Jessica Thompson

Postdoctoral Researcher in Computational Cognitive Neuroscience

Contact

jessica.thompson@psy.ox.ac.uk
http://thompsonj.github.io
+44 7908 922380

Research Interests

Abstraction, generalization, relational reasoning, compositionality, theoretical and computational neuroscience, understanding deep learning, philosophy of science, cognitive science, collective intelligence

Core Competencies

Problem formulation, critical thinking, multi-disciplinary synthesis, open-mindedness

Computer Skills

Proficient with Python, MATLAB, Java, shell scripting, LaTeX

Links

G Scholar: TJweLP0AAAAJ
Github: thompsonj
LinkedIn: jessica-af-thompson

Languages

English (native) and French (professional fluency)

Education

PhD Cognitive Science and Neuropsychology — Université de Montréal **2013–2020**
Supervised by Marc Schönwiesner and Yoshua Bengio

MA Digital Musics — Dartmouth College **2011–2013**
Supervised by Michael Casey

BA Psychology (Hons.), Computer Science, Music Technology — McGill University **2006–2011**
Supervised by Stephen McAdams, Evan Balaban and Robert Zatorre

Research Experience

Human Information Processing Lab, University of Oxford — Oxford, United Kingdom **March 2021–Now**
Postdoctoral Researcher
Develop and probe neuroscience-inspired neural network models of learning and reasoning

Self Organizers, Extinction Rebellion — International **Sep 2023-Now**
Researcher
Advance basic understanding of self organizing systems to guide climate activist groups around the world

Quebec Artificial Intelligence Institute (Mila) — Montréal, Canada **2014–2020**
PhD Researcher
Explored methods to compare deep networks to measurements of human neural activity

International Laboratory for Research on Brain, Music & Sound — Montréal, Canada **2013–2020**
PhD Researcher
Designed and conducted study on the representation of spectro-temporal modulations using machine learning-based analysis of 7T fMRI responses to dynamic ripples

Nuance Communications Canada Inc. — Montréal, Canada **2015–2018**
Mitacs PhD Fellow
Analyzed the transferability of intermediate features across languages in convolutional neural network-based acoustic models in automatic speech recognition systems

Department of Cognitive Neuroscience, Maastricht University — Maastricht, The Netherlands **2015–2016**
Visiting Researcher
Designed and conducted 7T fMRI study to model responses to native and non-native speech quilts with convolutional neural networks trained on natural speech

Bregman Media Labs, Dartmouth College — Hanover, USA **2011–2013**
Graduate Researcher
Conducted fMRI and EEG experiments about neural decoding of various acoustic and semantic music features

Distributed Digital Music Archives and Libraries Lab, McGill University — Montréal, Canada **2008–2011**
Programmer
Developed software in Java and Python for machine learning and information retrieval services with application to music research

Auditory Cognitive Neuroscience Lab, Montreal Neurological Institute — Montréal, Canada **2010–2011**
Student Researcher
Assessed the effect of circularity (non-independence) in whole brain fMRI region-of-interest (ROI) analysis

MEG Lab, Rotman Research Institute — Toronto, Canada **2010**
Student Researcher
Conducted MEG and behavioural experiments on binaural auditory beating

Music Perception and Cognition Lab, McGill University — Montréal, Canada **2008–2009**
Data Analyst
Employed continuous data analysis techniques to analyse psychophsyiological signals

Publications

Journal articles

Zero-shot numerical reasoning in dual stream neural networks and the primate visual system
Jessica Thompson, *Hannah Sheahan, Tsvetomira Dumbalska, Julian Sandbrink, Manuela Piazza, and Christopher Summerfield*
(In Preparation)

Thinking beyond the ventral stream
Summerfield, Christopher and **Jessica Thompson**
Behavioral and Brain Sciences (Accepted)

Forms of explanation and understanding in neuroscience and artificial intelligence
Jessica Thompson
Journal of Neurophysiology 126 (2021) pp. 1860–1874

