JOSEPH GERARD MAKIN

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West Lafayette, IN 47907   510-926-0335

EMPLOYMENT

Purdue University, School of Electrical and Computer Engineering
Assistant Professor   2020–

UCSF, Center for Integrative Neuroscience
Research Scientist (advisor: Edward Chang)   2017–2020
Postdoctoral Researcher (advisor: Philip Sabes)   2010–2017

EDUCATION

University of California, Berkeley
Ph.D., Electrical Engineering and Computer Sciences   2003–2008
(advisors: Srini Narayanan and Jerry Feldman)

Swarthmore College
B.A., Philosophy and B.S., Engineering   1999–2003

PROFESSIONAL AND HONONARY SOCIETY MEMBERSHIPS

Society for Neuroscience   2010–
Tau Beta Pi (top 1/5 of engineering class)   2003–

HONORS

Finalist, Mensa Foundation Prize   2025
NSF CAREER Award   2024
Outstanding Reviewer Award, Journal of Neural Engineering   2022
Winner, Neural Latents Benchmark (w/G. Meghanath and B. Jimenez)   2022
Finalist, BCI Award   2020
Fellow, Swartz Foundation for Theoretical Neuroscience   2016–2017

FUNDING

NSF CAREER (2339781) ($600,932)
PI; JGM responsible for $600,932.   2024–2029

NIH R01 (1R01DC021600-01) ($1,873,462)
PI; JGM responsible for $558,829.   2023–2028

Ralph W. and Grace M. Showalter Research Trust Award ($75,000)
PI; JGM responsible for $75,000.   2023–2024

Google Research Scholar Program ($60,000)
PI; JGM responsible for $60,000.   2023–

Belgian Science Foundation (€491,000)
co-PI; JGM responsible for €5,000.   2022–2026

Brain Research Foundation Seed Grant ($80,000)
PI; JGM responsible for $80,000.   2021–2023

FUNDING (cont.)

Ralph W. and Grace M. Showalter Research Trust Award ($75,000)
Co-PI (with M.C. Dadarlat [BME], PI); JGM responsible for $0. 2020–2021

Swartz Foundation for Theoretical Neuroscience, Fellowship ($85,000)
Fellow (P.N. Sabes, PI); J.G. Makin responsible for $50,000 2016–2017

NVIDIA Academic Hardware Grant Program (∼$3000 in equipment)
J.G. Makin responsible for all equipment 2014/18/22

PROFESSIONAL ACTIVITIES
COSYNE
Workshop co-organizer (with Philip Sabes) "Multisensory Processing in the Cortex." Mar. 2014

Center for Integrative Neuroscience, UCSF
Organizer, Theory Journal Club 2013–2015

Ad hoc reviewer for ICML, ICLR, NIPS, AAAI, *Nature Neuroscience, Neuron, Neural Computation, Journal of Neural Engineering, Frontiers in Human Neuroscience, PLoS One, COSYNE, IJNMBE*

GRADUATED STUDENTS

Rishi Jaiswal (with Supriyo Datta)	PhD	Fall 2025
Varun Kumar	MS	Fall 2024
Azwar Abdulsalam	MS	Spring 2023
Ganga Meghanath	MS	Fall 2022
Bryan Jimenez	MS	Sum. 2022

STUDENTS CURRENTLY BEING SUPERVISED

Bilal Ahmed	PhD	exp. 2026
Abraar Samar	PhD	exp. 2028
Shahed Ahmed	PhD	exp. 2029
Abbasali Koochakzadeh	PhD	exp. 2027
Zubin Kane	PhD	exp. 2027

NON-STUDENTS AND UNGRADUATES SUPERVISED

Elijah Jorgensen	undergraduate	Fall 2024
Woojin (Ryan) Lee	undergraduate	Fall 2024
Kurt Riegl	undergraduate	Fall 2024
Tyler Dierckman	undergraduate	Fall 2023
Herbert DeBruyn	undergraduate	Fall 2023
James Stonebridge	undergraduate	Fall 2023
Brian Yuan	undergraduate	2023
Miguel Castilho	undergraduate	Spring 2023
Rosie Tran	undergraduate	2022
Sohan Zaveri	undergraduate	Spring 2022
Josh Kosnoff	undergraduate	2021–2022
Ramya Banda	RA (with M.C. Dadarlat, BME)	2020–2022

COURSES DEVELOPED

ECE69500 (Purdue)	Inference & Learning in Generative Models	Spring 2021/22/24
NS219 (UCSF)	Computational Neuroscience	Spring 2013

COURSES "IN CHARGE OF"

NS300 (UCSF)	Digital Signal Processing	Spring 2014
ECE 20002	Fundamental of Electrical Engineering II	Spring 2025–
ECE 60131	Inference & Learning in Generative Models	Spring 2021–

SERIAL JOURNAL PAPERS

[1] Risi Jaiswal, Ming-Che Li, Lakshmi Anirudh Ghantasala, Archisman Ghosh, Behtash Behin-Aein, Joseph Makin, Shreyas Sen, and Supriyo Datta. Building block for p-circuits. *IEEE Solid State Circuits Letters*, 2025. **In press**.

