Judith E. Fan

Assistant Professor
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Academic Positions

2019 – *Assistant Professor*, Psychology, University of California, San Diego
Affiliated Faculty, Neurosciences Graduate Program, Halıcıoğlu Data Science Institute, The Design Lab, Computational Social Sciences Program

2017—2019 *Postdoctoral Scholar*, Psychology, Stanford University

2016 *Postdoctoral Research Associate*, Neuroscience Institute, Princeton University

Education

2011—2016 *PhD*, Psychology, Princeton University

2006—2010 *AB*, Neurobiology and Statistics, Harvard College
summa cum laude

Honors

2021 Outstanding Faculty Mentorship Award, UC San Diego Graduate Student Association

2017 Robert J. Glushko Prize for Outstanding Doctoral Dissertation, Cognitive Science Society

2017 Finalist for the NIH Director's Early Independence Award

2015 Computational Modeling Paper Prize in Perception & Action, Cognitive Science Society

2013 Early Graduate Student Researcher Award, American Psychological Association

2013 Object Perception, Attention, and Memory (OPAM) Student Travel Award

2011-2012 Walker McKinney '50 Life Sciences Fellowship, Princeton University

2009 Phi Beta Kappa, Harvard University

2007-2008 John Harvard Scholar, Harvard University (top 5% of class)

2006-2007 Harvard College Scholar, Harvard University (top 10% of class)

2006 Presidential Scholar, U.S. Department of Education (1 of 2 selected from state)

Research Grants

2021-2026 Faculty Early Career Development Program (CAREER) Award
Source: National Science Foundation
Title: Mechanisms enabling the flexible expression of visual concepts
Role: PI

2021-2023 Science of Autonomy Research Grant
Source: Office of Naval Research
Title: Harnessing human intelligence for adaptive human-robot collaboration
Role: co-PI, with Dorsa Sadigh (PI)

2020-2021 Course Development and Instructional Improvement Program Grant
Source: UC San Diego
Title: Enhancing the Psychology core methods curriculum: a new emphasis on computational literacy, open-science practices, and project-based collaboration
Role: PI, with Emma Geller and Celeste Pilegard (co-PIs)

2015-2016 Council of the Humanities David A. Gardner '69 Magic Project Grant
Source: Princeton University
Title: Drawing as a window into the mind
Role: PI, with Nick Turk-Browne (co-PI)

Fellowships

2015-2016 Cognitive Science Graduate Student Fellowship, Princeton University

2015-2016 Cognitive Science Graduate Research Grant, Princeton University

2015-2016 Council on Science and Technology Research Grant, Princeton University

2013-2016 Graduate Research Fellowship, National Science Foundation

2011-2012 Andrew W. Mellon Foundation Research Fellowship in Cultural Policy, Princeton University

2010-2011 Michael C. Rockefeller Foundation Memorial Fellowship, Harvard University

2009 Mary G. Roberts Mind/Brain/Behavior Thesis Fellowship, Harvard University

2009 Program for Research in Science and Engineering Fellowship, Harvard University

2008 Weissman International Internship Program Fellowship, Harvard University

2008 Lowe Career Decision Loan Fund Recipient, Harvard University

2007 Museum of Comparative Zoology Grants-in-Aid Recipient, Harvard University

2007-2009 Harvard College Research Program Fellowship, Harvard University

2006-2010 T.W. Lewis Foundation Scholar

2006-2010 Robert C. Byrd Scholar

Publications

2021 *Bear, D., *Wang, E., *Mrowca, D., *Binder, F., Tung, H.-Y., RT, P, Holdaway, C., Tao, S., Smith, K., Sun, F.-Y., Li, F.-F., Kanwisher, N., Tenenbaum, J., **Yamins, D., and ****Fan, J.** (2021). Physion: Evaluating Physical Prediction from Vision in Humans and Machines. *NeurIPS 2021.*

