Anna Ivanova

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Academic Appointment

Georgia Institute of Technology — *Atlanta, GA, USA*
Assistant Professor, School of Psychology — *from Jan 2024*
PI of the Language, Intelligence & Thought (LIT) lab

Massachusetts Institute of Technology — *Cambridge, MA, USA*
Postdoctoral Associate (MIT Quest for Intelligence) — *2022 - now*
with Jacob Andreas & Evelina Fedorenko

Education

Massachusetts Institute of Technology — *Cambridge, MA, USA*
Ph.D. in Brain and Cognitive Sciences — *2017 - 2022*
Advisor: Evelina Fedorenko

University of Miami — *Coral Gables, FL, USA*
B.S. in Neuroscience and Computer Science — *2013 – 2017*
Research advisor: Lucina Uddin

Publications

Journal Papers

2023. The language network is not engaged in object categorization.
*Benn Y., ***Ivanova A. A.,** Clark O., Mineroff Z., Seikus C., Silva J. S., Varley R., Fedorenko E.
Cerebral Cortex, bhad289

2022. Beyond linear regression: mapping models in cognitive neuroscience should align with research goals.
Ivanova A. A., Schrimpf M., Anzellotti S., Zaslavsky N., Fedorenko E., Isik L.
Neurons, Behavior, Data analysis, and Theory, 5

2022. Probabilistic atlas for the language network based on precision fMRI data from >800 individuals.
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. A., Kline Struhl M., **Ivanova A. A.,** Shannon S., Sathe A., Hoffmann M., Nieto-Castañón A., Fedorenko E.
Scientific Data, 9, p. 529

2021. The language network is recruited but not required for nonverbal event semantics.
Ivanova A. A., Mineroff Z., Zimmerer V., Kanwisher N., Varley R., Fedorenko E.
Neurobiology of Language, 2, pp. 176–201

2020. Comprehension of computer code relies primarily on domain-general executive brain regions.
Ivanova A. A., Srikant S., Sueoka Y., Kean H. H., Dhamala R., O'Reilly U.-M., Bers M. U., Fedorenko E.
eLife, 9, e58906

2019. The language of programming: a cognitive perspective.
Fedorenko E., **Ivanova A. A.,** Dhamala R., Bers M. U.
Trends in Cognitive Sciences, 23, pp. 525–528

2017. Intrinsic functional organization of putative language networks in the brain following left cerebral hemispherectomy.
Ivanova A. A., Zaidel E., Salamon N., Bookheimer S., Uddin L. Q., Bode S.
Brain Structure and Function, 222, pp. 3795–3805

2014. Post-fire succession in the northern pine forest in Russia: a case study.
Ivanova A. A., Kopylova-Guskova E. O., Shipunov A. B., Volkova P. A.
Wulfenia, 21, pp. 119–128

Conference Papers

2023. A Better Way to Do Masked Language Model Scoring.
Kauf C., **Ivanova A. A.**
Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics (ACL)

2022. Convergent Representations of Computer Programs in Human and Artificial Neural Networks.
*Srikant S., *Lipkin B., **Ivanova A. A.,** Fedorenko E., O'Reilly U.
Advances in Neural Information Processing Systems (NeurIPS), pp. 18834–18849

2021. Probing artificial neural networks: Insights from neuroscience.
Ivanova A. A., Hewitt J., Zaslavsky N.
ICLR 2021 Workshop "How Can Findings About The Brain Improve AI Systems?"

2020. Linguistic overhypotheses in category learning: Explaining the label advantage effect.
Ivanova A. A., Hofer M.
Proceedings of the 42nd Annual Conference of the Cognitive Science Society, pp. 723–729

2018. Does the brain represent words? An evaluation of brain decoding studies of language understanding.
*Gauthier J., ***Ivanova A. A.**
Computational Cognitive Neuroscience Conference

2018. Pragmatic inference of intended referents from binomial word order.
Ivanova A. A., Levy R. P.
Proceedings of the 40th Annual Conference of the Cognitive Science Society, pp. 1865–1870

Preprints

2023. Dissociating language and thought in large language models: a cognitive perspective.
*Mahowald K., ***Ivanova A. A.,** Blank I. A., Kanwisher N., Tenenbaum J. B., Fedorenko E.
arXiv, arXiv:2301.06627

