

# Polyphony J. Bruna

PHD STUDENT · COGNITIVE AND INFORMATION SCIENCES

University of California, Merced

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## Education

Research Interests: Computational Modeling, Complex & Dynamical Systems, Coordination, Alignment, Philosophy

### University of California, Merced

Merced, CA

PHD COGNITIVE AND INFORMATION SCIENCES

Expected 2027

- Advisors: Christopher T. Kello and Michael J. Spivey
- Other committee members: Jeff Yoshimi

### University of California, Los Angeles

Los Angeles, CA

GRADUATE FELLOW, INSTITUTE FOR PURE AND APPLIED MATHEMATICS

Fall 2024

- Program: Mathematics of Intelligences

### Vassar College

Poughkeepsie, NY

BA COGNITIVE SCIENCE AND PHILOSOPHY

2018 - 2022

- Minor in Japanese
- Overall GPA: 3.99/4.00
- Honors: *Phi Beta Kappa, Sigma Xi, Psi Chi, cum laude generalis et cum laude in materia subiecta*
- Thesis advisors: Jan Andrews and Josh de Leeuw  
Title: "Leveraging Surprise in a Recurrent Neural Network to (de)Construct Morphological Complexity in Japanese"

## Professional Experience

- 2024 **Humane Studies Fellow**, Institute for Humane Studies, George Mason University
- 2022-2023 **Adolph Sutro Fellow**, Vassar College
- 2021-2022 **Intern**, Cognitive Science, Vassar College
- 2021 **Senior Researcher**, Undergraduate Research Summer Institute, Vassar College
- 2019, 2020 **Research Fellow**, Undergraduate Research Summer Institute, Vassar College
- 2018-2021 **Research Assistant**, Cognitive Science, Vassar College

## Publications

\* Denotes co-principal authorship

### IN PREP

- Bruna, P.** & Gyllingberg, L. (2025). *Cognition without neurons: modelling anticipation in a basal reservoir computer*.  
<https://arxiv.org/abs/2505.02114>
- Kello, C. & **Bruna, P.** (2024). *Emergent Assembly of Mental Lexicon Functions in LLMs*.  
[https://osf.io/preprints/psyarxiv/gka2j\\_v1](https://osf.io/preprints/psyarxiv/gka2j_v1)

### PUBLISHED

- Bruna, P.** and Kello, C. (2025). Least Effort and Alignment in Task-Oriented Communication. *Cognitive Science*, 49, Article e70062. <https://doi.org/10.1111/cogs.70062>
- Abbas, M., Alharthi, D., Balbas, J., Beckelhymer, D., Beylkin, G., **Bruna, P.**, Cartmill, E., Chormai, P., Corea, F., Dai, X., Das, P., Dipoppa, M., Eberle, O., El Hady, A., Evans, J., Fegghi, E., Flack, J., Flores, C., Foster, J., ... Zhu, Y. (2021). White Paper: "Mathematics of Intelligences." *Institute for Pure and Applied Mathematics*. <https://www.ipam.ucla.edu/reports>
- de Leeuw, J. R., Andrews, J., Barney, L., Bigler, M., **Bruna, P.**, Chen, Y., Cherry, R., Dowie, D. R., Forbes, E., Haffey, B., Hu, X., Jaklitsch, M., Leopold, N., Lewis, C., MacDonald, D., McShaffrey, C., Nakayama, K., Olstad, W., Peng, R., ... Zhang, L. (2021). Words May Jump-Start Meaning More Than Vision: A Non-Replication of Early ERP Effects in Boutonnet and Lupyan (2015). *Collabra: Psychology*, 7(1). <https://doi.org/10.1525/collabra.29763>

## PROCEEDINGS

Kello, C. & **Bruna, P.** (2024). Emergent Mental Lexicon Functions in ChatGPT. *Proceedings of the Annual Meeting of the Cognitive Science Society*, 46. <https://escholarship.org/uc/item/5m9098b5>

\*Rane, S., \***Bruna, P.**, Sucholutsky, I., Kello, C., & Griffiths, T. (2023). Concept alignment. *1st NeurIPS Workshop on AI meets Moral Philosophy and Moral Psychology (MP2)*. <https://arxiv.org/abs/2401.08672>

## NON-ACADEMIC ARTICLES

2019 **Vassar College Journal of Philosophy**, "Taking Back Philosophy: A Multicultural Manifesto", Book Review

## Presentations

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\* Presenting author(s); \* Mentored undergraduate

## CONTRIBUTED TALKS

\***Bruna, P.** & Gyllingberg, L. 2025. *Basal Reservoir Computing*. Philosophy and Cognitive Science Working Group, University of California, Merced.

\***Bruna, P.** & \*Gyllingberg, L. 2024. *Non-neural Pattern Completion in an Adaptive Reservoir Computer*. Mathematics of Intelligences Culminating Workshop at Lake Arrowhead, Institute for Pure and Applied Mathematics, University of California, Los Angeles.