2021 Binder, F., Mattar, M., Kirsh, D. and **Fan, J.** (2021). Visual scoping operations for physical assembly. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 Holdaway, C., Bear, D., Radwan, S., Frank, M., Yamins, D., and **Fan, J.** (2021). Measuring and predicting variation in the interestingness of physical structures. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 Holt, S., Barner, D., and **Fan, J.** (2021). Improvised numerals rely on 1-to-1 correspondence. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 Huey, H., Walker, C., and **Fan, J.** (2021). How do the semantic properties of visual explanations guide causal inference? *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 Kachergis, G., Radwan, S., Long, B., **Fan, J.**, Lingelbach, M., Bear, D., Yamins, D., and Frank, M. (2021). Predicting children's and adults' preferences in physical interactions via physics simulation. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 *McCarthy, W., *Hawkins, R., Wang, H., Holdaway, C., and **Fan, J.** (2021). Learning to communicate about shared procedural abstractions. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 McCarthy, W., Mattar, M., Kirsh, D. and **Fan, J.** (2021). Connecting perceptual and procedural abstractions in physical construction. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 Wang, H., Polikarpova, N., and **Fan, J.** (2021). Learning part-based abstractions for visual object concepts. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 Wang, H., Vul, E., Polikarpova, N., and **Fan, J.** (2021). Theory acquisition as constraint-based program synthesis. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2021 Yang, J. and **Fan, J.** (2021). Visual communication of object concepts at different levels of abstraction. *Proceedings of the 43rd Annual Meeting of the Cognitive Science Society.*

2020 McCarthy, W., Holdaway, C., Hawkins, R., and **Fan, J.** (2020). Emergence of compositional abstractions in human collaborative assembly. *NeurIPS Workshop on Object Representations for Learning and Reasoning.*

2020 McCarthy, W., and **Fan, J.** (2020). Rapid policy updating in human physical construction. *ICML Workshop on Object-Oriented Learning: Perception, Representation, and Reasoning.*

2020 Wang, H., and **Fan, J.** (2020). Library learning for structured object concepts. *ICML Workshop on Object-Oriented Learning: Perception, Representation, and Reasoning.*

2020 McCarthy W., Kirsh D., *&* **Fan J.** (2020). Learning to build physical structures better over time. *Proceedings of the 42nd Annual Meeting of the Cognitive Science Society.*

2020 **Fan J.**, Wammes J., Gunn J., Yamins D., Norman K., Turk-Browne N. (2020). Relating visual production and recognition of objects in human visual cortex. *Journal of Neuroscience.*

2020 Xu T., **Fan J.**, *&* Dow S. (2020). Schema and Metadata Guide the Collective Generation of Relevant and Diverse Insights. *Proceedings of the 8th AAAI Conference on Human Computation and Crowdsourcing.*

2019 **Fan J.**, Hawkins R., Wu M., *&* Goodman N. (2019). Pragmatic inference and visual abstraction enable contextual flexibility during visual communication. *Computational Brain & Behavior.*

2019 Achlioptas, P., **Fan J.**, Hawkins R., Guibas L., *&* Goodman N. (2019). GeoGlot: Learning to Ground Referential Language in Geometry. *International Conference on Computer Vision (ICCV).*

2019 Hawkins R.*, Sano, M.*, Goodman N., *&* **Fan J.** (2019). Graphical convention formation during visual communication. *Proceedings of the 41st Annual Meeting of the Cognitive Science Society.*

2019 Mukherjee K., Hawkins R.., *&* **Fan J.** (2019). Communicating semantic part information in drawings. *Proceedings of the 41st Annual Meeting of the Cognitive Science Society.*

2019 Long B., **Fan J.**, Chai R., *&* Frank M. (2019). Developmental changes in the ability to draw distinctive features of object categories. *Proceedings of the 41st Annual Meeting of the Cognitive Science Society.*

2019 **Fan J.**, Dinculescu M., *&* Ha D. (2019). Collabdraw: An environment for collaborative sketching with an artificial agent. *Proceedings of the 2019 ACM SIGCHI Conference on Creativity and Cognition.*

2018 Cullen S., **Fan J.**, van der Brugge E., *&* Elga A. (2018). Improving analytical reasoning and argument understanding: A quasi-experimental field study of argument visualization. *npj Science of Learning.*