2022. Event knowledge in language models: the gap between the impossible and the unlikely.
*Kauf C., ***Ivanova A. A.,** Rambelli G., Chersoni E., She J., Chowdhury Z., Fedorenko E., Lenci A.
arXiv, arXiv.2212.01488

2022. The language network reliably 'tracks' naturalistic meaningful non-verbal stimuli.
*Sueoka Y., *Paunov A., **Ivanova A. A.,** Blank I. A., Fedorenko E.
bioRxiv, 2022.04.24.489316v1

Papers in preparation

Multiple brain regions show modality-invariant responses to event semantics.
Ivanova A. A., Kauf C., Kanwisher N., Kean H., Goldhaber T., Mineroff Z., Balewski Z., Varley R., Fedorenko E.

The language network responds robustly to sentences regardless of task.
Ivanova A. A., Siegelman M., Cheung C., Pongos A. L. A., Kean H., Fedorenko E.

** denotes equal contribution*

Presentations

Invited Talks

Dec 2023 [SCHEDULED]. NeurIPS 2023 workshop "Failure Modes in the Age of Foundation Models"'
Dissociating formal and functional linguistic competence in large language models.

Nov 2023 [SCHEDULED]. Cognitive & Information Sciences seminar, UC Merced
Dissociating language and thought in the brain and in large language models.

Nov 2023 [SCHEDULED]. Chang lab meeting, UCSF
Dissociating language and thought in the brain and in large language models.

Nov 2023 [SCHEDULED]. Stanford NLP seminar
Dissociating formal and functional linguistic competence in large language models.

Sep 2023. Interactions between formal & computational linguistics (ILFC) seminar, Lorraine Research Laboratory in Computer Science and its Applications (virtual)
Dissociating formal and functional linguistic competence in large language models.

Jul 2023. CogSci 2023, workshop "Psychology and Large Language Models" (virtual)
Dissociating language and thought in large language models: a cognitive perspective.

Jul 2023. Workshop "Machine learning and theory development", CIFAR & Jacobs Foundation (virtual)
Dissociating language and thought in large language models: a cognitive perspective.

Apr 2023. Workshop "AI and the Barrier of Meaning", Santa Fe Institute, Santa Fe, NM
Language understanding goes beyond language processing.

Apr 2023. KUIS AI seminar, Istanbul, Turkey (virtual; with K. Mahowald)
Dissociating language and thought in large language models: a cognitive perspective.

Mar 2023. Kungfu AI, Austin, TX (virtual)
The difference between language and thought.

Mar 2023. MOSAIC Journal Club, Allen Institute for AI (virtual; with K. Mahowald)
Dissociating language and thought in large language models: a cognitive perspective.

Mar 2023. NERT Journal Club, Georgetown University (virtual; with K. Mahowald)
Dissociating language and thought in large language models: a cognitive perspective.

Mar 2023. Intel Deep Learning Journal Club (virtual; with K. Mahowald)
Dissociating language and thought in large language models: a cognitive perspective.

Feb 2023. Google Education, Cambridge, MA
The difference between language and thought.

Feb 2023. Philosophy and Cognitive Science of Deep Learning, Columbia University (virtual; with K. Mahowald)
Discussion of the paper "Dissociating language and thought in large language models: a cognitive perspective".

Dec 2022. The Conversation @ the MIT Museum, Cambridge, MA
The difference between language and thought.

Dec 2022. Maryland Neuroimaging Center seminar, University of Maryland (virtual)
Beyond linear regression: mapping models in cognitive neuroscience should align with research goals.

Oct 2022. Research seminar, The Hong Kong Polytechnic University (virtual; with C. Kauf)
Event knowledge in language models: the gap between the impossible and the unlikely.

May 2022. ACL workshop "Learning with Natural Language Supervision" (virtual)
The role of language in broader human cognition.

Nov 2021. HuthLab meeting, UT Austin (virtual)
The language-semantics relationship.

Mar 2021. Colloquium, Department of Computer Science, UC Irvine (virtual)
The brain basis of computer code comprehension.

Mar 2021. Interview weekend, MIT Brain and Cognitive Sciences (virtual)
The role of language in broader human cognition.

Conferences and Workshops

Mar 2023. Oral presentation at the Philosophy of Deep Learning Conference, New York University, NY
Dissociating language and thought in large language models: a cognitive perspective.

Nov 2022. Poster presentation at MIT Quest for Intelligence Advances (with C. Kauf)
Event knowledge in language models: the gap between the impossible and the unlikely.

