

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) Honors Cognitive Science**
McGill University, Montreal, Quebec, Canada
Major: Cognitive Science. Minor: Philosophy. Graduated First Class Honors with Distinction.

Research Experience

- 3/2021 - **Postdoctoral Research Scientist - Advisor: Dr. Joshua Jacobs**
present Columbia University, Department of Biomedical Engineering
Investigations of human electrophysiology, with intracranial recordings and single units.
- 10/2020 - **Postdoctoral Scholar - Advisor: Dr. Bradley Voytek**
2/2021 UC San Diego, Department of Cognitive Science, Cognitive & Neural Dynamics Lab
Developing software tools for the analysis of electrophysiological recordings.
- 9/2014 - **Graduate Student Researcher - Advisor: Dr. Bradley Voytek**
9/2020 UC San Diego, Department of Cognitive Science, Cognitive & Neural Dynamics Lab
Mechanisms of neural communication using human electrophysiological recordings.
- 5/2013 - **Research Assistant - Advisor: Dr. Sylvain Baillet**
6/2014 Montreal Neurological Institute, Department of Neurology & Neurosurgery
Functional connectivity during sleep, using magnetoencephalography and polysomnography.
- 9/2012 - **Research Assistant - Advisor: Dr. Kris Onishi**
9/2014 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 Ostlund BD, **Donoghue T**, Anaya B, Gunther KE, Karalunas SL, Voytek B, Pérez-Edgar KE. Spectral parameterization for studying neurodevelopment: How and why. *PsyArXiv*. DOI: 10.31234/osf.io/btqyk. [LINK](#)
- preprint Waschke L, **Donoghue T**, Fiedler L, Smith S, Garrett DD, Voytek B & Oblesser J. Modality-specific tracking of attention and sensory statistics in the human electrophysiological spectral exponent. Preprint: *bioRxiv*. DOI: 10.1101/2021.01.13.426522. [LINK](#)
- 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. *bioRxiv*. DOI: 10.1101/839258. [LINK](#)

Journal Articles (Peer Reviewed)

Underlined are research assistants under my direct supervision.

- 2021 **Donoghue T**, Schaworonkow N & Voytek B. Methodological Considerations for Studying Neural Oscillations. *European Journal of Neuroscience*. DOI: 10.1111/ejn.15361. [LINK](#)
- 2021 **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, Shestyk A & Voytek B. Parameterizing Neural Power Spectra into Periodic and Aperiodic Components. *Nature Neuroscience*, 23. 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*, 7(6). 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*, 122(6). 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 - Selected)

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
- 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.

Honors & 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); PLoS Biology (1X); NeuroImage (1X); Biological Psychology (1X); Behavior Research Methods (1X); Human Brain Mapping (*1X); Neurobiology of Aging (*1X); Journal of Neurophysiology (*1X); Developmental Cognitive Neuroscience (1X); Journal of Open Source Software (#2X); Journal of Open Source Education (#2X); 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 - 03/2021	
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Undergraduate Research Assistants

Fenglin (Allen) Zhang	01/2019 - 03/2021	
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 **SpecParam**: Spectral Parameterization ([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 available on my [Github profile](#) and indexed [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
2020 [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)
- CdeCMx Challenge: *Soluciones científicas a problemas emergentes* (online, Aug. 2020)
- *Inteligencia Biológica & Artificial: Amigos o Enemigos?* (Ensenada, Mexico, Aug. 2019)
- *Bots on the Brain: Cognitive Science & Bio-Inspired Robotics* (Monterrey, Mexico, Aug. 2017)
- 2015 - **Instructor (3X)**, Academic Connections, UC San Diego
2017 [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 - **Teaching Assistant (7X)**, Department of Cognitive Science, UC San Diego
2018 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 - **Science Writer / Editor / Podcast Host, Useful Science Organization** ([usefulscience.org](#))
1/2017 Writing clear, concise and useful summaries of scientific research for a general audience.