ Research Funding for an EEG project on the temporal dynamics of perceptual learning

3/2014 **Owens Scholar Award, Johns Hopkins University** (*declined*)
18 000$ USD additional funding over 3 years offered with admission to Johns Hopkins.

11/2013 **Samuel de Champlain Quebec Program for International Collaboration**
Funds provided by my research supervisor (Dr. Baillet) for travel to NeuroSpin in France.

Academic Activities: Reviewing

Journal Articles (Ad-Hoc Reviewer)
PLoS Computational Biology (1X); NeuroImage (1X); Behavior Research Methods (1X); Human Brain Mapping (*1X); Neurobiology of Aging (*1X); Journal of Neurophysiology (*1X); Journal of Open Source Software (#2X); Journal of Open Source Education (#1X); ReScience (#1X);
**Co-reviewed with a research supervisor. #Includes code review.*

Conference Proceedings
Affective Computing & Intelligent Interaction (ACII 2019: 1 paper); Cognitive Computational Neuroscience (CCN 2019: 6 papers);

Books
Columbia Press (1X);

Research Mentorship

Students under my direct mentorship. Awards are where I supervised the application and project.

Masters Student Research Assistants

Tyler Farnan	01/2019 - *current*	

Undergraduate Research Assistants

Fenglin (Allen) Zhang	01/2019 - *current*	
Julio Dominguez	06/2018 - 01/2020	TRELS Scholarship
Luyanda Mdanda	10/2016 - 01/2020	HDSI Undergrad Fellowship
Meyhaa Buvanesh	04/2019 - 06/2019	
Lakshmi Menon	04/2019 - 09/2019	
Fiona Cisternas	01/2019 - 06/2019	HDSI Undergrad Fellowship
Priyadarshini Sebastian	10/2015 - 06/2018	FISP Trainee Award
Aeri Kim	10/2015 - 12/2016	
Will Fox	06/2015 - 06/2018	

Computational Skills & Contributions

Languages — Fluent in **Python**, **shell** scripting (bash) & **git**, intermediate in **Matlab** and **R**.

Packages — **FOOOF**: Fitting Oscillations & One-Over-F (Github - PYPI - Documentation)
Lead Developer - Python package for parameterizing neural power spectra.

LISC: Literature Scanner (Github - PYPI - Documentation)
Lead Developer **-** Python package for collecting and analyzing the scientific literature.

NeuroDSP: Neuro Digital Signal Processing (Github - PYPI - Documentation)
Co-Developer - Python package for analyze neural electrophysiological recordings.

ByCycle: Cycle-by-cycle analysis of neural oscillations (Github - PYPI - Documentation)
Maintainer - A package for analyzing cycle properties of neural oscillations.

Github — Code & open-source contributions are all available on my Github profile.
A curated list of my code contributions and projects is available here.

Teaching Experience & Materials

2018 **Instructor-of-Record**, Department of Cognitive Science, UC San Diego
COGS 18: Introduction to Python (30 hours lecture + coding labs; 200 undergrad students)
Developed & taught a course teaching introductory Python programming. Materials: LINK

2017 - **Instructor (3X)**, Clubes de Ciencia Mexico
Clubes de Ciencia is a non-profit organization promoting science education across Mexico.
1 week, hands-on research focused courses (25 hours of instruction; 12-18 students / year)
- *Title TDB* (online, Aug. 2020)
- *Inteligencia Biologica & Artificial: Amigos o Enemigos?* (Ensenada, Mexico, Aug. 2019)
- *Bots on the Brain: Cognitive Science & Bio-Inspired Robotics* (Monterrey, Mexico, Aug. 2017)

2015 - 2017 **Instructor (3X)**, Academic Connections, UC San Diego
Academic Connections offers university-level courses to advanced high school students.
Co-developed & taught a course introducing cognitive science. Materials: LINK
Introduction to Cognitive Science (75 hours of instruction; 16-24 students / year)
Ratings: Course {4.71, 4.80, 4.59}/5; Instructor: {4.86, 4.92, 4.92}/5; Years: {2015, 2016, 2017}.

2015 - 2018 **Teaching Assistant (7X),** Department of Cognitive Science, UC San Diego
COGS 108: Data Science in Practice (Winter '18, Prof. Bradley Voytek, TA Evals: 4.31/5)
COGS 108: Data Science in Practice (Spring '17, Prof. Bradley Voytek, TA Evals: 4.32/5)
COGS 107B: Systems Neuroscience (Winter '17, Prof. Douglas Nitz, TA Evals: 4.60/5)
COGS 17: Neurobiology of Cognition (Winter '16, Dr. Christine Johnson, TA Evals: 4.58/5)
COGS 9: Introduction to Data Science (Fall '15, Prof. Bradley Voytek, TA Evals: 4.34/5)
COGS 3: Introduction to Computing (Spring '15, Prof. Bradley Voytek, TA Evals: 4.54/5)
Awarded *Excellence in Teaching* Award from the UCSD Cognitive Science Dept.
COGS 107B: Systems Neuroscience (Winter '15: Prof. Douglas Nitz, TA Evals: 4.69/5)
Awarded *Outstanding Teaching* Award from the UCSD Cognitive Science Dept.

Training in Teaching, Teaching & Learning Commons, UC San Diego
2018 *Introduction to College Teaching:* course on evidence-based teaching (1 semester)
2017 *Equity, Diversity, & Inclusion in Postsecondary Education:* course on inclusive teaching (10 hrs)

Additional Teaching Materials
Data Science in Practice: open materials for learning data science. LINK
Python Boot Camp: open materials for a graduate student bootcamp. LINK
Electrophysiology Tutorials: Materials for getting started with M/EEG analyses. LINK

Science Outreach

2020 - **Mentoring & Assistance with Grad School Applications**
Organizations include: Cientifico Latino

2018 - **Public Workshops & Presentations**
Data Wrangling & Web Scraping: 2 hr interactive workshop with SCALE-SD (Oct. 2018). *LINK*

2013 - **Volunteer Tutoring & School Presenter**
Tutoring, presentations, science fair judging, and miscellaneous volunteering.
Organizations include: Brain Awareness, San Diego Science Fair, San Diego Refugee Tutoring

1/2014 - 1/2017 **Science Writer / Editor / Podcast Host, Useful Science Organization** (usefulscience.org)
Writing clear, concise and useful summaries of scientific research for a general audience.