Oct 2022. Poster presentation at the Society for Neurobiology of language (SNL) conference, Philadelphia, PA
Multiple brain regions show modality-invariant responses to event semantics.

Apr 2022. Oral presentation at LangCog meeting, Harvard (virtual)
Language models: Surprisingly good at language, unsurprisingly bad at thought.

Nov 2021. Oral presentation at CogLunch, MIT Brain and Cognitive Sciences (virtual)
Beyond linear regression: mapping models in cognitive neuroscience.

Sep 2021. Oral presentation at the Meaning and Language Workshop, MIT (joint with J. Hu)
Meaning in the brain.

Sep 2021. Oral presentation at the Computational Cognitive Neuroscience (CCN) Generative Adversarial Collaborations workshop (virtual)
Linear mapping models in cognitive neuroscience: progress report.

May 2021. Poster presentation at the ICLR 2021 Workshop "How Can Findings About The Brain Improve AI Systems?" (virtual)
Probing artificial neural networks: Insights from neuroscience.

Oct 2020. Opening presentation at the Computational Cognitive Neuroscience (CCN) Generative Adversarial Collaborations workshop (virtual)
Is it that simple? The use of linear models in cognitive neuroscience.

Jul 2020. Poster presentation at the 42nd Annual Meeting of the Cognitive Science Society (virtual)
Linguistic Overhypotheses in Category Learning: Explaining the Label Advantage Effect.

Oct 2019. Poster presentation at the Society for Neuroscience (SfN) conference, Chicago, IL, USA
The neural basis of program comprehension.

Oct 2019. Oral presentation at CogLunch, MIT Brain and Cognitive Sciences
The neural basis of program comprehension.

Sep 2019. Oral presentation at AMLaP 2019, Moscow, Russia
The language network is recruited but not required for non-verbal semantic processing.

Aug 2019. Flash presentation at the Center for Brains, Minds, and Machines (CBMM) retreat, Woods Hole, MA, USA
The neural basis of program comprehension.

Nov 2018. Oral presentation at CogLunch, MIT Brain and Cognitive Sciences
The language network is recruited but not required for non-verbal semantic processing.

Sep 2018. Poster presentation at the Conference on Cognitive Computational Neuroscience, Philadelphia, PA, USA
Does the brain represent words? An evaluation of brain decoding studies of language understanding.

Jul 2018. Poster presentation at the 40th Annual Meeting of the Cognitive Science Society, Madison, WI, USA
Pragmatic Inference of Intended Referents from Binomial Word Order.

Apr 2017. Poster presentation at the Science March, Miami, FL, USA
Neuroscience of language.

Mar 2017. Poster presentation at Research, Creativity and Innovation Forum (RCIF), Miami, FL, USA
Functional organization of language-sensitive brain regions during naturalistic story comprehension.

Apr 2015. Oral presentation at 10th Annual ACC Meeting of the Minds Conference, Raleigh, NC, USA
Functional organization of language brain networks in patients with a lone right hemisphere.

Sep 2014. Poster presentation at the Fourth Biennial Conference on Resting State & Brain Connectivity, Boston, MA, USA
Functional organization of language networks in children with left hemispherectomy.

Industry

Google, Inc. *Seattle, WA*
Software Engineering Intern *2016*
Applied machine learning and natural language processing techniques to develop a ticket classification system.

Honors & Awards

2022	**Diversity, Equity, Inclusion and Justice Impact Award**, recipient	*MIT BCS*
2021	**Whitaker Health Sciences Fund Fellowship**, recipient (one year of PhD funding)	*MIT*
2019	**Patrick J. McGovern Student Travel Award**, recipient	*McGovern Institute*
2019	**Angus MacDonald Award for Excellence in Undergraduate Teaching**, recipient	*MIT BCS*
2018	**"MIT Can Talk" Oratory Competition**, winner	*MIT*
2017	**IEEE Brain Data Bank Competition in Boston**, winning team	*Cambridge, MA*
2015	**Lois Pope Undergraduate Neuroscience Summer Research Fellowship**, recipient	*University of Miami*
2015	**Phi Beta Kappa**, member	*University of Miami*
2014	**Beyond the Book Scholarship** , recipient (funding for summer research)	*University of Miami*
2013	**Isaac Bashevis Singer Scholarship**, recipient (full tuition for 4 years)	*University of Miami*
2012	**All-Russian Biology Olympiad for high school students**, winner (5th place)	*Russia*
2011	**All-Russian Biology Olympiad for high school students**, winner (1st place)	*Russia*
2011	**Founder's Scholarship**, recipient (fifty percent of tuition for 2 years)	*EF Academy*