\***Bruna, P.** & Kello, C. 2024. *Least Effort and Alignment in Task-Oriented Communication*. Mathematics of Intelligences Seminar Series, Institute for Pure and Applied Mathematics, University of California, Los Angeles.

Rane, S., \***Bruna, P.**, Sucholutsky, I., Kello, C., & Griffiths, T. 2024. *Concept Alignment*. Mathematics of Intelligences Working Group on Architecture and Evaluation of Generative AI, Institute for Pure and Applied Mathematics, University of California, Los Angeles.

\***Bruna, P.** 2024. *Falandays-style Reservoir Networks*. Mathematics of Intelligences Working Group on Ecological and Homeostatic Intelligence, Institute for Pure and Applied Mathematics, University of California, Los Angeles.

Rane, S., \***Bruna, P.**, Sucholutsky, I., Kello, C., & Griffiths, T. 2024. *Concept Alignment*. Philosophy and Cognitive Science Working Group, University of California, Merced.

\***Bruna, P.**, Ryskin, R., & Spivey, M. J. 2023. *Semantics and Syntax Co-emerge in Adaptive Reservoir Network Dynamics*. Diverse Intelligences Summit, University of St. Andrews, Scotland.

\***Bruna, P.** 2020. *Hearing That It Is Silent: How to Hallucinate a Non-Perception*. 10th Annual Mid-Hudson Valley Undergraduate Philosophy Conference, Marist College, Poughkeepsie, NY. (Canceled due to COVID-19)

## CONTRIBUTED POSTERS

\*Gyllingberg, L., Tian, Y., Sumpter, D., & **Bruna, P.** 2025. *Oscillations and Adaptation: Mathematical Models of Non-Neural Cognition*. Biological Systems that Learn, National Institute for Theory and Mathematics in Biology, Chicago, IL.

\***Bruna, P.** & \*Kello, C. 2024. *Alignment Through Dyadic Least Effort in Task-Oriented Conversations*. 65th Annual Meeting of the Psychonomic Society, New York City, NY.

\***Bruna, P.** & Kello, C. 2024. *Alignment Through Dyadic Least Effort in Task-Oriented Conversations*. Modeling Multi-Scale Collective Intelligences, Institute for Pure and Applied Mathematics, University of California, Los Angeles.

\*Kello, C. & \***Bruna, P.** 2024. *Emergent Mental Lexicon Functions in ChatGPT*. 46th Annual Conference of the Cognitive Science Society, Rotterdam, Netherlands.

\*\*Thao, K., **Bruna, P.**, & Kello, C. 2024. *Exploring Emergent Embodied Intelligence in Large Language Models: Insights from ChatGPT-4*. 15th Annual California Cognitive Science Conference, Berkeley, CA.

\*Rane, S. & \***Bruna, P.** 2023. *Concept alignment*. 1st NeurIPS Workshop on AI meets Moral Philosophy and Moral Psychology (MP2), New Orleans, LA.

\*\*Leshock, E., \*\*Pena, Y., **Bruna, P.**, & Andrews, J. 2021. *Learned Categorical Perception with Artificially Generated Faces*. 36th Annual URSI Symposium, Vassar College, Poughkeepsie, NY.

\*Bigler, M. & \***Bruna, P.** 2020. *Probing the Methodology and Interpretation of Learned Categorical Perception Research*. 35th Annual URSI Symposium, Vassar College, Poughkeepsie, NY.

\*Bruna, P. & \*Marks, P. 2019. *Psychophysical Adaptive Procedure: Developing a New, Generalizable Method*. 34th Annual URSI Symposium, Vassar College, Poughkeepsie, NY.

## INVITED TALKS

Fall 2024. *Least Effort and Alignment in Task-Oriented Communication*. Dept. of Cognitive Science, Vassar College, Poughkeepsie, NY.

## Honors

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2025 Graduate Student Highlight ("Rising Star: How Life's Journey Shaped a Cognitive Scientist's Path to Discovery"),  
<https://graduatedivision.ucmerced.edu/Polyphony-J-Bruna>

