Thomas Donoghue

PhD Candidate
Department of Cognitive Science
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Languages: English (native), French (proficient), Spanish (intermediate)

Areas of Specialization

Cognitive Neuroscience - Electrophysiology - Neural Oscillations - Data Science

Education

2014 - **PhD, Cognitive Science**
UC San Diego, La Jolla, California, USA
Topic: Periodic & Aperiodic Activity in Neuro-Electrophysiological Data
Advisor: Dr. Bradley Voytek

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

2008 - 2011 **Diplome D'Etudes Collegial (DEC) Double Diploma in Science & Social Science**
John Abbott College, Sainte Anne de Bellevue, Quebec, Canada
In Quebec, a DEC is a necessary intermediary degree between high school & university

Research Experience

9/2014 - **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.

3/2015 - 6/2015 **Graduate Rotation Student - Advisor: Dr. Virginia De Sa**
UC San Diego, Department of Cognitive Science, Natural Computation Lab
Brain-computer interfaces (BCIs) to investigate the role of neural oscillations in cognition.

11/2013 **Visiting Scholar - Advisor: Dr. Ghislaine Dehaene-Lambertz**
Neurospin, INSERM-CEA Cognitive Neuroimaging Unit, Neurospin, Saclay, France
Connectivity analysis in infant electrophysiology investigating language and cognition.

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.

Research Articles: Peer Reviewed Journal Articles

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

Research Articles: Preprints

** denotes equal contribution. Underlined are research assistants under my direct supervision.*

2020 **Donoghue T**, Dominguez J & Voytek B. Electrophysiological Band-Ratio Measures Conflate Changes in Periodic and Aperiodic Activity. *bioRxiv.* DOI: 10.1101/2020.01.11.900977. LINK

2019 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

2018 Haller M*, **Donoghue T***, Peterson EJ*, Varma P, Sebastian P, Gao R, Noto T, Knight RT, Shestyuk A & Voytek B. Parameterizing Neural Power Spectra. *bioRxiv.* DOI: 10.1101/299859. LINK

Software Related Papers (Peer Reviewed)

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 & 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 Talks

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

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

Conference Workshops

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

Invited Research Talks

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.

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,** Oblesser J & Voytek B. Attention-Modulated Tracking of 1/f Stimulus Characteristics in Human EEG.
Signals & Noise in the Auditory Pathway, Lubeck, 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.

Research Grants & Fellowships

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

Honours & Awards

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

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)
NeuroImage (1X); Neurobiology of Aging (*1X); Journal of Neurophysiology (*1X); Human Brain Mapping (*1X);
**Co-reviewed with a research supervisor*

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

Books
Columbia Press (1X);

Academic Memberships

2018 - Cognitive Science Society
2016 - Cognitive Neuroscience Society
2014 - Society for Neuroscience

Research Mentorship

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

Masters Student Research Assistants

Tyler Farnan	01/2019 - *current*	

Undergraduate Research Assistants

Meyhaa Buvanesh	04/2019 - *current*	
Fenglin (Allen) Zhang	01/2019 - *current*	
Julio Dominguez	06/2018 - *current*	TRELS Scholarship
Luyanda Mdanda	10/2016 - *current*	HDSI Undergrad Fellowship
Lakshmi Menon	04/2019 - 09/2019	
Fiona Cisternas	01/2019 - 06/2019	HDSI Undergrad Fellowship
Tianyu Zhang	03/2018 - 12/2018	
Priyadarshini Sebastian	10/2015 - 06/2018	FISP Trainee Award
Aeri Kim	10/2015 - 12/2016	
Will Fox	06/2015 - 06/2018	

Teaching Experience

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

2017 - 2019 **Instructor**, Clubes de Ciencia Mexico
Clubes de Ciencia is a non-profit organization promoting science education across Mexico.
Developed & taught 1-week (25 hours of instruction), hands-on research focused courses.
Course Title: Inteligencia Biologica & Artificial: Amigos o Enemigos?
18 students, Ensenada, Mexico, August 2019 (course taught in English & Spanish)
Course Title: Bots on the Brain: Cognitive Science & Bio-Inspired Robotics
12 students, Monterrey, Mexico, August 2017 (course taught in English)

2015 - 2017 **Instructor**, Academic Connections, UC San Diego
Title: Introduction to Cognitive Science (75 hours of instruction; 16-24 students / year)
With co-instructor Eric Leonardis, we designed and implemented a course, teaching three iterations offering University credit classes to high-achieving high school students.
Summer 2017: Student Ratings - Course: 4.71/5, Instructor: 4.86/5
Summer 2016: Student Ratings - Course: 4.80/5, Instructor: 4.92/5
Summer 2015: Student Ratings - Course: 4.59/5, Instructor: 4.92/5

