Hope H. Kean

hopekean@mit.edu | www.mit.edu/~hopekean
46-4127G, 43 Vassar Street, Cambridge, MA 02139

EDUCATION

Massachusetts Institute of Technology,
Department of Brain & Cognitive Sciences, Postdoc 2026-present

Massachusetts Institute of Technology,
Department of Brain & Cognitive Sciences, PhD 2020-2026

Princeton University
A.B. in Neuroscience with Honors and Certificate in Cognitive Science 2018

PAPERS

Kean, H., Fung, A., Jaggers, P., Chen, J., Rule, J., Benn, Y., Tenenbaum, J., Piantadosi, S., Varley, R., & Fedorenko, E. (2026). Evidence from Formal Logical Reasoning Reveals that the Language of Thought is not Natural Language. *PNAS*

Kean, H., Fung, A., Chen, J., Ohams, C., Rule, J., Tenenbaum, J., Piantadosi, S., & Fedorenko, E. A human brain network specialized for abstract formal reasoning. (*under review*).

Kean, H., & Boix, E. (2026) Logical subspace in LLMs: a minimal viable subspace for reasoning. (*submitted*)

Kean, H. (2026). The Neural Architecture of Human Reasoning: Higher-order Cognitive Specialization for Formal Thought and in Atypical Brains. (Doctoral dissertation, MIT).

Kean, H., Wolna, A., Swords, S., Jhingan, N., Shewmon, A., Richardson, M., Fedorenko, E. (forthcoming, see version in thesis). Functional specificity is a core principle of human brain organization, as revealed by highly anatomically atypical brains.

Kean, H., Fung, A., Pramod, RT., Chomik-Morales, J., Kanwisher, N., & Fedorenko, E. (2025). Intuitive physical reasoning is not mediated by linguistic nor exclusively domain-general abstract representations. *Neuropsychologia*.

deVarda, A., D'Elia, F., **Kean, H.,** Lampinen, A., and Fedorenko, E. (2026) The cost of thinking is similar between large reasoning models and humans**.** *PNAS*

Gao, R., Cheung, C., Siegelman, M., Pongos, A., **Kean, H**., Tanner, A., Fedorenko, E., Ivanova, A. (2026). The language network responds robustly to sentences across diverse tasks. *Imaging Neuroscience*

Ivanova, A., Kauf, C., Gao, R., She, J., **Kean, H**., Goldhaber, T., Nieto-Castañón, A., Varley, R., Kanwisher, N., Fedorenko, E. (2026) Semantic reasoning takes place largely outside the language network. (*under review*)

Shain*, C., **Kean*, H.,** Casto, C., Lipkin, B., Affourtit, J., Siegelman, M., Mollica, F., Fedorenko, E. (2024) Distributed Sensitivity to Syntax and Semantics throughout the Language Network. *Journal of Cognitive Neuroscience*.

Regev, T., Lipkin B., Boebinger D., Paunov A., **Kean, H**., Norman-Haignere S.V., and Fedorenko, E. (2024) Preserved functional organization of human auditory cortex in individuals missing one temporal lobe from birth. *iScience*.

Li, J., **Kean, H.**, Fedorenko, E. and Saygin, Z. (2022). Intact reading ability despite lacking a canonical visual word form area in an individual born without the left superior temporal lobe. *Cognitive Neuropsychology.*

Tuckute, G., Paunov, A., **Kean, H.,** Small, H., Mineroff, Z., Blank, I.A., Fedorenko, E. (2022): Frontal language areas do not emerge in the absence of temporal language areas: A case study of an individual born without a left temporal lobe, *Neuropsychologia.*

Hu, J, Small, H., **Kean, H.,** Takahashi, A., Zekelman, L., Kleinman, D., Ryan, E., Nieto-Castañón, A., Ferreira, V., and Fedorenko, E. (2022). Precision fMRI reveals that the language-selective network supports both phrase-structure building and lexical access during language production. *Cerebral Cortex.*

