

Jessica Thompson

Postdoctoral Researcher in Computational Cognitive Neuroscience

Contact

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Research Interests

Theoretical and computational neuroscience, understanding deep learning, philosophy of science, cognitive science

Core Competencies

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

Computer Skills

Proficient with Python, MATLAB, Java, shell scripting, L^AT_EX

Links

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

Languages

English and French

Education

PhD Cognitive Science and Neuropsychology
Supervised by Marc Schönwiesner and Yoshua Bengio

Université de Montréal **2013–2020**

MA Digital Musics
Supervised by Michael Casey

Dartmouth College **2011–2013**

BA Psychology (Hons.), Computer Science, Music Technology
Supervised by Stephen McAdams, Evan Balaban and Robert Zatorre

McGill University **2006–2011**

Research Experience

Human Information Processing Lab, University of Oxford
Postdoctoral Researcher

Oxford, United Kingdom **March 2021–Now**

Develop machine learning models of human cognition

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 psychophysiological signals

Publications

Journal articles

Encoding of dynamic ripple mixtures in human auditory cortex

Jessica Thompson, Federico De Martino, Elia Formisano, and Marc Schönwiesner

(In Preparation)

Forms of explanation and understanding in neuroscience and artificial intelligence,

Jessica Thompson

Under review at Journal of Neurophysiology, preprint available on PsyArXiv (2021)

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

Under Review at Neuroimage Reports, preprint on bioRxiv (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 papers

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, Berlin, Germany

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, Brighton, UK

Towards a common philosophy of explanation for artificial and biological intelligence

Jessica Thompson

Cognitive Computational Neuroscience (CCN) Conference, 2018, Philadelphia, USA

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), 2013, Lake Tahoe, USA

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), 2012, Porto, Portugal

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), 2012

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), 2012, Porto, Portugal

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), 2011, Sierra Nevada, Spain

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), 2009, Kobe, Japan

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), 2009, Kobe, Japan

Oral and Poster Presentations

How transferable are intermediate acoustic representations of speech across languages in human and machine speech recognition?

***Jessica Thompson**, Federico De Martino, Marc Schönwiesner, Yoshua Bengio, Elia Formisano, and Daniel Willett*

Montreal Artificial Intelligence and Neuroscience (MAIN) Conference, 2017, Montreal, Canada

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

Invited Talks

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

Montréal, Canada 2016

Teaching Experience

Teaching Assistant

Montréal, Canada Winter 2020

IFT 6135 - Representation Learning (Department of Computer Science and Operations Research, University of Montreal)

Prepare and grade practical and theoretical assignments for graduate level course on deep learning.

Educational course speaker

Montréal, Canada Nov 2019, Dec 2020

Montreal Artificial Intelligence and Neuroscience (MAIN) Conference

Gave didactic lectures on comparing activations in artificial and biological neural networks

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/Teaching Assistant

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

Other Experience

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.

Mentor

Online 2019-2020

UNIQUE Student Symposium 2019 and Women in Machine Learning Workshop 2020

Led mentorship roundtables on surviving graduate school

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

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

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

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

Administrative Assistant

Montréal, Canada 2010-2011

Distributed Digital Music Archives and Libraries Lab, McGill University

Assisted with preparing large-scale grant applications

Awards

Best Poster Award

Local conference (\$400)

Montreal Artificial Intelligence and Neuroscience Conference **2019**

Mitacs Accelerate PhD Fellowship

National competition (\$30,000/yr for three years)

Université de Montréal and Nuance Communications Inc. **2015–2018**

Best Poster Award

Local conference (\$400)

Montreal Artificial Intelligence and Neuroscience Conference **2017**

Fonds de recherche du Québec - Nature et technologies (FRQNT) Doctoral scholarship

Provincial competition (\$26,666)

Université de Montréal **2015–2016**

Erasmus Mundus Mobility Fellowship in Auditory Cognitive Neuroscience

International competition (€17,000)

Maastricht University **2015**

Natural Sciences and Engineering Research Council (NSERC) CREATE

Graduate Fellowship in Auditory Cognitive Neuroscience

National competition (\$21,000)

Université de Montréal **2014–2015**

Dartmouth Fellowship

Full tuition scholarship (\$55,000/yr) and stipend (\$20,000/yr) for two years

Dartmouth College **2011–2013**

NSERC-CREATE Undergraduate Student Research Award in Auditory Cognitive Neuroscience

National competition (\$4,600)

Rotman Research Institute **2010**

NSERC-CREATE Undergraduate Student Research Award in Auditory Cognitive Neuroscience

National competition (\$4,600)

McGill University **2009**

Reviewing

PLoS Biology

Reviewed one journal article.

2021

Neural Information Processing Systems (NeurIPS)

Reviewed six conference submissions • Rated in the top 10% of reviewers

2020

Cognitive Computational Neuroscience Conference (CCN)

Reviewed six conference submissions

2019

International Conference on Learning Representations (ICLR)

Reviewed two conference submissions

2018

Neural Information Processing Systems (NeurIPS)

Reviewed six conference submissions • Rated in the top 30% of reviewers

2018

Women in Machine Learning Workshop (WiML)

Reviewed three abstracts

2017

Hearing Research

Assisted with review of journal article

2014