2015 - 2018 **Teaching Assistant,** Department of Cognitive Science, UC San Diego
COGS 108: Data Science in Practice (Winter '18, Prof. Bradley Voytek, TA Evals: 4.31/5.00)
COGS 108: Data Science in Practice (Spring '17, Prof. Bradley Voytek, TA Evals: 4.32/5.00)
COGS 107B: Systems Neuroscience (Winter '17, Prof. Douglas Nitz, TA Evals: 4.60/5.00)
COGS 17: Neurobiology of Cognition (Winter '16, Dr. Christine Johnson, TA Evals: 4.58/5.00)
COGS 9: Introduction to Data Science (Fall '15, Prof. Bradley Voytek, TA Evals: 4.34/5.00)
COGS 3: Introduction to Computing (Spring '15, Prof. Bradley Voytek, TA Evals: 4.54/5.00)
Awarded *Excellence in Teaching* Award from the UCSD Cognitive Science Dept.
COGS 107B: Systems Neuroscience (Winter '15: Prof. Douglas Nitz, TA Evals: 4.69/5.00)
Awarded *Outstanding Teaching* Award from the UCSD Cognitive Science Dept.

Teaching Materials & Course Design

The following are links to teaching materials that I created and/or supervised and worked on.

Introduction to Python (COGS18), Department of Cognitive Science, UC San Diego
Tutorials & Assignments for teaching Python. LINK

Data Science in Practice (COGS108), Department of Cognitive Science, UC San Diego
Tutorials & Assignments for teaching data science. LINK

VoytekLab Tutorials, Voytek Lab, UC San Diego
Materials for getting started with the Voytek lab. LINK

Python Boot Camp, Department of Cognitive Science, UC San Diego
Materials for grad student bootcamp. LINK

Introduction to Cognitive Science, Academic Connections, UC San Diego
Class materials, assignments & experiments. LINK

Computational Skills & Contributions

Languages — Fluent in **Python**, **shell** scripting (bash) & **git**, intermediate in **Matlab** and **R**.
I also have experience with **Javascript** (including D3), **Java**, **HTML** and **CSS.**

Packages — **Lead Developer**, FOOOF - Fitting Oscillations & One-Over-F
A package for parameterizing neural power spectra, measuring periodic & aperiodic signals.
Github - PYPI - Documentation Site

Lead Developer, LISC - Literature Scanner
A package for scraping and analyzing the scientific literature.
Github - PYPI - Documentation Site

Co-Developer, NeuroDSP - Neuro Digital Signal Processing
A collection of modules & utilities to analyze neural electrophysiological recordings.
Github - PYPI - Documentation Site

Open Source — I contribute to open-source package development, including contributions to:

JupyterBook	Feature extensions: added download buttons
pandas	Documentation updates
matplotlib	Documentation updates
MNE	Documentation updates

Github — All code contributions are available on Github.

Review — Software and paper reviewer for the Journal of Open Source Software (1X).

Software Workshops

10/2018 — **Data Wrangling & Web Scraping**, Downtown Works, San Diego, CA
Created & presented a 2 hour interactive workshop, in partnership with SCALE-SD. LINK

2013 - 2015 — **Brainstorm Software for M/EEG Analyses**
Assisted with interactive workshops for the *Brainstorm* Matlab toolbox.

Science Outreach

3/2017 - *current* — **San Diego Country Science Fair Judge**
Work as a judge on the annual San Diego county science fair (middle & high school students)

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

10/2016 - 6/2018 — **Volunteer Tutor, San Diego Refugee Tutoring**, San Diego, CA, USA
Tutoring children from families with refugee status with their schoolwork

1/2015 - 6/2016 — **School Presenter, UCSD**, San Diego, CA, USA
Giving presentations to local schools (all levels) on topics in neuroscience

9/2014 - 6/2016 — **Penpal, Mary Fey Pendleton School**, Oceanside, CA, USA
Penpal with grade 7-8 students, as a mentor and to foster an interest in science as a career

2/2013 - 2/2014 — **High School Presenter, Brain Awareness Organization**, Montreal, QC, Canada
Gave presentations on how the brain works and the neural effects of drugs

Additional Training: Neuroscience & Technical Skills

2018 **MIND Summer School - Methods In Neuroscience at Dartmouth**
Dartmouth College, Hanover, NH, USA
Short course on methods in neuroscience. Competitive application (~20% acceptance).
Topic: Narratives and Natural Contexts.

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

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

Additional Training: Teaching

2018 **Introduction to College Teaching**
UC San Diego, Teaching & Learning Commons,
Participated in a semester long class on evidence-based teaching.

2017 **Equity, Diversity and Inclusion in Postsecondary Education**
UC San Diego, UCSD Extension
Participated in a week-long course on topics and strategies regarding inclusive teaching.