# Jacob S. Prince

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## Education

**Harvard University** — Cambridge, MA
Ph.D. Candidate in Psychology (Cognition, Brain, and Behavior) — September 2021 – present
Advisors: Dr. Talia Konkle and Dr. George Alvarez

**Yale University** — New Haven, CT
B.S. in Cognitive Science, GPA: 3.70/4.00 — September 2014 – December 2018
Thesis: "Covert metrics of conscious visual perception: pupil, microsaccade and blink dynamics"

## Research Experience

**Carnegie Mellon University, Dept. of Psychology** — Pittsburgh, PA
Research Associate — Advisor: Dr. Michael Tarr — September 2019 - August 2021

Developed GLMsingle, a user-friendly fMRI preprocessing toolbox for accurate single-trial response estimation; achieved significant SNR boosts in large-scale NSD and BOLD5000 datasets.

**Harvard University, Dept. of Psychology** — Cambridge, MA
Undergraduate Researcher — Advisor: Dr. Talia Konkle — May 2018 - August 2019

Tested theories of information processing in visual cortex using neural networks. Implemented new analysis routines the study of category selectivity in ANNs, with comparison to brain ROIs.

**Yale School of Medicine, Dept. of Neurology** — New Haven, CT
Undergraduate Researcher — Advisor: Dr. Hal Blumenfeld — May 2016 - May 2018

Developed covert measure of conscious perception using machine learning and pupillometry. Modeled disruption of conscious function in epilepsy via seizure-induced changes in EEG and behavior.

## Manuscripts

1. **Prince, JS.**, Fajardo, G., Alvarez, GA., Konkle, T. (2024). Manipulating dropout reveals an optimal balance of efficiency and robustness in biological and machine visual systems. *ICLR 2024*. https://openreview.net/forum?id=ADDCErFzev.

2. **Prince, JS.**, Alvarez, GA., Konkle, T. (2023). A unifying contrastive coding framework for visual category representation in the human brain. Under review at *Science Advances*. https://doi.org/10.1101/2023.08.04.551888.

3. Conwell, C., **Prince, JS.**, Alvarez, GA., Konkle, T. (2023). What can 1.8 billion regressions tell us about the pressures shaping high-level visual representation in brains and machines? Under review at *Nature Communications*. https://doi.org/10.1101/2022.03.28.485868.

4. Vinken, K., **Prince, JS.**, Konkle, T., Livingstone, M. (2023). The neural code for 'face cells' is not face specific. *Science Advances*. https://doi.org/10.1126/sciadv.adg1736.

5. **Prince, JS.**, Charest, I., Kurzawski, JW., Pyles, JA., Tarr, MJ., Kay, KN. (2022). Improving the accuracy of single-trial fMRI response estimates using GLMsingle. *eLife*. https://doi.org/10.7554/eLife.77599.

6. Jain, N., Wang, A., Henderson, MH., Lin, R., **Prince, JS.** ... Wehbe L. (2022). Selectivity for food in human ventral visual cortex. *Nature Communications Biology*. https://doi.org/10.1038/s42003-023-04546-2.

7. Allen, EJ., St-Yves, G., Wu, Y., Breedlove, JL., **Prince, JS.** ... Kay KN. (2022). A massive 7T fMRI dataset to bridge cognitive neuroscience and artificial intelligence. *Nature Neuroscience*. https://doi.org/10.1038/s41593-021-00962-x.

8. Kronemer, SI., Aksen, M., Ding, Z., Ryu, JH., Xin, Q., Ding, Z., **Prince, JS**...Blumenfeld, H. (2022). Human visual consciousness involves large scale cortical and subcortical networks independent of task report and eye movement activity. *Nature Communications*. https://doi.org/10.1038/s41467-022-35117-4.

## Conference Proceedings

1. **Prince, JS.**, Conwell, C., Konkle, T. (2024). Large datasets: a Swiss Army knife for diverse research aims in neuroAI. Accepted symposium **talk** at "Large-scale visual neural datasets: where do we go from here?"; to present at Vision Sciences Society, May 17-24, St. Pete Beach, FL.

2. **Prince, JS.**, Hamblin, C., Alvarez, GA., Konkle, T. (2024). Interpreting distributed population codes with feature-accentuated visual encoding models. Submitted to Vision Sciences Society, May 17-24, St. Pete Beach, FL.