Chen, X., Affourtit, J., Ryskin, R., Regev, T., Norman-Haignere, S., Jouravlev, O., Malik-Moraleda, S.,
Kean, H., Varley, R., and Fedorenko, E. (2022). The human language system does not support music processing. *Cerebral Cortex.*

Lipkin, B., Tuckute, G., Affourtit, J., Small, H., Mineroff, Z., **Kean, H.,** Jouravlev, O., Rakocevic, L., Pritchett, B., Siegelman, M., Hoeflin, C., Pongos, A., Blank, I., Kline, M., Ivanova, A., Shannon, S., Sathe, A., Hoffman, M., Nieto-Castañón, A., and Fedorenko, E. (2022). LanA (Language Atlas): A probabilistic atlas for the language network based on fMRI data from >800 individuals. *Nature Scientific Data.*

Ivanova, A., Srikant, S., Sueoka, Y., **Kean, H.,** Dhamala, R., O'Reilly, U., Bers, M., and Fedorenko, E. (2020) Comprehension of computer code relies primarily on domain-general executive brain regions. *eLife*

Mollica, F., Siegelman, M., Diachek, E., Piantadosi, S., Futrell, R., Mineroff, Z., **Kean, H.,** Qian, P., and Fedorenko, E. (2020) Composition is the core driver of the language-selective network. *Neurobiology of Language*.

Guterstam*, A., **Kean*, H.,** Webb, T., Kean, F., and Graziano, M. (2018) Implicit model of other people's visual attention as an invisible, force-carrying beam projecting from the eyes. *PNAS*.

Webb, T., **Kean, H.,** and Graziano, M. (2016) Effects of awareness on the control of attention. *Journal of Cognitive Neuroscience.*

IN PREPARATION

Kean, H., Diachek, E., Blank, I., and Fedorenko, E. (in prep) Logic, Arithmetic, and Language Co-Lateralize in the Brain.

Kean, H., Fung, A., Chen, J., Rule, J., Piantadosi, S., Tenenbaum, J., & Fedorenko, E. (in prep). Neural Mechanisms of Inductive Inference.

Kean*, H., deVarda*, A., Piantadosi, S., & Fedorenko, E. (in prep). Why Language Representations are an Impoverished Format for Thought.

PRESENTATIONS

1. Kean, H. (2026) The Neural Architecture of Human Reasoning. EPFL Confluence Workshop.

2. Kean, H. (2026) The Neural Architecture of Logical Reasoning. Webb Lab. Princeton Neuroscience Institute.

3. Kean, H. (2026) The human brain network specialized for abstract formal reasoning. McGovern Institute for Brain Research (MIBR) Visiting Committee. MIT.

4. Kean, H. (2026) The Logical Subspace of LLMs. Workshop on Learning Dynamics in Natural and Artificial Intelligence. Kempner Institute. Harvard.

5. Kean, H. (2026) The Neural Architecture of Human Reasoning. Center for Neuroimaging Research (CNIR) Institute for Basic Science (IBS) Korea.

6. Kean, H. (2026) The Neural Architecture of Human Reasoning. Language & Cognition (LangCog) Harvard University Department of Psychology.

7. Kean, H. (2026) The Neural Architecture of Human Reasoning. Moss Rehab (Buxbaum Group). Jefferson.

8. Kean, H. (2026) The Neural Architecture of Human Reasoning. LCNS Lab Meeting. University of Pennsylvania Medical School.

9. Kean, H. (2026) Theories of the Mind & Cognitive Neuroscience. Collegium Institute UPenn.

10. Kean, H. (2025) The Neural Architecture of Logical Reasoning. University of Trento CIMeC Colloquium.

11. Kean, H. (2025) Neural Architecture of Human Reasoning. University of Thomas Aquinas. Guest Lecture.

12. Kean, H. (2025) Keynote Speaker. On the Neural Ontology of Thought and Human Reasoning. Boston College 52nd annual Insight Conference.