Noise increases the correspondence between artificial and human vision
Jessica Thompson
PLoS Biology 19 (13 2021) pp. 4–7

Training neural networks to recognize speech increased their correspondence to the human auditory pathway but did not yield a shared hierarchy of acoustic features
Jessica Thompson, *Federico De Martino, Yoshua Bengio, Elia Formisano, and Marc Schönwiesner*
bioRxiv preprint (2021)

Human cortical responses to slow and fast binaural beats reveal multiple mechanisms of binaural hearing
Ross, Bernhard, Takahiro Miyazaki, **Jessica Thompson**, *Shahab Jamali, and Takako Fujioka*
Journal of Neurophysiology 112.8 (Oct. 2014) pp. 1871–1884

Sound envelope encoding in the auditory cortex revealed by neuromagnetic responses in the theta to gamma frequency bands
Miyazaki, Takahiro, **Jessica Thompson**, *Takako Fujioka, and Bernhard Ross*
Brain Research 1506 (2013) pp. 64–75

Conference and workshop proceedings

Humans and Neural Networks Show Similar Patterns of Transfer and Interference in a Continual Learning Task
Holton, Eleanor, Lukas Braun, **Jessica Thompson**, *and Christopher Summerfield*
Cognitive Computational Neuroscience Conference (2023)

Learning to count visual objects by combining “what” and “where” in recurrent memory
Jessica Thompson, *Hannah Sheahan, and Christopher Summerfield*
Proceedings of the 1st Gaze Meets ML workshop, PMLR. Vol. 210 (2023) pp. 199–218

Zero-Shot Visual Numerical Reasoning with Dual-Stream Neural Networks
Jessica Thompson, *Hannah Sheahan, and Christopher Summerfield*
Cognitive Computational Neuroscience Conference (2023)

The effect of task and training on intermediate representations in convolutional neural networks revealed with modified RV similarity analysis
Jessica Thompson, *Marc Schönwiesner, and Yoshua Bengio*
Cognitive Computational Neuroscience (CCN) Conference (2019)

How transferable are features in convolutional neural network acoustic models across languages?
Jessica Thompson, *Marc Schönwiesner, Yoshua Bengio, and Daniel Willett*
Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) (2019) pp. 2827–2831

Towards a common philosophy of explanation for artificial and biological intelligence
Jessica Thompson
Cognitive Computational Neuroscience (CCN) Conference (2018)

Conference ticket allocation via non-uniform random selection to address systemic biases
Jessica Thompson, *Laurent Dinh, Nicolas Le Roux, and Layla El Asri*
Neural Information Processing Systems (NeurIPS) workshop on Correcting and Critiquing Trends in Machine Learning (2018)

How can deep learning advance computational modeling of sensory information processing?

Jessica Thompson, *Yoshua Bengio, Elia Formisano, and Marc Schönwiesner*
Neural Information Processing Systems workshop on Representation Learning in Artificial and Biological Neural Networks (MLINI) (2016)

Audio stimulus reconstruction using multi-source semantic embedding
Jessica Thompson, *Michael Casey, and Lorenzo Torresani*
Neural Information Processing Systems workshop on Machine Learning and Interpretation in Neuroimaging (MLINI) (Dec. 2013)

Digital document image retrieval using optical music recognition
Hankinson, Andrew, John Ashley Burgoyne, Gabriel Vigliensoni, Alastair Porter, **Jessica Thompson**, *Wendy Liu, Remi Chiu, and Ichiro Fujinaga*
Proceedings of the 13th Intl. Society for Music Information Retrieval Conference (ISMIR) (Oct. 2012) pp. 577–582

Musical neurosemantic decoding using online weighted approximate-rank pairwise loss optimization in a joint semantic space
Jessica Thompson, *Michael Casey, and Lorenzo Torresani*
Neural Information Processing Systems workshop on Machine Learning and Interpretation in Neuroimaging (MLINI) (Dec. 2012). Lake Tahoe, USA

Music imagery information retrieval: Bringing the song on your mind back to your ears
Stober, Sebastian and **Jessica Thompson**
Proceedings of the 13th International Conference on Music Information Retrieval (ISMIR) (Oct. 2012)