3. **Prince, JS.**, Fajardo, G., Alvarez, GA., Konkle, T. (2023). Manipulating category selectivity and information distribution in visual recognition systems using dropout. **Talk** presented at the Conference on Cognitive Computational Neuroscience, Aug 24-27, Oxford, UK.

4. Conwell, C., **Prince, JS.**, Alvarez, GA., Konkle, T. (2023). The Unreasonable Effectiveness of Word Models in Predicting High-Level Visual Cortex Responses to Natural Images. **Poster** presented at the Conference on Cognitive Computational Neuroscience, Aug 24-27, Oxford, UK.

5. Conwell, C., **Prince, JS.**, Hamblin, C., Alvarez, GA. (2023). Controlled assessment of CLIP-style language-aligned vision models in prediction of brain & behavioral data. **Poster** presented at the Workshop on Understanding Foundation Models, ICLR 2023, May 1-5, Kigali, Rwanda.

6. **Prince, JS.**, Alvarez, GA., Konkle, T. (2023). Lesioning category-selective units *in silico* yields functionally specialized deficits. **Poster** presented at the Vision Sciences Society, May 19-24, St. Pete Beach, FL.

7. Conwell, C., **Prince, JS.**, Alvarez, GA., Konkle, T. (2023). Language Models of Visual Cortex: Where do they work? And why do they work so well where they do? **Poster** presented at the Vision Sciences Society, May 19-24, St. Pete Beach, FL.

8. **Prince, JS.**, Konkle, T. (2022). Neural and computational evidence that category-selective visual regions are facets of a unified object space. **Talk** presented at the Vision Sciences Society, May 13-18, St. Pete Beach, FL.

9. Conwell, C., **Prince, JS.**, Alvarez, G., Konkle, T. (2022). What can 5.17 billion regression fits tell us about artificial models and the human visual system? **Poster** presented at the Vision Sciences Society, May 13-18, St. Pete Beach, FL.

10. Conwell, C., **Prince, JS.**, Kay, K., Alvarez, GA., Konkle, T. (2022). Opportunistic experiments on a large-scale survey of diverse artificial vision models in prediction of 7T human fMRI data. **Poster** presented at the Conference on Cognitive Computational Neuroscience, August 25-28, San Francisco, CA.

11. Vinken, K., **Prince, JS.**, Konkle, T., Livingstone, M. (2022). Common encoding axes for face-selectivity and non-face objects in macaque face cells. **Poster** presented at the Conference on Cognitive Computational Neuroscience, August 25-28, San Francisco, CA.

12. **Prince, JS.**, Charest, I., Kurzawski, JW., Pyles, JA., Tarr, MJ., Kay, KN. (2021). GLMsingle: a turnkey solution for accurate single-trial fMRI response estimates. **Poster** presented at the Virtual Vision Sciences Society, May 21-26. Video: www.tinyurl.com/jp-vss2021.

13. **Prince, JS.**, Konkle, T. (2020). Computational evidence for integrated rather than specialized feature tuning in category-selective regions. **Talk** presented at the Virtual Vision Sciences Society, June 19-24. Video: www.tinyurl.com/jp-vss2020.

14. Kallmayer, A., **Prince, JS.**, Konkle, T. (2020). Comparing representations that support object, scene, and face recognition using deepnet trajectory analysis. **Poster** presented at the Virtual Vision Sciences Society, June 19-24.

15. McCafferty, CP., Gruenbaum, BF., Vincent, P., Tung, R., Kratochvil, ZB., **Prince, JS**... Blumenfeld, H. (2019). Mechanisms of absence seizures explored by functional MRI, EEG, behavior and neuronal changes in an awake rodent model. **Poster** presented at the American Epilepsy Society, December 6-10, Baltimore, MD.

16. **Prince, JS.**, Konkle, T. (2019). Relating category-selective regions in biological and artificial neural networks. **Poster** presented at the Vision Sciences Society, May 17-22, St. Pete Beach, FL.

17. Kronemer, SI., Aksen, M., Kwon, H., Micek, C., Christison-Lagay, K., Forman, S., **Prince, JS**...Blumenfeld, H. (2018). Early and late electrophysiological changes to visual conscious perception. **Poster** presented at the Society for Neuroscience, November 3-7, San Diego, CA.

