

BENJAMIN PAUL GOLD

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Electrical Engineering & Computer Science, Vanderbilt University
2301 Vanderbilt Place, Nashville, TN 37235

EDUCATION

McGill University Ph.D., Integrated Program in Neuroscience	Montreal, QC, Canada September 2014 – August 2019
Aalto University M.Sc. in Technology with Distinction, Brain and Mind	Espoo, Uusimaa, Finland September 2013 – June 2014
Brown University B.Sc. with Honors, Cognitive Neuroscience	Providence, RI, U.S.A. September 2007 – May 2011

AWARDS AND HONORS

McGill MedStar Award for Excellent Papers McGill University Faculty of Medicine	December 2019
Graduate Fellowship Natural Sciences and Engineering Research Council, Complex Dynamics Network	September 2018 – August 2019
Graduate Research Enhancement and Travel Award McGill University Integrated Program in Neuroscience	April 2019
Graduate Travel Award Centre for Research on Brain, Language and Music, for the Society for Neuroscience Annual Meeting	November 2018
Jeanne Timmins Costello Fellowship McGill University Integrated Program in Neuroscience	September 2017 – August 2018
SEMPRE Young Researcher Conference Award Society for Education, Music and Psychology Research, for the 15th International Conference on Music Perception and Cognition/10th triennial conference of the European Society for the Cognitive Sciences of Music	July 2018
FENS, The Brain Prize and IBRO-PERC stipend Federation of European Neuroscience Societies Conference: Computational Neuroscience of Prediction	April 2018
Graduate Excellence Award BrainReach High Schools	August 2017

Outstanding Poster Award

June 2017

The Neurosciences and Music VI Conference:
Music, Sound and Health

Fulbright STEM Award for Graduate Students

September 2014 – May 2017

Fulbright Canada

Graduate Fellowship (declined)

September 2014 – August 2015

Natural Sciences and Engineering Research Council,
Auditory Cognitive Neuroscience Network

RESEARCH EXPERIENCE

Vanderbilt University

Nashville, TN, U.S.A.

Postdoctoral Scholar

October 2019 – Present

Supervisor: Dr. Catie Chang

**The Virtual Brain, Rotman Research Institute, Baycrest
Hospital, University of Toronto**

Toronto, ON, Canada

Visiting Graduate Researcher

January 2019 – August 2019

Supervisor: Dr. Randy McIntosh

McGill University

Montreal, QC, Canada

Graduate Researcher

September 2014 – August 2019

Supervisors: Dr. Robert Zatorre, Dr. Alain Dagher

University of Helsinki/Aalto University

Helsinki/Espoo, Finland

Research Assistant

August 2011 – July 2014

Supervisors: Dr. Risto Näätänen, Dr. Sari Ylinen,
Dr. Elvira Brattico

Georgetown University

Washington, D.C., U.S.A.

Research Assistant, Program in Cognitive, Computational and
Systems Neuroscience

January 2014 – July 2014

Supervisors: Dr. Josef Rauschecker, Dr. Elvira Brattico

Brown University

Providence, R.I., U.S.A.