Teaching

Teaching Experience

Educational Studies Program *MIT*
Volunteer Teacher *2018 - 2020, 2023*
Classes: Introductory Neuroscience, Brain and Language, Public Speaking

MIT Department of Brain and Cognitive Sciences *MIT*
Teaching Assistant *2018 - 2019*
Classes: 9.46 – Neuroscience of Morality, 9.13 – The Human Brain

Academic Teaching Initiative *MIT*
Computer Science Teacher *2017 - 2018*
Class: AP Computer Science (Java)

Academic Resource Center *University of Miami*
Peer Tutor *2014-2017*
Subjects: Biology, Chemistry, Physics, Computer Science, Statistics

Guest Lectures

Nov 2023 [FUTURE]	**418: Philosophy of Mind**, guest lecture	*Rutgers University*
Nov 2023 [FUTURE]	**9.58: science of intelligence**, guest lecture	*MIT*
Jul 2023	**Python Club Summer Camp**, guest lecture	*Charlton MA*
May 2023	**9.012: introduction to cognitive science**, guest lecture	*MIT*
May 2023	**MIT Abstracts**, invited talk	*MIT Museum*
Apr 2023	**COGS005: introduction to language & linguistics**, guest lecture	*UC Merced*
Mar 2023	**9.S52: language in the mind and brain**, guest lecture	*MIT*
Feb 2023	**418: Philosophy of Mind**, guest lecture	*Rutgers University*
Dec 2022	**Science research**, guest lecture	*Ursuline School (virtual)*
May 2022	**9.012: introduction to cognitive science**, guest lecture	*MIT*
Apr 2022	**COGS005: introduction to language & linguistics**, guest lecture	*UC Merced (virtual)*
Mar 2022	**9.S52: language in the mind and brain**, guest lecture	*MIT*
Mar 2022	**STEAM weekend**, invited talk	*Dwight School (virtual)*
Mar 2021	**9.S52: language in the mind and brain**, guest lecture	*MIT (virtual)*
Feb 2021	**TEDx EF Academy**, alumna talk	*EF Academy (virtual)*

Leadership

2022 - now	**World Knowledge in Large Language Models**, team leader	*MIT*
2020 - 2022	**Generative Adversarial Collaboration**, team leader	*CCN Conference*
2018 - 2020	**MIT Grad Blog**, editor	*MIT*
2017 - 2019	**Peer Lectures**, organizer	*MIT*
2016 - 2017	**University of Miami Debate Team**, president	*University of Miami*
2016 - 2017	**Academic Resource Center**, lead tutor	*University of Miami*

Service

2023	**DEIJ in Human Research**, reading group leader	*MIT BCS*
2021 - 2023	**DEIJ Community of Practice**, lab representative	*MIT BCS*
2019 - 2023	**Application Assistance Program**, mentor	*MIT BCS*
2019 - 2021	**Resources for Easing Friction and Stress (REFS)**, member (peer support program)	*MIT BCS*
2018 - 2022	**Gradvocates**, member (grad student advocacy group)	*MIT BCS*

Grant proposal reviewer	National Science Foundation (ad hoc, 2023)
Journal reviewer	PNAS, Neuron, Psychonomic Bulletin & Review, Cortex, Cerebral Cortex, Behavioral and Brain Functions, PLOS One, Journal of Integrative Neuroscience, Aperture, Brain Structure and Function, Communications Biology
Assisted with journal reviews	PNAS, Nature Human Behavior, Nature Communications, Neuron, eLife, Journal of Neuroscience, Neuroimage, Neuropsychologia, Cerebral Cortex
Conference reviewer	Association for Computational Linguistics (ACL; ad hoc), Society for Neuroscience of Language (SNL), Cognitive Science (ad hoc), Conference on Computational Natural Language Learning (CoNLL), Cognitive Modeling and Computational Linguistics (CMCL), International Conference on Learning Representations (ICLR) brain2AI workshop