2022 Best Technical Write-Up, Mid-Hudson IEEE Undergraduate Capstone Project Awards

## Awards, Fellowships, & Grants

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\* Awarded but declined

2025	Summer Research Fellowship, University of California, Merced	\$ 5,400
	Hayek Fund, Institute for Humane Studies	\$ 3,475
	Graduate Workshop in Computational Social Science Scholarship, Santa Fe Institute	\$ 1,000
	Hayek Fund, Institute for Humane Studies	\$ 2,400
2024	Humane Studies Fellowship, Institute for Humane Studies	\$ 5,000
	Fall Research Fellowship, University of California, Merced	\$ 6,000
	MacKenzie Scott Graduate Student Travel Award, University of California, Merced	\$ 1,000
	Travel Award, University of California, Merced	\$ 1,800
	Summer Research Fellowship, University of California, Merced	\$ 5,475
2023	Alumni Research Award, Diverse Intelligences Summer Institute	\$ 750
	Fall Research Fellowship, University of California, Merced	\$ 22,500
	Travel Award, University of California, Merced	\$ 800
	Summer Research Fellowship, University of California, Merced	\$ 1,600
2022	Chancellor's Recruitment Fellowship, University of California, Merced	\$ 45,000
	*Foreign Language and Area Studies (FLAS) Fellowship, U.S. Department of Education	\$ 22,500
	Adolph Sutro Fellowship, Vassar College	\$ 10,000
	The Jamie Nisse Greenberg Philosophy Prize, Vassar College	\$ 900
	Critical Language Scholarship for advanced Japanese, alternate, U.S. Department of State; American Councils for International Education	
2021	Frances Lehman Loeb 1928 Scholarship, Vassar College	\$ 44,000
	Summer Research Fellowship, Vassar College	\$ 4,000
2020	Frances Lehman Loeb 1928 Scholarship, Vassar College	\$ 44,000
	Undergraduate Research Summer Institute Fellowship, Vassar College	\$ 5,000
2019	Frances Lehman Loeb 1928 Scholarship, Vassar College	\$ 42,500
	Undergraduate Research Summer Institute Fellowship, Vassar College	\$ 5,000
2018	1956 Memorial Scholarship, Vassar College	\$ 42,000

## Teaching Experience

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- Spr. 2025 **Critical Reasoning**, Teaching Assistant, *Philosophy, University of California, Merced*  
Spr. 2024 **Contemporary Moral Problems**, Teaching Assistant, *Philosophy, University of California, Merced*  
Spr. 2022 **Introduction to Cognitive Science**, Teaching Assistant, *Cognitive Science, Vassar College*  
Fall 2021 **Introduction to Cognitive Science**, Teaching Assistant, *Cognitive Science, Vassar College*

## Outreach & Professional Development

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### WORKSHOPS & TRAINING

- 2025 **Santa Fe Institute**, Graduate Workshop in Computational Social Science, *Santa Fe, New Mexico*  
**Complexity Science Hub**, Winter School on Complex Systems in Our Changing World, *Vienna, Austria*
- 2024 **Institute for Pure and Applied Mathematics**, Mathematics of Intelligences Culminating Retreat, *UCLA Lake Arrowhead Lodge*  
**Institute for Pure and Applied Mathematics**, Modeling Multi-Scale Collective Intelligences, *University of California, Los Angeles*  
**Berggruen Institute**, Future Humans Workshop on Computational Consciousness, *Beverly Hills, California*  
**Institute for Pure and Applied Mathematics**, Naturalistic Approaches to Artificial Intelligence, *University of California, Los Angeles*  
**Institute for Humane Studies**, Aristotle and Human-Centered AI, *Webinar*  
**Institute for Pure and Applied Mathematics**, Theory and Practice of Deep Learning, *University of California, Los Angeles*  
**Dynamic Interactions and Methodologies Symposium**, *University of California, Los Angeles*  
**Institute for Pure and Applied Mathematics**, Analyzing High-dimensional Traces of Intelligent Behavior, *University of California, Los Angeles*
- 2023 **Sante Fe Institute**, Complexity-GAINs International Summer School on Intelligence and Representation, *Isaac Newton Institute for Mathematical Sciences, University of Cambridge*  
**Diverse Intelligences Summer Institute**, *University of St. Andrews*
- 2022 **Phi Beta Kappa**, Key Connections, *Webinar*
- 2020 **Center for Philosophy of Science**, Pittsburgh Summer Program in Philosophy of Science and Specialized Sciences, *University of Pittsburgh and Carnegie Mellon University*

### SERVICE POSITIONS

- 2025 **Brownbag Organizer**, Cognitive and Information Sciences, *University of California, Merced*  
**Book Club President**, Cognitive and Information Sciences, *University of California, Merced*
- 2023-2024 **Graduate Student Chair**, Cognitive and Information Sciences, *University of California, Merced*  
**Research Mentor**, Learning Aligned Employment Program, *University of California, Merced*
- 2021 **Research Mentor**, Undergraduate Research Summer Institute, *Vassar College*
- 2018-2019 **Editor**, Vassar College Journal of Philosophy, *Vassar College*

## PEER REVIEW

Cognitive Science  
Minds and Machines  
Journal of Experimental Psychology: General

## PROFESSIONAL MEMBERSHIPS

Phi Beta Kappa, Academic Honor Society  
Sigma Xi, The Scientific Research Honor Society  
Psi Chi, International Honor Society in Psychology  
Cognitive Science Society  
MetaSTEM, Research Group on the Philosophy and Science of Science  
Merced Complexity Lab

## SKILLS

Languages: English (native), Japanese (conversational)  
Programming: Python, R, JavaScript, HPC parallel computing  
Technical: Neural networks, Information theory, Bayesian statistics, Data visualization