

Eghbal A. Hosseini

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Research at the intersection of computational neuroscience and AI, studying how data and context shape internal representations in Large Language Models. Prior work covers representational structure during pretraining and in-context learning, and convergence across modalities and the brain. Current focus: pre- and post-training strategies for agentic behavior and long-term planning.

Current Position

2025 – Present **Visiting Researcher**, Google DeepMind, San Francisco, CA

Education

- 2016 – 2024 **Ph.D. Computational Neuroscience**, Massachusetts Institute of Technology (MIT)
Thesis: *Towards Synergistic Understanding of Language Processing in Biological and Artificial Systems*.
- 2023 **Analytical Connectionism**, Gatsby Computational Neuroscience Unit,
University College London.
- 2017 **Brains, Minds, and Machines**, Marine Biological Laboratory
University of Chicago.
- 2012 – 2014 **M.Sc. Electrical Engineering**, George Mason University (GMU)
- 2005 – 2010 **B.Sc. Electrical Engineering**, Iran University of Science and Technology (IUST)

Research Publications

Selected

King, J., Fedorenko, E., & **Hosseini**[†], E. A. (2026). Representational curvature modulates behavioral uncertainty in large language models [†senior author]. *International Conference on Machine Learning (ICML)*. [🔗](#).

Hosseini, E. A., Cheung, B., Fedorenko, E., & Williams, A. H. (2026). Modulating cross-modal convergence with single-stimulus, intra-modal dispersion. *ICLR 2026 Re-Align Workshop*. [🔗](#).

Hosseini, E. A., Li, Y., Bahri, Y., Campbell, D., & Lampinen, A. K. (2026). Context structure reshapes the representational geometry of language models. *arXiv*. [🔗](#).

Lampinen, A. K., Li, Y., **Hosseini**, E. A., Bhardwaj, S., & Shanahan, M. (2026). Linear representations in language models can change dramatically over a conversation. *arXiv*. [🔗](#).

Hosseini, E. A., Casto, C., Zaslavsky, N., Conwell, C., Richardson, M., & Fedorenko, E. (2024). Universality of representation in biological and artificial neural networks. *bioRxiv*. [🔗](#).

Hosseini, E. A., Schrimpf, M., Zhang, Y., Bowman, S., Zaslavsky, N., & Fedorenko, E. (2024). Artificial neural network language models predict human brain responses to language even after a developmentally realistic amount of training. *Neurobiol Lang (Camb)*, 5(1), 43–63. [🔗](#).

Hosseini, E. A., & Fedorenko, E. (2023). Large language models implicitly learn to straighten neural sentence trajectories to construct a predictive representation of natural language. *NeurIPS*. [🔗](#).

Schrimpf, M., Blank*, I. A., Tuckute*, G., Kauf*, C., **Hosseini**, E. A., Kanwisher, N., Tenenbaum, J. B., & Fedorenko, E. (2021). The neural architecture of language: Integrative modeling converges on predictive processing [*equal contribution]. *Proc. Natl. Acad. Sci. U. S. A.*, 118(45). [🔗](#).

Additional

Cohen*, Z., Jagadish*, A. K., **Hosseini*, E. A.**, & Eckstein, M. K. (2026). Reinforcement learning: Computational modeling of learning and decision-making [*equal contribution]. *Proceedings of the Analytical Connectionism Schools 2023–2024*, PMLR, 320, 87–101. [🔗](#).

Regev, T. I., Casto, C., **Hosseini, E. A.**, Adamek, M., Ritaccio, A. L., Willie, J. T., Brunner, P., & Fedorenko, E. (2024). Neural populations in the language network differ in the size of their temporal receptive windows. *Nat. Hum. Behav.*, 8(10), 1924–1942. [🔗](#).

Hosseini, E. A., Zaslavsky, N., Casto, C., & Fedorenko, E. (2023). Teasing apart the representational spaces of ANN language models to discover key axes of model-to-brain alignment. *Computational Cognitive Neuroscience*, (Oral presentation, top 5% submission). [🔗](#).

Wang, J., **Hosseini, E. A.**, Meirhaeghe, N., Akkad, A., & Jazayeri, M. (2020). Reinforcement regulates timing variability in thalamus. *Elife*, 9. [🔗](#).

Alhussein, L., **Hosseini, E. A.**, Nguyen, K. P., Smith, M. A., & Joiner, W. M. (2019). Dissociating effects of error size, training duration, and amount of adaptation on the ability to retain motor memories. *J. Neurophysiol.*, 122(5), 2027–2042. [🔗](#).