13. Kean, H., Fung, A., Rule, J., Piantadosi, S., Tenenbaum, J., and Fedorenko, E. (2025) Deduction and Induction Dissociate in the Human Brain. MIT Brain & Cognitive Sciences Graduate Research Poster Session.

14. Kean, H. (2024) Deduction and Induction Dissociate in the Human Brain. McGovern Institute for Brain Research (MIBR) Visiting Committee (VC). MIT.

15. Kean, H. (2024) Domain-general Reasoning in the Human Brain. Piantadosi Computational Language Lab Meeting. UC Berkeley.

16. Kean, H. (2024) Reasoning Systems in the Human Brain. MIT Quest for Intelligence Visiting Committee.

17. Kean, H., Fung*, A., Jaggers*, P., Rule, J., Benn, Y., Tenenbaum, J., Piantadosi S., Varley R., Fedorenko, E. (2024) The Language of Thought is not Language: Evidence from Formal Induction. SNL

18. Kean*, H., Wolna*, A., Swords, S., Jhingan, N., Shewmon, A., Richardson, M., Fedorenko, E. (2024) Functional specificity is a core principle of human brain organization, as revealed by highly anatomically atypical brains. SNL

19. Kean, H., Fung, A., Rule, J., Piantadosi, S., Tenenbaum, J., and Fedorenko, E. (2024) Deduction and Induction Dissociate in the Human Brain. Cognitive Computational Neuroscience Conference.

20. Kean, H. (2024) Inductive Inference and Reasoning in the Human Brain, 51st Annual Summer Insight Boston College Philosophy Conference.

21. Kean, H. (2023) Domain-general Reasoning in the Human Brain, Cognitive Department Lunch Series MIT BCS Cog Lunch

22. Kean, H. (2023) Program Induction and Reasoning in the Human Brain. Emerging Scholar in Psychological Science, Princeton Neuroscience Institute.

23. Kean, H. (2023) Guest Lecture for 9.85 Infant Cognition: Language Development and the Human Brain

24. Kean, H. (2022) The Interesting Brains Project: Preserved Cognition after Massive Lesions to Cortex. Inauguration of the MIT Museum, Cambridge Science Festival. https://www.youtube.com/watch?v=3NGX6taF_rw&ab_channel=ddlk66

25. Kean, H. (2022) Guest Lecture for 9.85 Infant Cognition: Language Development and the Human Brain

26. Regev T, Jhingan N, Kim HS, Kean H, Casto C, and Fedorenko E. (2022) Neural Representation of Prosody. Society for the Neurobiology of Language

27. Kean, H. (2021) Temporal Receptive Windows, Cognitive Department Lunch Series (MIT BCS Cog Lunch)

28. Ivanova, A. A., Siegelman, M., Cheung, C., Pongos, A. L. A., Kean, H. H., & Fedorenko, E. (2020) The effect of task on sentence processing in the language and multiple demand brain networks. Society for the Neurobiology of Language.

29. Hu, J., Small, H., Kean, H. H., Takahashi, A., Zekelman, L., Kleinman, D., Ryan, E., Ferreira, V., & Fedorenko, E. (2020). Distributed and overlapping neural mechanisms for lexical access and syntactic encoding during language production. Society for the Neurobiology of Language

30. Gallée J, Kean HH, Fedorenko E (2020) Robust Neural Adaptation to Syntactic Structure. Cognitive Neuroscience Society.

31. Kean, H. (2019) Probabilistic Program Generation: Intuitive Physical Theory of Balance, Brains, Minds, & Machines (CBMM)

32. Kean HH, Ellis CT, Webb TW, Graziano MSA (2017) Implicit biases about invisible forces that project from the eyes. Princeton Neuroscience Institute Research Symposium

33. Liao VTY, Webb TW, Kean HH, Graziano MSA (2017) Effects of Awareness on the Control of Attention: An Auditory Behavioral Paradigm. Princeton Neuroscience Institute Research Symposium.