2018 **Fan J.**, Yamins D., *&* Turk-Browne, N. (2018) Common object representations for visual production and recognition. *Cognitive Science.*

2018 Long, B., **Fan J.**, *&* Frank M. (2018) Drawing as a window into developmental changes in object representations. *Proceedings of the 40th Annual Conference of the Cognitive Science Society.*

2016 **Fan J.**, Hutchinson, J., and Turk-Browne, N. (2016) When past is present: Substitutions of long-term memory for sensory evidence in perceptual judgments. *Journal of Vision.* 16(8), 1-12.

2016 **Fan J.** and Turk-Browne, N. (2016) Incidental biasing of attention from long-term memory. *Journal of Experimental Psychology: Learning, Memory, & Cognition.* 42(6), 970-977.

2016 **Fan J.**, Turk-Browne, N., *&* Taylor, J. (2016) Error-driven learning in statistical summary perception. *Journal of Experimental Psychology: Human Perception and Performance*, 42(2), 266–280.

2015 **Fan J.**, Yamins D., *&* Turk-Browne, N. (2015) Common object representations for visual recognition and production. *Proceedings of the 37th Annual Meeting of the Cognitive Science Society.*

2015 **Fan J.** (2015) Drawing to learn: how producing graphical representations enhances scientific thinking. *Translational Issues in Psychological Science.* 1(2), 170-181.

2014 **Fan J.** and Suchow, J. (2014) The crowd is self-aware. *Behavioral and Brain Sciences*, 37(1), 81-82.

2013 **Fan J.** and Turk-Browne, N. (2013) Internal attention to features in visual short-term memory guides object learning. *Cognition*, 129(2), 292-308.

2013 **Fan J.**, Turk-Browne, N., *&* Taylor, J. (2013) Feedback-driven tuning of statistical summary representations. *Visual Cognition*, 21(6), 685-689.

2013 **Fan J.** (2013) Can ideas about food inspire real social change? The case of Peruvian gastronomy. *Gastronomica*, 13(2), 31-42.

2010 Strange B., Kroes M., **Fan J.**, *&* Dolan R. (2010) Emotion causes targeted forgetting of established memories. *Frontiers in Behavioral Neuroscience.* 4, 1-13.

2009 Sharot T., Shiner T. Brown A., **Fan J.**, *&* Dolan, R. (2009) Dopamine enhances expectation of pleasure in humans. *Current Biology*, 24(19), 2077-1080.

Invited Colloquia

2021 Cognitive technologies for visual communication
CogSci 2021 Workshop: Symbolic and sub-symbolic systems in people and machines, July 2021.

2021 Drawing games as a window into concepts, communication, and collaboration.
CogSci 2021 Workshop: Using games to understand intelligence, July 2021.

2021 Cognitive technologies for making the invisible visible
Diverse Intelligences Summer Institute, July 2021.

2021 Relating visual production and recognition in human visual cortex.
Wellcome Trust Centre for Neuroimaging, June 2021.

2021 Cognitive tools for making the invisible visible.
Workshop on Sketch-Oriented Deep Learning, CVPR, June 2021.

2021 Cognitive tools for learning and communication.
Stevens Institute of Technology, March 2021.

2021 Cognitive tools for learning and communication.
Nokia Bell Labs, February 2021.

2021 Cognitive tools for learning and communication.
Department of Cognitive, Linguistic & Psychological Sciences, Brown University, February 2021.

2020 Cognitive tools for learning and communication.
Institute for Cognitive Science, University of Michigan, September 2020.

2020 Cognitive tools for making the invisible visible.
Department of Philosophy, University of Southern California, June 2020.

2020 Emergence of graphical communication protocols.
Robotics: Science & Systems Workshop: Emergent Behaviors in Human-Robot Systems, July 2020.

2020 Cognitive tools for making the invisible visible.
ICLR Workshop on Bridging AI and Cognitive Science, Addis Ababa, Ethiopia, April 2020.