Undergraduate Researcher, Laboratory for
Neural Computation and Cognition

September 2010 – May 2011

Supervisor: Dr. Michael Frank

Concordia University

Montreal, QC, Canada

Summer Intern, Laboratory for Motor Learning
and Neural Plasticity

May 2010 – August 2010

Supervisor: Dr. Virginia Penhune

PROFESSIONAL EXPERIENCE

- Science Mentor, Frontiers for Young Minds** January 2020 – Present
Guiding young scientists through scientific research and the peer review process
- Interviewer, Brown University Alumni Interviewing** August 2011 – Present
Conducting and reporting applicant interviews
- Teaching Assistant: Applied Statistics for Nursing** September 2018 – December 2018,
September 2017 – December 2017,
September 2016 – December 2016
Grading and providing feedback on assignments, leading and assisting SPSS workshops, reviewing material, and creating and delivering lectures
- Co-Coordinator and Teacher, I Speak Science** July 2017 – December 2018
Designing and teaching science lessons for an organization that provides an after-school program of hands-on science lessons for young students
- Research Mentor, McGill University** October 2015 – August 2018
Supervising undergraduate and Master's student research assistants in experimental design, data processing, and analysis
- English School Coordinator, BrainReach** May 2017 – August 2018
Recruiting teachers, co-organizing volunteer placements, and collecting feedback for an organization that brings neuroscience lessons to under-served schools
- Volunteer Teacher, BrainReach** November 2014 – August 2018
Delivering regular neuroscience lessons for 4th- or 10th-grade students in local under-served schools
- Community Organizations Coordinator, HANY** November 2016 – September 2017
Established and maintained community relationships and recruited students, workshop facilitators, and volunteers for an organization that provided French and English tutoring for refugees in Montreal
- Co-Founder and Volunteer Co-Coordinator, Say Ça!** December 2015 – July 2016
Co-managed tutor and mentor recruitment and training, lesson planning, feedback systems, and administration for an organization that tutors and mentors Syrian refugee teenagers in Montreal
- International Student Buddy, McGill University** July 2015 – May 2016
Assisted and advised new international students through their transitions to McGill and Montreal

Peer Support Mentor, McGill University
Mentored struggling undergraduate students

March 2015 – May 2016

Volunteer Tutor and Mentor, Homework Zone
Weekly tutored and mentored a struggling 5th-grade student in an under-served neighborhood

October 2015 – December 2015

PROFESSIONAL DEVELOPMENT

Machine Learning and Deep Learning Workshops December 2018
Two workshops over two days introducing machine learning and deep learning techniques and software for neuroscience, through the Montreal Artificial Intelligence & Neuroscience 2018 meeting

Basic and Advanced Brain Connectivity Workshop September 2018
Two-day course on state-of-the-art tools and methods in resting-state and structural brain connectivity, through the Sixth Biennial Conference on Resting State and Brain Connectivity

Skills of Communication Workshop February 2018
One-day workshop on verbal communication tools and tips, by McGill Skillsets

3-Minute Thesis Workshops and Competition February 2018
Two workshops and a competition on effective communication skills, by the McGill 3-Minute Thesis organization

Teaching Assistant Training September 2016
One-day workshop on teaching assistant skills, by the Association of Graduate Students Employed at McGill

Science Graduate Teaching Workshop September 2015
Two-day intensive workshops on teaching science for university students by the Tomlinson Project in University-Level Science Education

Active Listening & Interpersonal Communication Training March 2015
One-day intensive workshop on mentorship skills, by the McGill Staff-Student Mentoring Program

Learning to Teach Day November 2014
One-day intensive workshop on teaching skills, by McGill Skillsets

PEER-REVIEWED PUBLICATIONS

Fasano, M.C., Glerean, E., **Gold, B. P.**, Sams, M., Rauschecker, J., Sheng, D., & Brattico, E. (in revision). Inter-subject synchronization of brain responses after multimodal learning in experts: A behavioural and neuroimaging study on learning to play a piano sonata.

Gold, B. P. & Zatorre, R. J. (in press). The reward of musical emotions and expectations. In L. Kirmayer et al. (Eds.), *Culture, Mind and Brain* (12 p.). Cambridge, UK: Cambridge University Press.

Bianco, R., **Gold, B. P.**, Johnson, A., & Penhune, V. (2019). Music predictability and liking enhance pupil dilation and promote motor learning in non-musicians. *Scientific Reports*, *9*, 17060.

Gold, B. P., Pearce, M. T., Mas-Herrero, E., Dagher, A., & Zatorre, R. J. (2019). Predictability and uncertainty in the pleasure of music: a reward for learning? *Journal of Neuroscience*, *39*(47), 9397-9409.

Kliuchko, M., Brattico, E., **Gold, B. P.**, Tervaniemi, M., Bogert, B., Sams, M., Toiviainen, P., & Vuust, P. (2019). Fractionating auditory priors: A neural dissociation between active and passive experience of musical sounds. *PLoS One*, *14*(5), e0216499.