34. Kean, H. (2016) TARP γ-8, γ-2, Cornichon, Auxiliary Binding Proteins in AMPA Receptor Trafficking, Seoul National University

35. Webb TW, Kean HH, and Graziano MSA (2015) Awareness alters the control of attention. Poster presented at the Society for Neuroscience Annual Meeting, Chicago.

36. Kean HH, Ogilvie K, Lussier M, Roche K (2014) Binding of MAGUK family proteins to Neuroligin -1 and -2. NINDS Summer Research Symposium.

37. Kean HH, Ogilvie K, Lussier M, Roche K (2014) Binding of MAGUK family proteins to Neuroligin -1 and -2. NINDS Award Ceremony and Winning Presentation Meeting.

OTHER RELEVANT RESEARCH EXPERIENCE

Diverse Intelligences Summer Institute *DISI Summer School* 2022

Center for Brain, Minds, & Machines *CBMM Summer School* 2019

Technical Associate & Lab Manager,
EvLab, Brain & Cognitive Sciences, MIT 2018 – 2020

Research Assistant, *Princeton Neuroscience Institute,*
Cognitive Science Fellowship 2014 – 2018

Research Student, *Semmelweis University Medical School* Summer 2016

Paideia Institute, *Intern & Project Lead – NeuroLatin Initiative* 2016

Research Fellow, *Seoul National University Medical School*
Neuroscience Department Summer 2015

Cancer Hospital Volunteer Researcher, *Seoul National University Hospital* Summer 2015

Neurosurgery Intern, *Bethesda Surgery Center* 2014

Research Intern, *NINDS / NIH* Summer 2013

TEACHING & MENTORSHIP EXPERIENCE

Research Mentor, *Undergraduate, Post-bac, and RA*
Research Mentor in Dept. Brain & Cog. Sci., MIT 2020-present

Graduate Resident Tutor, *MIT Simmons Hall*
advised students (approx. 30 per year) 2021-2025

Teaching Assistant (& Guest Lecture), *Infant Cognition 9.85* 2023

Teaching Assistant (& Guest Lecture), *Infant Cognition 9.85* 2022

Tutor, *Aristotle Circle* 2011-2014

AWARDS & FUNDING

Templeton World Charities Foundation ("*On Understanding"*) Grant TWCF-2025-35513
Independent Funding for Neuroscience of Reasoning 2026–present

Postdoc Funding, AIQ DARPA Grant ("*Characterizing/understanding LLM reasoning capabilities"*) 2026

Fellowship, K. Lisa Yang Integrative Computational Neuroscience Center 2024

Fellowship, Friends of the McGovern Institute Student Fellow 2022

MIT Presidential Fellowship 2020

Princeton Cognitive Science Fellowship 2018

Streicker International Research Fellowship – fully funded research internship
Seoul National University 2015

Outstanding Work – Princeton Theatre Class of 2018 2015

James Madison Program Fellowship – fully funded research on Spoken Latin in Rome with the Paideia Institute 2015

Bausch & Lomb Honorary Science Award 2013

St. Michael's Book Award for Academic Achievement and Social Conscience 2013

MEDIA

MIT News: Separating Logic and Language

The Wall Street Journal: Why Even Smart People Believe AI Is Really Thinking

The New York Times: The Curious Hole in my Head

MIT Technology Review (China): Reasoning doesn't rely on language; has the LLM approach gone astray?

Psychology Today: How the Brain Processes Different Components of Language

MIT News: Studies of unusual brains reveal critical insights into brain organization, function

WIRED: She was missing a chunk of her brain. It didn't matter

Psychology Today: The temporal lobe and language development

Devil in the Stack: Searching for the Soul of the New Machine

Science Rehashed Podcast: Cracking the code: the neural basis of computer code comprehension

The New York Art Fair: Times Square Art Exhibit “Presence of the Absence”

MIT News: To the brain, reading computer code is not the same as reading language