2019 Cognitive tools for learning and communication.
Design @ Large, UC San Diego, La Jolla, CA, May 2019.

2019 Cognitive tools for learning and communication.
Halıcıoğlu Data Science Institute, UC San Diego, La Jolla, CA, January 2019.

2018 Cognitive tools for learning and communication.
Hult International Business School, San Francisco, CA, April 2018.

2018 Drawing as a window into the mind.
Netflix, Los Gatos, CA, April 2018.

2018 Cognitive tools for learning and communication.
University of California Berkeley, Berkeley, CA, February 2018.

2018 Cognitive tools for learning and communication.
University of California San Diego, La Jolla, CA, January 2018.

2018 Cognitive tools for learning and communication.
Indiana University, Bloomington, IN, January 2018.

2017 Drawing as a window into the mind.
Rhode Island School of Design, Providence, RI, November 2017.

2017 Role of cognitive actions in learning.
Annual Meeting of the Cognitive Science Society, London, UK, July 2017.

2016 Drawing as a window into the mind.
Princeton University Art Museum, Princeton, NJ, October 2016.

2016 Drawing as cognitive technology.
Drawing and the Brain Symposium, Indiana University Center for Art + Design, Bloomington, IN, April 2016.

2016 Drawing to learn: how visual production refines object representations.
Indiana University in Bloomington, IN, April 2016.

2015 Drawing as a window into learning.
Educational Testing Service, Princeton, NJ, October, 2015.

2015 Common object representations for visual recognition and production.
University of British Columbia, Vancouver, BC, March, 2015.

2015 Drawing as a window into the mind.
Smart Design, New York City, NY, March, 2015.

2013 Can ideas about food lead to real social change?
Princeton Woodrow Wilson School Bernstein Gallery Art Exhibit on "Cooking for Change", Princeton, NJ, May 2013.

2011 Apégate a la causa! La gastronomía peruana como fenómeno social total.
Faculty of Social Sciences, Pontificia Universidad Católica del Perú, Lima, Peru, July 2011.

Selected Conference Presentations

2021 McCarthy W., Kirsh D., *&* Fan J. (2021). Exploring the role of prototyping in physical construction. Poster to be presented at the *Society for Philosophy and Psychology Annual Meeting.*

2020 McCarthy W., Kirsh D., *&* **Fan J.** (2020). Learning to build physical structures better over time. Talk presented at the *42nd Annual Meeting of the Cognitive Science Society.*

2020 McCarthy, W., and **Fan, J.** (2020). Rapid policy updating in human physical construction. Spotlight talk presented at the *ICML Workshop on Object-Oriented Learning: Perception, Representation, and Reasoning.*

2020 Wang, H., and **Fan, J.** (2020). Library learning for structured object concepts. Poster presented at the *ICML Workshop on Object-Oriented Learning: Perception, Representation, and Reasoning.*

2019 Fan J. *&* Hawkins R. (2019). Visual content and social context jointly determine pictorial meaning. Poster presented at the *Society for Philosophy and Psychology Annual Meeting.*

2019 Fan J., Dinculescu M., *&* Ha D. (2019). collabdraw: an environment for collaborative sketching with an artificial agent. Poster presented at the *2019 ACM SIGCHI Conference on Creativity and Cognition.*

2019 Hawkins R.*, Sano, M.*, Goodman N., Fan J. (2019). Graphical convention formation during visual communication. Talk presented at the *41st Annual Meeting of the Cognitive Science Society.* * *equal contribution; Sayan Gul Travel Award*

2019 Mukherjee K., Hawkins R.., *&* Fan J. (2019). Communicating semantic part information in drawings. Poster presented at the *41st Annual Meeting of the Cognitive Science Society.*

2019 Long B., Fan J., Chai R., *&* Frank M. (2019). Developmental changes in the ability to draw distinctive features of object categories. Talk presented at the *41st Annual Meeting of the Cognitive Science Society.*

2018 Fan J., Hawkins R., Wu M., *&* Goodman, N. Modeling contextual flexibility in visual communication. Talk presented at the *Vision Sciences Society Annual Meeting in St. Pete's Beach, FL May 2018.*