Shany, O., Singer, N., **Gold, B. P.**, Jacoby, N., Hendler, T., & Granot, R. (2019). Surprise-related activation in the nucleus accumbens interacts with music-induced pleasantness. *Social Cognitive and Affective Neuroscience*, *14*(4), 459-470.

Gold, B. P., Mas-Herrero, E., Zeighami, Y., Benovoy, M., Dagher, A., & Zatorre, R. J. (2019). Musical reward prediction errors engage the nucleus accumbens and motivate learning. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(8), 3310-3315.

Bogert, B., Numminen-Kontti, T., **Gold, B.**, Sams, M., Numminen, J., Burunat, I., Lampinen, J., & Brattico, E. (2016). Hidden sources of joy, fear, and sadness: Explicit versus implicit neural processing of musical emotions. *Neuropsychologia*, *89*, 393-402.

Kliuchko, M., Heinonen-Guzejev, M., Monacis, L., **Gold, B. P.**, Heikkilä, K. V., Spinosa, V., Tervaniemi, M., & Brattico, E. (2015). The association of noise sensitivity with music listening, training, and aptitude. *Noise and Health*, *17*(78), 350-357.

Gold, B. P., Frank, M. J., Bogert, B., & Brattico, E. (2013). Pleasurable music affects reinforcement learning according to the listener. *Frontiers in Auditory Cognitive Neuroscience*, *4*, 541.

CONFERENCE PRESENTATIONS

Gold, B. P., Pearce, M. T., Mas-Herrero, E., Dagher, A., McIntosh, A. R., & Zatorre, R. J. (2019, August). *The Virtual Musical Brain: What large-scale network models can tell us about music listeners*. Oral presentation at the Natural Sciences and Engineering Research Council - Collaborative Research and Training Experience Symposium in Complex Dynamics, Montreal, Quebec, Canada.

Gold, B. P., Pearce, M. T., Mas-Herrero, E., Dagher, A., & Zatorre, R. J. (2019, June). *The prediction game: how music engages the reward system by balancing predictability*. Poster at the Organization for Human Brain Mapping meeting, Rome, Italy.

Gold, B. P., Pearce, M. T., Mas-Herrero, E., Dagher, A., & Zatorre, R. J. (2019, April). *The prediction game: how music engages the reward system by balancing predictability*. Poster at the Learning and Plasticity Meeting, Åkäslompolo, Finland.

Gold, B. P., Pearce, M. T., Mas-Herrero, E., Dagher, A., & Zatorre, R. J. (2018, November). *Predictability and uncertainty in the pleasure of music*. Poster at the Society for Neuroscience Annual Meeting, San Diego, California, U.S.A.

Gold, B. P., Neumann, K. A., Litrico, C., Pearce, M. T., Mas-Herrero, E., Dagher, A. T., & Zatorre, R. J. (2018, July). *Predictive processing in music liking and arousal: influences of syntactic and explicit music predictability*. Poster at the 15th International Conference on Music Perception and Cognition/10th triennial conference of the European Society for the Cognitive Sciences of Music, Montreal, Quebec, Canada.

Gold, B. P., Neumann, K. A., Litrico, C., Pearce, M. T., Mas-Herrero, E., Dagher, A. T., & Zatorre, R. J. (2018, April). *Predictability and uncertainty in the pleasure of music: neural, psychophysiological, and behavioral effects*. Poster at the twelfth semiannual Brain Conference: Computational Neuroscience of Prediction, Copenhagen, Denmark.

Gold, B. P., Mas-Herrero, E., Zeighami, Y., Benovoy, M., Dagher, A., & Zatorre, R. J. (2017, June). *Can music convey reward prediction errors? A formal test of the effects of musical expectations in reward-related brain structures*. Poster and oral presentation at the sixth triennial meeting of the Neurosciences and Music: Music, Sound and Health, Boston, Massachusetts, U.S.A.

Gold, B. P., Mas-Herrero, E., Zeighami, Y., Benovoy, M., Dagher, A., & Zatorre, R. J. (2017, June). *Can music convey reward prediction errors?* Poster at Neuropsychology Day, Montreal, Quebec, Canada.