[2] R. Jaiswal, S. Datta, and J.G. Makin. Energy-efficient supervised learning with a binary stochastic forward-forward algorithm. *IEEE Transactions on Artificial Intelligence*, 2025. **In press**.

[3] B. Ahmed, J.D. Downer, B.J. Malone, and J.G. Makin. Deep Neural Networks Explain Spiking Activity in Auditory Cortex. *PLoS Computational Biology*, 2025.

[4] A. Abdulsalam and J.G. Makin. Revisiting contrastive divergence for density estimation and sample generation. *Transactions on Machine Learning Research*, 2025. **In press**.

[5] G. Meghanath, B. Jimenez, and J.G. Makin. Inferring population dynamics in macaque cortex. *J. Neural Engin.*, 20(5):1–14, Nov. 2023.

[6] D.A. Moses, S.L. Metzger, J.R. Liu, G.K. Anumanchipalli, J.G. Makin, P.F. Sun, J. Chartier, M.E. Dougherty, P.M. Liu, G.M. Abrams, A. Tu-Chan, K. Ganguly, and E.F. Chang. Neuroprosthesis for decoding speech in a paralyzed person with anarthria. *New England Journal of Medicine*, 385:217–227, 2021.

[7] J.G. Makin, D. A. Moses, and E. F. Chang. Machine translation of cortical activity to text with an encoder-decoder framework. *Nature Neuroscience*, 23:575–582, 2020. **Top 0.04% of all papers ever tracked by Altmetric**.

[8] D.A. Moses, M.K. Leonard, J.G. Makin, and E.F. Chang. Real-time decoding of question-and-answer speech dialogue using human cortical activity. *Nature Comm.*, 10(3096), July 2019.

[9] J.G. Makin, J.E. O'Doherty, M.M.B. Cardoso, and P.N. Sabes. Superior arm-movement decoding with a new, unsupervised-learning algorithm. *J. Neural Engin.*, 15(2):1–19, Jan. 2018.

[10] J.G. Makin*, B.K. Dichter*, and P.N. Sabes. Learning to estimate dynamical state with probabilistic population codes. *PLoS Computational Biology*, 11(11), 2015. (*equal contribution).

[11] J.G. Makin and S. Narayanan. A hybrid-system model of the coagulation cascade: Simulation, sensitivity, and validation. *J. Bioinform. Comput. Biol.*, 11(5), Oct. 2013.

[12] J.G. Makin*, M.R. Fellows*, and P.N. Sabes. Learning multisensory integration and coordinate transformation via density estimation. *PLoS Computational Biology*, 9(4):1–17, April 2013. (*equal contribution).

[13] J.G. Makin and S. Narayanan. Real-time control of human coagulation. *IET Control Theory and Applications*, 6(17):2630–2643, Nov. 2012.

CONFERENCE PAPERS

[1] Abraar R. Samar and J.G. Makin. Pretraining with masked autoencoding improves speech decoding from ECoG. In *12th International IEEE/EMBS Conference on Neural Engineering (NER)*, Nov. 2025. **Spotlight paper**.

[2] A. Abdulsalam and J.G. Makin. Exponential-family harmoniums with linear sufficient statistics. In *AAAI 2025 - 39th AAAI Conference on Artificial Intelligence*, 2025.

[3] A. Abdulsalam and J.G. Makin. Learning recurrent models with temporally local rules. In *ICML Localized Learning Workshop*, 2023.

[4] J.G. Makin and P.N. Sabes. Sensory integration and density estimation. In Z. Ghahramani, M. Welling, C. Cortes, N.D. Lawrence, and K.Q. Weinberger, editors, *Advances in Neural Information Processing Systems (NIPS) 27: Proceedings of the 2014 Conference*, 2014.

[5] J.G. Makin and S. Narayanan. A hybrid-system model of the coagulation cascade. In F. Saheed and B. DasGupta, editors, *Proceedings of the 5th International Conference on Bioinformatics and Computational Biology (BICOB-2013)*, pages 205–212, Honolulu, HA, Mar 2013. **Best Paper Award**.

[6] J.G. Makin and L.A. Molter. Generalized switching, splitting, and multiplexing operations using circular arrays of coupled waveguides. In *Optical Fiber Communications (OFC) Conference*, volume 1, pages 47–50, Atlanta, GA, March 2003.

BOOK CHAPTERS

[1] J.G. Makin, D.A. Moses, and E.F. Chang. Speech decoding as machine translation. In C. Guger, B.Z. Allison, and A Gunduz, editors, *Brain-Computer Interface Research, Vol. 10*, pages 23–33. Springer, Cham, Switzerland, 2021.

SELECTED CONFERENCE PRESENTATIONS

[1] Bilal Ahmed, Brian Malone, and J.G. Makin. Understanding auditory cortex with deep neural networks. **Poster**, COSYNE, March 2023.

[2] J.G. Makin, D.A. Moses, and E.F. Chang. Machine translation of cortical activity to text with an encoder-decoder framework. **Poster**, Center for Neural Engineering and Prosthetics, U.C. Berkeley, December 2019.

