Joshua S. Rule

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Research Interests

Computational cognitive science, conceptual development, mathematical development, probabilistic modeling, program induction, programming language theory, foundations of computation

Academic Positions

2020–Pres. University of California, Berkeley
Postdoctoral Scholar
Advisors: Alison Gopnik, Steven T. Piantadosi

2013–2020 Massachusetts Institute of Technology
Graduate Student
Advisor: Joshua B. Tenenbaum

2010–2013 Georgetown University
Research Assistant & Lab Manager
Advisor: Maximilian Riesenhuber

2009 University of Illinois, Urbana-Champaign
Research Assistant
Advisor: Dan Roth

Education

2020 Massachusetts Institute of Technology
PhD, Brain & Cognitive Sciences, Thesis Advisor: Joshua B. Tenenbaum

2009 University of Illinois Urbana-Champaign
BS, Computer Science, Summa cum Laude
BA, Philosophy, Magna cum Laude

Awards & Honors

2016 Angus MacDonald Award for Excellence in Undergraduate Teaching, MIT
2015 Glushko Student Travel Award, Cognitive Science Society
2014 Graduate Research Fellowship, National Science Foundation
Eugene Stark Graduate Fellowship, MIT
2013 Leventhal Graduate Fellowship, MIT
2010 University Honors, UIUC, top 3% of graduating class

Journal Articles & Book Chapters

Piantadosi, S. T., Muller, D. C. Y., Rule, J. S., Kaushik, K., Gorenstein, M., Leib, E. R., & Sanford, E. (under review). How cognitive science (probably) figured out concepts.

Rule, J. S., Goddu, M. K., Chu, J., Pinter, V., Reagan, E. R., Bonawitz, E., Gopnik, A., & Ullman, T. (under review). Winning isn't fun: Children selectively manipulate task difficulty when "playing for fun" vs. "trying to win".

Rule, J. S., & Piantadosi, S. T. (under review). The end of radical concept nativism.

Rule, J. S., Piantadosi, S. T., & Tenenbaum, J. B. (under review). Efficient learning of symbolic concepts via metaprogram search.

Piantadosi, S. T., Rule, J. S., & Tenenbaum, J. B. (2024). Learning as Bayesian inference over programs. In T. L. Griffiths, N. Chater, & J. B. Tenenbaum (Eds.), Bayesian models of cognition: Reverse-engineering the mind. MIT Press.

Srivastava, A., Rastogi, A., Rao, A., Shoeb, A. A. M., Abid, A., Fisch, A., Brown, A. R., Santoro, A., Gupta, A., Garriga-Alonso, A., Kluska, A., Lewkowycz, A., Agarwal, A., Power, A., Ray, A., Warstadt, A., Kocurek, A. W., Safaya, A., Tazarv, A., ... Wu, Z. (2023). Beyond the imitation game: Quantifying and extrapolating the capabilities of language models. Transactions on Machine Learning Research.

Rule, J. S., & Riesenhuber, M. (2021). Leveraging prior concept learning improves ability to generalize from few examples in computational models of human object recognition. Frontiers in Computational Neuroscience.

Rule, J. S., Piantadosi, S. T., & Tenenbaum, J. B. (2020). The child as hacker. Trends in Cognitive Sciences.

Glezer, L. S., Kim, J., Rule, J., Jiang, X., & Riesenhuber, M. (2015). Adding words to the brain's visual dictionary: Novel word learning selectively sharpens orthographic representations in the VWFA. Journal of Neuroscience, 35(12).

Conference Papers

Rule, J., Schulz, E., Piantadosi, S. T., & Tenenbaum, J. B. (2018). Learning list concepts through program induction. Proceedings of the Cognitive Science Society.

Rule, J., Dechter, E., & Tenenbaum, J. B. (2015). Representing and learning a large system of number concepts with Latent Predicate Networks. Proceedings of the Cognitive Science Society.

Sammons, M., Vydiswaran, V. G. V., Vieira, T., Johri, N., Chang, M.-W., Goldwasser, D., Srikumar, V., Kundu, G., Tu, Y., Small, K., Rule, J., Do, Q., & Roth, D. (2009). Relation alignment for textual entailment recognition. Proceedings of the Textual Alignment Conference.

Abstracts & Posters

Rule, J. S., & Piantadosi, S. T. (2023). Algorithmic foundations of mathematical development [Symposium chair]. Proceedings of the Mathematical Cognition and Learning Society.