Population codes representing musical timbre for high-level fMRI categorization of music genres
Casey, Michael, **Jessica Thompson**, *Olivia Kang, and Thalia Wheatley*
Neural Information Processing Systems workshop on Machine Learning and Interpretation in NeuroImaging (MLINI) (Dec. 2011)

Additions and improvements to the ACE 2.0 music classifier
Jessica Thompson, *Cory McKay, John Ashley Burgoyne, and Ichiro Fujinaga*
Proceedings of the 10th International Conference on Music Information Retrieval (ISMIR) (Oct. 2009) pp. 435–440

Using the ACE XML 2.0 file formats to store and share music classification data
McKay, Cory, John Ashley Burgoyne, **Jessica Thompson**, *and Ichiro Fujinaga*
Proceedings of the 10th International Conference on Music Information Retrieval (ISMIR) (Oct. 2009) pp. 303–308

Selected Conference Abstracts and Presentations

Making Sense of Probabilistic Representation
Lippl, Samuel, **Jessica Thompson**, *Raphael Gerraty, and Gerardo Viera*
Society for Philosophy and Psychology, 2022, Milan, Italy

Encoding of dynamic ripple mixtures in human auditory cortex using 7T fMRI
Jessica Thompson, *Federico De Martino, Marc Schönwiesner, and Elia Formisano*
Annual Meeting of the Organization for Human Brain Mapping (OHBM), 2016, Geneva, Switzerland

Reconstructing musical audio features from continuous single-trial EEG
Jessica Thompson *and Michael Casey*
Annual Meeting of the Organization for Human Brain Mapping (OHBM), 2014, Hamburg, Germany

Experience, perception, and physicality in experimental music: An argument for the role of neuroscience in music phenomenology
Jessica Thompson
Cognitio - Creative Minds: Cognitive Sources of Art and Discovery, 2013, Montreal, Canada

Reconstructing musical audio features from continuous single-trial EEG
Jessica Thompson
Cognitively-Based Music Information Retrieval (CogMIR) workshop, 2013, Toronto, Canada

Music information retrieval from neurological signals: Towards neural population codes for music
Jessica Thompson *and Michael Casey*
Conference of the Society for Music Perception and Cognition (SMPC), 2013, Toronto, Canada

Predicting crowdsourced musical tags from brain activity
Jessica Thompson, *Michael Casey, and Lorenzo Torresani*
Cognitively Based Music Information Retrieval (CogMIR), 2012, Toronto, Canada

Searching the Liber Usualis: Using CouchDB and ElasticSearch to Query Graphical Music Documents
Jessica Thompson, *Andrew Hankinson, and Ichiro Fujinaga*
Proceedings of the 12th International Conference on Music Information Retrieval (ISMIR), 2011, Miami, USA

Left and right auditory cortices contribute differently to perception of slow and fast binaural beats
Miyazaki, Takahiro, **Jessica Thompson**, *and Bernhard Ross*
Annual Meeting of the Cognitive Neuroscience Society (CNS), 2011, San Francisco, USA

Transition from Transient to Steady-State Gamma-Band Responses: An MEG Study on Acoustic Beats
Miyazaki, Takahiro, **Jessica Thompson***, and Bernhard Ross*
Annual Meeting of the Organization for Human Brain Mapping (OHBM), 2011, Québec, Canada

Teaching and Mentorship

Masters project supervisor Oxford, United Kingdom **Trinity 2023**
Department of Experimental Psychology, University of Oxford
Supervise human eyetracking and behavioural experiment and neural network simulations

Undergraduate project supervisor Oxford, United Kingdom **Hilary 2023**
Department of Experimental Psychology, University of Oxford
Supervise human eyetracking and behavioural experiment

Tutor Oxford, United Kingdom **Michaelmas 2021**
How To Build A Brain From Scratch (Department of Experimental Psychology, University of Oxford)
Lead tutorial discussion and provide feedback on essays.