[3] J.G. Makin and E.F. Chang. End-to-end decoding of speech from human cortex. **Poster**, Society for Neuroscience, November 2018.

[4] J.G. Makin, J.E. O'Doherty, and P.N. Sabes. Superior limb-movement decoding from cortex with a new, unsupervised-learning algorithm. **Poster**, COSYNE, February 2017.

[5] J.G. Makin, J.E. O'Doherty, and P.N. Sabes. Decoding limb movement from BMIs with a new, unsupervised-learning algorithm. **Poster**, Swartz Meeting (CalTech), August 2016.

[6] J.G. Makin, B.K. Dichter, and P.N. Sabes. Predictions for parietal cortex from a neural-network model of state estimation. **Poster**, Swartz Meeting (Janelia), August 2015.

[7] J.G. Makin. Computational models of posterior parietal cortex and their application to BMIs. **Talk**, Center for Neural Engineering and Prosthetics, U.C. Berkeley, December 2014.

[8] J.G. Makin and P.N. Sabes. Computational models of posterior parietal cortex. **Poster**, Society for Neuroscience, November 2014.

[9] J.G. Makin and P.N. Sabes. Models of computation in posterior parietal cortex. **Talk**, Sloan Swartz meeting (U.W.), June 2014.

[10] J.G. Makin and P.N. Sabes. What is neural "integration"? **Talk**, COSYNE Workshops, March 2014.

[11] J.G. Makin, Dichter B.K. and P.N. Sabes. Learning to track moving stimuli with population codes. **Talk ($< 6.4\%$ of submissions)**, COSYNE, February 2014.

[12] Dichter B.K. J.G. Makin, and P.N. Sabes. Learning to perform state estimation with populations of model neurons. **Poster**, Society for Neuroscience, November 2013.

[13] J.G. Makin, Chaisanguanthum K.S. and P.N. Sabes. Models of intersensory recalibration. **Poster**, Society for Neuroscience, October 2012.

[14] M.R. Fellows, J.G. Makin, and P.N. Sabes. Multisensory integration via density estimation. **Poster**, COSYNE, February 2011.

SELECTED OTHER WORKS

[1] J.G. Makin. *An Introduction to Modern Statistical Learning.* Unpublished textbook; available at `https://engineering.purdue.edu/MakinLab/IMSL/IMSL.pdf`, 2025.

[2] B.A. Yuan and J.G. Makin. Improving Speech Decoding from ECoG with Self-Supervised Pre-training. preprint available at `https://arxiv.org/abs/2405.18639v1`, 2024.

[3] J.E. O'Doherty, M.M.B. Cardoso, J.G. Makin, and P.N. Sabes. Nonhuman Primate Reaching with Multichannel Sensorimotor Cortex Electrophysiology. Online electrophysiology data set; available at `https://zenodo.org/record/583331`, 2017.

[4] J.G. Makin, B.K. Dichter, and P.N. Sabes. Recurrent Exponential-Family Harmoniums without Backprop-Through-Time. **In revision**, JMLR; preprint available at `https://arxiv.org/abs/1605.05799`, 2016.

[5] J.G. Makin and S. Narayanan. Human Coagulation: Stability, Model Reduction, and Control. In preparation, 2012.

[6] J.G. Makin. *Theology as Grammar*. Unpublished, 2010.

[7] J.G. Makin. *A Computational Model of Human Blood Clotting: Simulation, Analysis, Control, and Validation*. PhD thesis, University of California, Berkeley, 2008.

[8] J.G. Makin, S. Narayanan, and R. Ramamoorthi. Hybrid System Modeling Human Blood Clotting, 2005. Patent Pending US60/716,585.

INVITED TALKS

[1] Understanding Auditory Cortex with Deep Neural Networks. Collaborative Research in Comptational Neuroscience, funders meeting, Univerity of Minnesota, August 2024.

[2] Understanding Auditory Cortex with Deep Neural Networks. Department for Brain and Cognitive Sciences, Univerity of Rochester, June 2023.

[3] Towards a Neural Speech Prosthesis. CSE Fall Seminar, Notre Dame, Oct. 2021.

[4] Density Estimation and Information Retention for Dynamical Stimuli. Workshop on Dynamic Probabilistic Inference in the Brain, Bernstein Conference, Sept. 2020.

[5] Statistical Learning for Neuroscience. School of Electrical and Computer Engineering, Purdue, May 2020.

[6] Workshop on Learning Body Models, Lorentz Center, U. Leiden. **Invited Talk**, Oct. 2018.

[7] Computational Modeling of Multisensory Integration and Coordinate Transformation. Department of Neuroscience, Baylor College of Medicine, April 2018.

[8] Sensory Integration, Density Estimation, and Information Retention. Redwood Center for Theoretical Neuroscience, U.C. Berkeley, Jan. 2018.

[9] Computation and Learning in Posterior Parietal Cortex. Center for Neural Science, NYU, March 2016.

[10] Computation and Learning in Posterior Parietal Cortex. Center for Perceptual Systems, U.T. Austin, Feb. 2016.