Nguyen, K. P., Zhou, W., McKenna, E., Colucci-Chang, K., Bray, L. C. J., **Hosseini, E. A.**, Alhussein, L., Rezazad, M., & Joiner, W. M. (2019). The 24-h savings of adaptation to novel movement dynamics initially reflects the recall of previous performance. *J. Neurophysiol.*, 122(3), 933–946. [🔗](#).

Remington, E. D., Narain, D., **Hosseini, E. A.**, & Jazayeri, M. (2018). Flexible sensorimotor computations through rapid reconfiguration of cortical dynamics. *Neuron*, 98(5), 1005–1019.e5. [🔗](#).

Wang*, J., Narain*, D., **Hosseini, E. A.**, & Jazayeri, M. (2018). Flexible timing by temporal scaling of cortical responses [*equal contribution]. *Nat. Neurosci.*, 21(1), 102–110. [🔗](#).

Hosseini, E. A., Nguyen, K. P., & Joiner, W. M. (2017). The decay of motor adaptation to novel movement dynamics reveals an asymmetry in the stability of motion state-dependent learning. *PLoS Comput. Biol.*, 13(5), e1005492. [🔗](#).

Hosseini, E. A., & Sadjadian, H. (2015). Noise resistant design of wavelet based multiresolution control. *American Control Conference (ACC)*, 2015, 4959–4963. [🔗](#).

Talks & Presentations

Invited Talks

Towards Synergistic Understanding of Language Processing in Biological and Artificial Systems

- Feb 2026 Sungkyunkwan University (SKKU), Suwon, South Korea
- Apr 2025 Department of Psychology, UC Berkeley
- Dec 2024 ANCOR Seminar, Computer Science, Brown University
- Sep 2024 Google DeepMind, Mountain View, CA

Conference & Workshop Talks

- Aug 2025 **Universality of representation across biological and artificial neural networks**, Community Event: “Universality and Idiosyncrasy of Perceptual Representations”, Cognitive Computational Neuroscience (CCN) 2025, University of Amsterdam, Netherlands
- Aug 2023 **Teasing apart the representational spaces of ANN language models to discover key axes of model-to-brain alignment** (oral presentation, top 5% submission), Cognitive Computational Neuroscience (CCN) 2023, Oxford, UK

Technical & Research Skills

Research Expertise	Computational neuroscience, Language modeling, Representation learning, Mechanistic interpretability, Neuroimaging analysis (fMRI, ECoG)
Programming & ML Frameworks	Python, MATLAB, R, \LaTeX , PyTorch, JAX/Flax, TensorFlow, Slurm
Languages	Fluent in reading, writing, and speaking <i>English</i> and <i>Persian</i>

Experiences & Awards

Research Experience

2025–Present	Visiting Researcher , Google DeepMind, San Francisco, CA
Spring 2025	Visiting Scientist , Special Year on Large Language Models and Transformers, Part 2, Simons Institute for the Theory of Computing, UC Berkeley
2024–2025	Postdoctoral Associate , Dr. Evelina Fedorenko, EvLab, McGovern Institute for Brain Research, MIT
2019–2024	Graduate Research Assistant , Dr. Evelina Fedorenko, EvLab, McGovern Institute for Brain Research, MIT
2017–2018	Graduate Fellowship Student , Dr. Edward S. Boyden, Synthetic Neurobiology Group, McGovern Institute for Brain Research, MIT
2015–2016	Technical Assistant , Dr. Mehrdad Jazayeri, JazLab, McGovern Institute for Brain Research, MIT
2013–2014	Graduate Research Assistant , Dr. Wilsaan Joiner, Sensorimotor Integration Lab, Volgenau School of Engineering, GMU

Mentoring

2024–2026	Jack G. King , MIT SuperUROP (Undergraduate Research Opportunities Program) — representational curvature and behavioral uncertainty in LLMs (ICML 2026)
2020–2022	Alexandra So , MIT UROP — Optimal stimulus design for developing neural network models of language processing

Teaching Experience

2020	Teaching Assistant , Dr. Michale Fee, Introduction to Neural Computation, Department of Brain and Cognitive Sciences, MIT
2017	Teaching Assistant , Dr. Tomaso Poggio, Science of Intelligence, MIT

Reviewing

2024–Present	NeurIPS, ICLR, ICML (conferences); Nature Human Behaviour (journal)
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Awards and Achievements

2020	Friends of the McGovern Institute Fellowship , MIT
2017–2018	BCS Hilibrand Graduate Student Fellowship , MIT
2016–2017	Henry E. Singleton(1940) Presidential Fellowship , MIT