

Anna Ivanova

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Academic Appointment

Massachusetts Institute of Technology

Postdoctoral Associate (MIT Quest for Intelligence)

Cambridge, MA, USA

2022 - now

Principal investigators: Jacob Andreas, Evelina Fedorenko, Josh Tenenbaum, Roger Levy

Education

Massachusetts Institute of Technology

Ph.D. in Brain and Cognitive Sciences

Cambridge, MA, USA

2017 - 2022

Advisor: Evelina Fedorenko

University of Miami

B.S. in Neuroscience and Computer Science

Coral Gables, FL, USA

2013 - 2017

Research advisor: Lucina Uddin

Key Research Topics

- **The role of language** in broader human cognition
- The neural basis of **semantic processing**
- World knowledge in humans vs. **large language models**

Publications

JOURNAL PAPERS

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

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)

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
2021. No evidence for a special role of language in feature-based categorization.
 *Benn Y., ***Ivanova A. A.**, Clark O., Mineroff Z., Seikus C., Silva J. S., Varley R., Fedorenko E.
bioRxiv, 2021.03.18.436075

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

- Apr 2023 [SCHEDULED]. Workshop “AI and the Barrier of Meaning”, Santa Fe Institute, Santa Fe, NM
 Dissociating language and thought in large language models: a cognitive perspective.
- Mar 2023 [SCHEDULED]. Intel Deep Learning Journal Club (virtual; with K. Mahowald)
 Dissociating language and thought in large language models: a cognitive perspective.
- Feb 2023 [SCHEDULED]. KUIS AI seminar, Istanbul, Turkey (virtual)
 Dissociating language and thought in large language models: a cognitive perspective.
- Feb 2023 [SCHEDULED]. 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

- 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.

Teaching

TEACHING EXPERIENCE

Educational Studies Program

Volunteer Teacher

MIT
2018 - 2020

Classes: Introductory Neuroscience, Brain and Language, Public Speaking

MIT Department of Brain and Cognitive Sciences

Teaching Assistant

MIT
2018 - 2019

Classes: 9.46 – Neuroscience of Morality, 9.13 – The Human Brain

Academic Teaching Initiative

Computer Science Teacher

MIT
2017 - 2018

Class: AP Computer Science (Java)

Academic Resource Center

Peer Tutor

Subjects: Biology, Chemistry, Physics, Computer Science, Statistics

University of Miami

2014-2017

GUEST LECTURES

May 2023 (scheduled)	MIT Abstracts , invited talk	MIT Museum
Apr 2023 (scheduled)	COGS005: introduction to language & linguistics , guest lecture	UC Merced (virtual)
Mar 2023 (scheduled)	SHBT 205 Neural Coding and Perception of Sound , guest lecture	SHBT, Harvard/MIT
Mar 2023 (scheduled)	9.S52: language in the mind and brain , guest lecture	MIT
Feb 2023 (scheduled)	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)

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

Industry

Google, Inc.

Software Engineering Intern

Applied machine learning and natural language processing techniques to develop a ticket classification system.

Seattle, WA

2016

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

2021 - now	Diversity, Equity, Inclusion, and Justice , lab representative	MIT BCS
2019 - now	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

Journal reviewer	PNAS, Neuron, Psychonomic Bulletin & Review, Cortex, Cerebral Cortex, Behavioral and Brain Functions, PLOS One, Journal of Integrative Neuroscience, Aperture, 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

Professional Development

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

Research Mentorship

2021 - now	David Oluigbo , undergraduate	MIT
2021 - 2022	Selena She , undergraduate at Haverford College	MIT
2020 - 2021	Zawad Chowdhury , undergraduate	MIT
2020 - 2021	Chandler Cheung , high school student (now an undergraduate at UPenn)	MIT
2018 - now	Yotaro Sueoka , undergraduate (now a PhD student at Johns Hopkins University)	MIT

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

The Difference Between Speaking and Thinking	The Atlantic
Matteo Wong	Jan 2023
• Popular press article discussing Mahowald, Ivanova, et al, 2023 (<i>arXiv</i>)	
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 (<i>NeurIPS</i>)	
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 (<i>Neurobiology of Language</i>) and Ivanova et al., 2020 (<i>eLife</i>)	
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 (<i>eLife</i>)	

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

Anne Trafton

- 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

MIT News

Dec 2020

Language is the scaffold of the mind

Anna Ivanova

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

Nautilus

Sept 2019