Research Mentorship

2023 - now	**George Flint**, undergraduate at UC Berkeley	*MIT*
2023 - now	**Josleen St Luce**, undergraduate	*MIT*
2022 - now	**Alyx Tanner**, research assistant	*MIT*
2021 - now	**David Oluigbo**, undergraduate	*MIT*
2021 - now	**Selena She**, undergraduate at Haverford College, now RA at MIT	*MIT*
2020 - 2021	**Zawad Chowdhury**, undergraduate	*MIT*
2020 - 2021	**Chandler Cheung**, high school student (now an undergraduate at UPenn)	*MIT*
2018 - 2023	**Yotaro Sueoka**, undergraduate (now a PhD student at Johns Hopkins University)	*MIT*

Professional Development

Summer School in Neuroscience and Philosophy (SSNAP) — *Duke University*
A two-week collaborative research program — *2023*

Diversity & Inclusion Badge Program — *University of Rhode Island*
A series of online DEI workshops — *2022*

Statistical Methods for Linguistics and Psychology — *University of Potsdam*
Online school. Track: advanced methods in frequentist statistics with Julia — *2021*

Neuromatch Academy: Deep Learning — *Neuromatch*
Online summer school on deep learning and its applications to neuroscience — *2021*

Hack for Inclusion — *MIT*
Social justice hackathon organized by MIT Sloan School of Management — *2021*

Semantic Processing and Semantic Knowledge — *Dartmouth University*
Workshop at the Center for Cognitive Neuroscience at Dartmouth — *2019*

Kaufman Certificate Teaching Program — *MIT*
Teaching course conducted by MIT's Teaching and Learning Lab — *2019*

Genetics & Neurobiology of Language — *Cold Spring Harbor Lab*
Summer school for early-career researchers — *2018*

Skills

Programming Languages	Python, R, MATLAB, Java
Data Collection Tools	fMRI, MEG, online and in-lab behavioral testing
Languages	Native Russian, intermediate Spanish and French, basic Japanese

Media Coverage & Outreach

Devil in the Stack: Searching for the Soul of the New Machine [upcoming] — *Grove Atlantic*
Andrew Smith — *Mar 2024*
- A popular science book chapter discussing Ivanova et al, 2020 (*eLife*), including a description of the author's visit to MIT

To build smarter chatbots, look to the brain — *Boston, MA*
TEDxBoston — *May 2023*
- A short TED-style summary of Mahowald, Ivanova et al, 2023 (*arXiv*)

Does ChatGPT "think"? A Cognitive Neuroscience Perspective — *TWIML*
This Week in Machine Learning (TWIML) podcast — *Mar 2023*
- A podcast episode discussing Mahowald, Ivanova et al, 2023 (*arXiv*)

To understand language models, we must separate 'language' from 'thought' — *Tech Talks*
Ben Dickson — *Feb 2023*
- Popular press article discussing Mahowald, Ivanova et al, 2023 (*arXiv*)

The Difference Between Speaking and Thinking — *The Atlantic*
Matteo Wong — *Jan 2023*
- Popular press article discussing Mahowald, Ivanova, et al, 2023 (*arXiv*)

This is your brain. This is your brain on code — *MIT News*
Steve Nadis — *Dec 2022*
- Popular press article discussing Srikant, Lipkin, et al, 2022 (*NeurIPS*)

Language and Thought in the Brain — *MIT*
Modus Mirandi podcast — *Aug 2022*
- A podcast episode discussing my PhD work
- Papers covered include Ivanova et al., 2021 (*Neurobiology of Language*) and Ivanova et al., 2020 (*eLife*)

Google's powerful AI spotlights a human cognitive glitch: mistaking fluent speech for fluent thought — *The Conversation*
Kyle Mahowald & Anna Ivanova — *Jun 2022*
- Popular press article; reached 200,000 views in the first month

Cracking the code: the neural basis of computer code comprehension — *MGH*
Science Rehashed podcast — *Apr 2021*
- A podcast episode discussing Ivanova et al., 2020 (*eLife*)

To the brain, reading computer code is not the same as reading language — *MIT News*
Anne Trafton — *Dec 2020*
- Popular press article discussing Ivanova et al., 2020 (*eLife*)
- The most popular MIT News article in December 2020, reaching over 100,000 views
- Multiple follow-up articles, including coverage in Mandarin, Spanish, Japanese, and Russian

Language is the scaffold of the mind *Nautilus*
Anna Ivanova *Sept 2019*

- Popular press article; reached 10,000 views in the first week