2018 Long, B., Fan J., *&* Frank, M. Drawing as a window in the development of object category representations. Talk presented at the *Cognitive Science Society Annual Meeting in Madison, WI July 2018.*

2018 Long, B., Fan J., *&* Frank, M. Drawing as a window in the development of object category representations. Poster presented at the *Vision Sciences Society Annual Meeting in St. Pete's Beach, FL May 2018.*

2018 Wammes, J., Fan, J., Lee R., Gunn J., Yamins,, D. Norman K., *&* Turk-Browne, N. Changing object representations during visual production training. Poster presented at the *Vision Sciences Society Annual Meeting in St. Pete's Beach, FL May 2018.*

2017 Fan J., Yamins D., *&* Norman, K., *&* Turk-Browne, N. Consequences of visual production on object representations. Dynamic poster presented at the *Society for Neuroscience Annual Meeting in Washington, DC, November, 2017.*

2017 Fan J., Yamins D., *&* Turk-Browne, N. Visual production induces categorical perception. Poster presented at the *Vision Sciences Society Annual Meeting in St. Pete's Beach, FL May 2017.*

2016 Fan J., Yamins D., *&* Turk-Browne, N. Dynamic visual feedback is sufficient to improve drawing. Poster presented at the *Vision Sciences Society Annual Meeting in St. Pete's Beach, FL May 2016.*

2015 Fan J., Yamins D., *&* Turk-Browne, N. Common object representations for visual recognition and production. Talk given at *Cognitive Science Society Annual Meeting in Pasadena, CA July 2015.* * *Computational Modeling Paper Prize in Perception & Action*

2015 Fan J., Yamins D., *&* Turk-Browne, N. How drawing alters object representations. Poster presented at the *Vision Sciences Society Annual Meeting in St. Pete's Beach, FL May 2015.*

2014 Fan J., Yamins D., DiCarlo, J., *&* Turk-Browne, N. Mapping core similarity among visual objects across image modalities. Poster presented at *ACM SIGGRAPH 2014 in Vancouver, BC, Canada, August 2014.*

2014 Fan J. *&* Turk-Browne, N. Feature distributions constrain object perception. Poster presented at the *Vision Sciences Society Annual Meeting in St. Pete's Beach, FL, May 2014.*

2014 Everaert, J., Fan, J., Koster, E., *&* Turk-Browne, N. Attentional capture from emotional associations in long-term memory. Poster presented at the *Vision Sciences Society Annual Meeting in St. Pete's Beach, FL, May 2014.*

2013 Fan, J., Turk-Browne, N., *&* Taylor, J. Feedback-driven tuning of statistical summary representations. Talk given at the *Annual Meeting on Object Perception, Attention, and Memory in Toronto, Ontario, Canada, November 2013.* * *Student Travel Award*

2013 Fan, J., Hutchinson, J., *&* Turk-Browne, N. Incidental expression of visual long-term memory in online perception. Poster presented at the *Annual Meeting of the Psychonomic Society in Toronto, Ontario, Canada, November 2013.*

2013 Fan, J. and Turk-Browne, N. Visual long-term memory for objects biases perceptual attention. Poster presented at the *Vision Sciences Society Annual Meeting in Naples, FL, May 2013.*

2012 Fan, J. and Turk-Browne, N. Accessing visual memory distorts object representations. Talk given at the *Vision Sciences Society Annual Meeting in Naples, FL, May 2012.*

Advising

Students

UC San Diego

Graduate Students

2019 — Haoliang Wang

2019 — Holly Huey (co-advised by Caren Walker)

2019 — Will McCarthy (co-advised by David Kirsh)

2019 — Sebastian Holt (co-advised by David Barner)

2020 — Tone Xu (co-advised by Steven Dow)

2020 — Felix Binder (co-advised by David Kirsh)

2020 — Cameron Holdaway (co-advised by Ed Vul)