Gold, B. P., Bogert, B., Frank, M. J., & Brattico, E. (2014, June). *Individual differences in reward-related activity during music and learning*. Poster at the Neurodynamics of Language and Music Symposium, Helsinki, Finland.

Gold, B. P., Bogert, B., Frank, M. J., & Brattico, E. (2014, May-June). *Pleasurable music enhances reinforcement learning through the reward system and related structures*. Poster at the fifth triennial meeting of the Neurosciences and Music: Cognitive Stimulation and Rehabilitation, Dijon, France.

Gold, B. P., Frank, M. J., Bogert, B., & Brattico, E. (2013, November). *Pleasurable music affects reinforcement learning according to the listener*. Poster at the second annual Brain Research at Aalto University and University of Helsinki (BRAHE) symposium, Helsinki, Finland.

Gold, B., Frank, M., Bogert, B., & Brattico, E. (2013, October). *The power of music can help us learn*. Poster at the 40th anniversary meeting for the Brain Research Society of Finland, Helsinki, Finland.

Gold, B. P., Frank, M., Bogert, B., & Brattico, E. (2013, September). *Pleasurable music affects reinforcement learning according to the listener*. Poster at the final conference of the initial training network for Europe, Brain and Music (EBRAMUS): New Perspectives for Stimulating Cognitive and Sensory Processes, Pavia, Italy.

Gold, B., Frank, M., Bogert, B., & Brattico, E. (2013, June). *Pleasurable music affects reinforcement learning according to the listener*. Poster and oral presentation at the Third International Conference on Music and Emotion, Jyväskylä, Finland.

Gold, B., Frank, M., & Brattico, E. (2012, July). *Experiential effects of musical pleasure on dopaminergic learning*. Poster at the 12th International Conference on Music Perception and Cognition/8th Triennial Conference of the European Society for the Cognitive Sciences of Music, Thessaloniki, Greece.

Gold, B., & Brattico, E. (2012, March). *The effects of musical pleasure on dopaminergic learning*. Poster at the Monte Verità Workshop on Music in Neuroscience, Ascona, Switzerland.

Gold, B. P., Frank, M. J., & Brattico, E. (2012, March). *The effects of musical pleasure on dopaminergic learning*. Poster at the first annual Brain Research at Aalto University and University of Helsinki (BRAHE) symposium, Helsinki, Finland.

Gold, B., Spilka, M., Steele, C. J., & Penhune, V. B. (2010, August). *From Bandleader to follower: Are musicians expert imitators?* Poster at the Auditory Cognitive Neuroscience Summer Workshop, Hamilton, Ontario, Canada

PUBLIC ENGAGEMENT

Dorémi Documentary Demonstrated my research on musical arousal and pleasure in a documentary about music and music appreciation	In development
CBC Radio: Let's Go with Sabrina Marandola Discussed my research on the neuroscience of musical preferences in a live interview on CBC Radio.	November 2019
3AW Breakfast with Ross and John Discussed my research on musical complexity and preferences in a live interview for Australia's highest-rated radio program	October 2019
CBC Radio: The World This Weekend Interview Discussed my research on musical expectations and pleasure for a CBC Radio program about the love of music	March 2019

Interview for MedicalResearch.com

February 2019

Discussed my research in an interview for a public audience at <https://medicalresearch.com/author-interviews/music-activates-central-hub-of-brains-reward-system/47560/>

Invited talk: Center for Music in the Brain, Aarhus

April 2018

Presented my research in a public talk at the Center for Music in the Brain at Aarhus University, Denmark

3-Minute Thesis CompetitionsNovember 2017,
February 2018

Presented my research in a brief and general manner to a public audience during McGill's neuroscience and university-wide 3-Minute Thesis Competitions

Great American Railroad Journeys: Montreal

January 2018

Demonstrated and discussed my research on musical pleasure and arousal as a feature of Montreal on a BBC travel series

SKILLS AND INTERESTS

Programming languages/software: Matlab, FSL, Presentation, SPSS, SPM, Windows OS, Linux OS

Languages: English (native), Italian (intermediate), Finnish (intermediate)

Interests: Semi-professional musician (trombone, bass guitar), science education/outreach, squash