Teaching Assistant Montréal, Canada **Winter 2020**
IFT 6135 - Representation Learning (Department of Computer Science, University of Montreal)
Prepare and grade practical and theoretical assignments for graduate level course on deep learning.

Mentor Online **2019-2020**
UNIQUE Student Symposium 2019 and Women in Machine Learning Workshop 2020
Led mentorship roundtables on surviving graduate school

Methods Workshop Organizer Montréal, Canada **Jun 2017**
Centre for Research on Brain, Language and Music
Designed and gave workshop on machine learning in python for psychologists and neuroscientists

Tutor/Supervisor Maastricht, The Netherlands **Spring 2015**
PSY2027: Research: How to do it? (Faculty of Psychology and Neuroscience, Maastricht University)
Supervised a group of 2nd year undergraduate students while they carried out all aspects of a research project about auditory perception

Invited Talks and Guest Lectures

Tools and metrics are means, not ends Oxford, UK **2023**
Generative Adversarial Collaboration at the Cognitive Computational Neuroscience Conference

Explanation and understanding at the intersection of neuroscience and artificial intelligence Glasgow, Scotland **2023**
Philosophy, psychology and neuroscience seminars, University of Glasgow

Learning to count by learning to map: How spatial maps grounded in action support relational judgements Lisbon, Portugal **2022**
Computational and Systems Neuroscience (COSYNE) workshop on The neural codes of abstraction and the link to behavioral generalization

Forms of understanding and explanation for neuroscience and artificial intelligence Amsterdam, Netherlands **Nov 2021, 2022**
VU University of Amsterdam Honours Programme course concerning scientific theories

Comparing activations in artificial and biological neural networks Montevideo, Uruguay **Jul 2021**
IBRO-LARC Neuroscience and AI for all Virtual Associate School

Comparing activations in artificial and biological neural networks Montréal, Canada **Nov 2019, Dec 2020**
Montreal Artificial Intelligence and Neuroscience (MAIN) Conference

Theoretical motivations of deep learning as it relates to artificial intelligence and the brain Montréal, Canada **2016**
Breakout talk at the Canadian University Software Engineering Conference (CUSEC)

Funding & Awards

Postdoctoral Fellowship — Canada Natural Sciences and Engineering Research Council (NSERC) **beginning Dec 2023**
National competition ($45,000 CAD/yr for two years)

Junior Research Fellowship — Somerville College, Oxford **beginning Dec 2023**
Institutional competition

SSNAP Fellowship + Sub-award — Summer Seminars in Neuroscience and Philosophy (SSNAP) **2021-2022**
Co-PI with two other SSNAP fellows ($30,000 USD)

Best Poster Award — Montreal Artificial Intelligence and Neuroscience Conference **2019**
Local conference ($400)

Mitacs Accelerate PhD Fellowship — Université de Montréaland Nuance Communications Inc. **2015–2018**
National competition ($30,000/yr for three years)

Best Poster Award — Montreal Artificial Intelligence and Neuroscience Conference **2017**
Local conference ($400)

Fonds de recherche du Québec - Nature et technologies (FRQNT) Doctoral scholarship — Université de Montréal **2015–2016**
Provincial competition ($26,666)

Erasmus Mundus Mobility Fellowship in Auditory Cognitive Neuroscience — Maastricht University **2015**
International competition (€17,000)

Natural Sciences and Engineering Research Council (NSERC) CREATE Graduate Fellowship in Auditory Cognitive Neuroscience — Université de Montréal **2014–2015**
National competition ($21,000)

Dartmouth Fellowship — Dartmouth College **2011–2013**
Full tuition scholarship ($55,000/yr) and stipend ($20,000/yr) for two years

NSERC-CREATE Undergraduate Student Research Award in Auditory Cognitive Neuroscience — Rotman Research Institute **2010**
National competition ($4,600)

NSERC-CREATE Undergraduate Student Research Award in Auditory Cognitive Neuroscience — McGill University **2009**
National competition ($4,600)