2021 — Hannah Lloyd

Qualifying Exam Committee

2020 Lauren Oey

2020 Erik Brockbank

2021 Mohan Gupta

2021 Yang Wang

2021 Cameron Holdaway

2021 James Qi

Dissertation Committee

2021 Aubrey Lau

2021 Helen Wang

Selected Undergraduates

2019 — Justin Yang, Honors: *Chancellor's Research Scholarship, HDSI Research Scholarship*

2019 — Xuanchen Lu, Honors: *UCSD Psychology Research Perseverence During COVID Award*

2019—20 Julia Xu, Honors: *HDSI Research Scholarship*

2020 — Sirui Tao, Honors: *HDSI Research Scholarship*

2020 — Zhe Huang, Honors: *Triton Research & Experiential Learning Scholarships*

Stanford

Renata Chai (Master's, Stanford, 2018-19), Xin Yuan (Master's, Tsinghua University, 2018-19), Kushin Mukherjee (undergraduate, Vassar, 2018-19), Megumi Sano (undergraduate, Stanford, 2018-19), Karl Mulligan (undergraduate, Rutgers, 2017)

Princeton

Laura Herman (undergraduate, Princeton, 2015-16), Jessica Ji (undergraduate, Princeton, 2016), Jordan Gunn (undergraduate, Princeton, 2015), Rachel Klebanov (undergraduate, Princeton, 2015), Ryan O'Connell (undergraduate, Princeton, 2013-14), Annie Chen (undergraduate, Carnegie Mellon, 2013), Max Luo (undergraduate, University of Pennsylvania, 2012–2013)

Appointments

2017-2018 Stanford Center for the Study of Language & Information, Mentor

2012–2016 Princeton Wilson College, Resident Graduate Advisor

2015-2016 Princeton Cognitive Science Program Graduate Student Fellow

2013-2014 Princeton Psychology Senior Thesis Writing Group Leader

Teaching

UC San Diego

Instructor-of-Record

2021 PSYC 60: Introduction to Statistics, Instructor

2021 PSYC 230: Computational Approaches to Visual Abstraction, Instructor

2020 PSYC 193: Perception & Computation, Instructor

2020 PSYC 60: Introduction to Statistics, Instructor

2019 PSYC 272: Computational Approaches to Visual Abstraction, Instructor

Guest Lectures

2021 PSYC 523b: Cognitive Psychology (Yale)
2021 PHIL 281: Non-Linguistic Representation (UCLA)
2020 NEU 200C: Basic Neuroscience
2020 PSYC 111A: Research Methods
2020 COGS 200: Faculty Research Seminar

Professional Service

Service to the University and Broader Community

2020 Marshall College Commencement Representative
2020- Pathways2AI Initiative, Co-Founder
2020- Psychology Undergraduate Research Assistant Common Application Initiative, Co-Chair

Service to the Field

2020 Mentor, Científico Latino Graduate Student Mentorship Initiative
2021 Program Committee, Conference on the Theory and Application of Diagrams
2021 Program Committee, ACM Creativity and Cognition
2020 Program Committee, NeurIPS Object Representations for Learning and Reasoning Workshop
2020 Program Committee, ICML Object-Oriented Learning Workshop
2020 Awards Committee, Cognitive Science Society
2020 Program Committee, Cognitive Science Society

Ad Hoc Reviewer or Panelist

Grants

NSF Integrative Strategies for Understanding Neural and Cognitive Systems (NCS)
NSF Perception, Action & Cognition
NSF Cognitive Neuroscience

Journals

Cognition
Cognitive Research: Principles and Implications
Cognitive Science
Developmental Science
Gastronomica

Journal of Experimental Psychology: General
Journal of Experimental Psychology: Human Perception and Performance
MIT Handbook of Attention
PLoS Computational Biology
Psychonomic Bulletin & Review
Psychological Review
Quarterly Journal of Experimental Psychology
Translational Issues in Psychological Science

Affiliations

Association for Computing Machinery (2019–), Cognitive Science Society (2015–), Association for Psychological Science (2014–), American Psychological Association (2011–), Vision Sciences Society (2010–), Society for Neuroscience (2008–), American Association for the Advancement of Science (2008–)

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