Goddu, M. K., Rule, J. S., Bonawitz, E., Gonik, A., & Ullman, T. (2022a). Fun isn't easy: Children optimize for difficulty when "playing for fun" vs. "playing to win" in a game design task [Talk and abstract]. Budapest CEU Conference on Cognitive Development Programs and Abstracts.

Goddu, M. K., Rule, J. S., Bonawitz, E., Gonik, A., & Ullman, T. (2022b). Fun isn't easy: Children optimize for difficulty when "playing for fun" vs. "playing to win" in a game design task [Poster and abstract]. Cognitive Development Society Abstract Book.

Goddu, M. K., Rule, J. S., Bonawitz, E., Gonik, A., & Ullman, T. (2022c). Fun isn't easy: Children optimize for difficulty when "playing for fun" vs. "playing to win" in a game design task [Poster and abstract]. Society for Research in Child Development's Learning through Play and Imagination: Expanding Perspectives.

Rule, J. S., Piantadosi, S. T., & Tenenbaum, J. B. (2022). Learning as programming: Efficient search in models of human concept learning [Talk and abstract]. Proceedings of the Cognitive Science Society.

Rule, J. S., Piantadosi, S. T., & Tenenbaum, J. B. (2019). Learning a novel rule-based conceptual system [Poster and abstract]. Proceedings of the Cognitive Science Society.

Dechter, E., Rule, J., & Tenenbaum, J. B. (2015). Latent Predicate Networks: Concept learning with probabilistic context-sensitive grammars [Poster and abstract]. Proceedings of the AAAI Spring Symposium Series.

Dechter, E., Rule, J., & Tenenbaum, J. B. (2014). Unsupervised learning of probabilistic programs with Latent Predicate Networks [Poster and abstract]. Proceedings of the NIPS Workshop on Probabilistic Programming.

Glezer, L. S., Kim, J. S., Rule, J., Jiang, X., & Riesenhuber, M. (2013). Novel word learning selectively sharpens orthographic representations in the VWFA [Poster and abstract]. Neuroscience 2013 Abstracts.

Dissertation

2020 The child as hacker: Building more human-like models of learning
Committee: Susan Carey, Steven T. Piantadosi, Laura Schulz (chair), Joshua B. Tenenbaum

Invited Talks

Oct. 2023 The child as hacker, Dagstuhl, Approaches and Applications of Inductive Programming
Apr. 2022 The child as hacker, UC Berkeley, CogSci C131 guest lecture
Oct. 2021 The child as hacker, UC Berkeley, Computational Cognitive Neuroscience Lab
Mar. 2021 Learning as hacking, NSF Expeditions: Understanding the world through code, Cognitive science working group
Jan. 2021 The child as hacker, MPI Tübingen, Computational Principles of Intelligence Lab
Oct. 2020 The child as hacker, UC Berkeley, Institute for Human Development & Developmental Psychology Colloquium
Feb. 2019 Learning in a flexible language of thought, UC Berkeley, Computation and Cognition Lab
Jul. 2018 Learning list concepts through program induction, Cognitive Science Society, Learning as Program Induction Workshop
May 2018 Learning structured concepts through program induction, MIT, Brain and Cognitive Sciences CogLunch
Jul. 2015 Representing and learning a large system of number concepts with Latent Predicate Networks, Cognitive Science Society

Reviewing

CogSci, Trends in Cognitive Sciences, IJCAI-ECAI Workshops, Cognition, OpenMind, eLife

Mentoring

2023 – Pres. Justine Krieger (Project Manager)
2022 Li Chenyi (BS), MSCS student at NYU Tandon
2020 – 2021 Shardul Chiplunkar (BS), PhD student at EFPL, Switzerland
2018 – 2019 Nicholas Alvarado (BS), Software Engineer, Google
2017 Benjamin Kaplan (BS), Data, Thrive Capital

Teaching

Fall 2015	9.660 - Computational Cognitive Science Teaching Assistant with Joshua Tenenbaum, MIT
Fall 2014	9.660 - Computational Cognitive Science Teaching Assistant with Joshua Tenenbaum, MIT
Spring 2009	CS225 - Data Structures Teaching Assistant with Cinda Heeren, UIUC
Fall 2008	CS225 - Data Structures Teaching Assistant with Cinda Heeren, UIUC
Spring 2008	CS225 - Data Structures Teaching Assistant with Cinda Heeren, UIUC