Media & Outreach

Science from an Indigenous worldview — Science for the People Magazine **forthcoming**
Book review

Explanation and understanding in neuroscience and AI — Journal of Neurophysiology podcast series **May 2022**
Podcast interview

The Deep Sociality of Science: Understanding Science as a Cooperative Process — Science for the People Magazine **Jan 2022**
Book review

Neuro-AI Explanation — Brain Inpsired **Jul 2021**
Podcast Interview

Equity, Diversity, and Inclusion

Secretary, Chair of the Records Committee **2015–2020**
Board of Directors, Women in Machine Learning Inc.
Led long-term organizational planning • Maintained all private records, the public WiML directory, all internal and outward-facing communication, websites and social media accounts • Trained and coordinated volunteers

Diversity and Inclusion Chair — Montréal, Canada **2018**
Montreal Artificial Intelligence Symposium (MAIS)
Assisted the organizers to achieve their diversity and inclusion goals • Designed demographics questionnaire • Enforced and responded to violations of the code of conduct

Logistics Chair — Montréal, Canada **2014**
Women in Machine Learning Workshop
Made local arrangements and participated in all aspects of event planning and fund raising

Professional Service and Other Experience

Member of the Early Career Researcher Committee Oxford, UK **2023-Now**
Department of Experimental Psychology, University of Oxford
Represent ECRs in my department. Organize social events.

Membership & Recruitment Officer, Member of the Executive Committee Oxford, UK **2023-Now**
University and College Union - University of Oxford Branch
Lead efforts to build the capacity of the branch. Coordinate membership support and training.

Departmental Representative for Experimental Psychology Oxford, UK **2023-Now**
University and College Union - University of Oxford Branch
Act as a point of contact for UCU members in the Department of Experimental Psychology.

Symposium Organizer Online **2021**
Virtual Symposium on Explanation in Neuroscience and Artificial Intelligence
Organized one-day symposium to facilitate discussion among philosophers of science, neuroscientists and AI researchers. Also gave an introductory lecture and was a panelist during discussion panel.

Student Affairs Committee Member and Liaison to EDI Committee Montreal, Canada **2019-2020**
Unifying Neuroscience and Artificial Intelligence in Quebec (UNIQUE) research cluster
Represented student interests to the governance of UNIQUE and oversaw the organization of an annual student symposium

Workshop organizer Vancouver, Canada **2019**
NeurIPS workshop 'Real Neurons and Hidden Units: Future Directors at the Intersection of Artificial Intelligence and Neuroscience'
Orchestrated the open submission and review system and participated in all aspects of event organization

Reviewer **2014-Now**
Conferences: Computational and Systems Neuroscience, International Conference on Learning Representations, Neural Information Processing Systems (rated in top 30% [2018] and top 10% [2020] of reviewers), Cognitive Computational Neuroscience, Women in Machine Learning.
Journals: Journal of Personality and Social Psychology, PLoS Biology, Current Biology, Hearing Research

Symposium organizer Hanover, USA **2013**
Dartmouth Arts and Music in Medicine and Neuroscience mini symposium
Made logistical arrangements, processed event registrations, advertised event

Hackathon organizer Montréal, Canada **2012**
Musitk
Secured sponsorship, processed reimbursements, oversaw logistics

SIG meeting organizer Hanover, USA **2012**
North East Music Informatics Special Interest Group (NEMISIG) meeting
Arranged catering, selected speakers, facilitated discussion sessions

Administrative Assistant Montréal, Canada **2010–2011**
Distributed Digital Music Archives and Libraries Lab, McGill University
Assisted with preparing large-scale grant applications

References

Professor Christopher Summerfield **christopher.summerfield@psy.ox.ac.uk**
University of Oxford, Google Deepmind
Postdoctoral supervisor

Professor Marc Schönwiesner **marcs@uni-leipzig.de**
University of Leipzig, University of Montreal
Doctoral supervisor

Professor Yoshua Bengio **yoshua.bengio@mila.quebec**
University of Montreal, Quebec AI Institute (Mila)
Doctoral co-supervisor