18. Aksen, M., Kronemer, SI., **Prince, JS**...Blumenfeld, H. (2018). Pupil dynamics as a covert measure of conscious perception in a visual no report paradigm. **Poster** presented at the Society for Neuroscience, November 3-7, San Diego, CA.

19. **Prince, JS**...Blumenfeld, H. (2017). Machine learning to predict conscious visual perception using pupillary dynamics. **Poster** presented at the Society for Neuroscience, November 11-15, Washington, D.C.

## Invited Talks

- Bissell Grogan Symposium, The Brimmer and May School, Newton MA — Jan. 16, 2024
  *The promise and pitfalls of AI for visual recognition.*
- Visual Inference Lab, Columbia University (PI: Nikolaus Kriegeskorte) — Jan. 5, 2024
  *A unifying contrastive coding framework for visual category representation in the human brain.*
- Vision and Computational Cognition Group, Max Planck Institute (PI: Martin Hebart) — Dec. 21, 2023
  *A unifying contrastive coding framework for visual category representation in the human brain.*
- Brains Minds and Machines Summer Course, Marine Biological Laboratory, Woods Hole — Aug. 23, 2023
  *Quantifying dataset diversity with brain-guided curriculum learning.*
- University of Minnesota – Dept. of Psychology Perception Lunch — Feb. 21, 2023
  *GLMsingle: A toolbox for accurate single-trial fMRI response estimates.*
- MIT Brain and Cognitive Sciences – Computational Tutorial Series — April 29, 2022
  *GLMsingle: a toolbox for improving single-trial fMRI response estimates.*
  *Recording: https://cbmm.mit.edu/video/glmsingle-toolbox-improving-single-trial-fmri-response-estimates.*
- University of Minnesota – Computational Visual Neuroscience Laboratory (PI: Kendrick Kay) — Sept. 25, 2020
  *Data-driven fMRI denoising enhances cross-dataset representational stability and boosts image decodability.*
- Natural Scenes Dataset Conference 2020 (online) — Aug. 12, 2020
  *GLMsingle: a turnkey solution for accurate single-trial fMRI estimates.*
- University of California, Irvine – Visual Perception and Neuroimaging Lab (PI: Emily Grossman) — Mar. 18, 2020
  *The effect of fMRI design and preprocessing paradigms on SNR and temporal autocorrelation.*
- Carnegie Mellon University - VisCog Group (PIs: M.Behrmann, D.Plaut, M.Tarr, B.Nozari, B.Mahon) — Feb. 3, 2020
  *An overview of large-scale neuroimaging datasets and implications for the study of high level vision.*

## Grants and Awards

- National Defense Science and Engineering Graduate (NDSEG) Fellowship — Award Term: 2022-2024
- Elsevier/Vision Research Travel Award — Vision Sciences Society 2020
- Rising Stars Travel Grant: Shared Visual Representations in Humans and Machines Workshop — NeurIPS 2019

## Activities and Service

- Brains, Minds, and Machines Summer Course, Marine Biological Laboratory, Woods Hole — August 2023
  *Attended intensive month-long summer school, completed project assessing whether human visual representational dimensions can guide the selection of useful training samples for object recognition ANNs.*
- Mentor, Harvard Prospective Ph.D. & RA Event in Psychology (PPREP) — Sept. 2021 - present
  *Provide career guidance and CV/essay feedback to 3 students (per year) from historically minoritized groups in STEM who are applying to graduate school, lab manager, and/or research assistant positions.*
- TA, Computational Methods in Human Neuroscience (NSCI 258, Prof. Nick Turk-Browne, Yale) — Spring 2019
  *Assisted with creation and debugging of Python workbooks with focus on ML-driven computational fMRI analyses. Mentored students and reinforced key concepts from lecture during weekly office hours.*
- Journal and conference reviewing: Imaging Neuroscience; Conference on Cognitive Computational Neuroscience; SVHRM Workshop @ NeurIPS; Re-Align Workshop @ NeurIPS.

## Skills

- **Programming:** Python (PyTorch, FFCV, Sklearn, PyCortex, Nilearn, BrainIAK), MATLAB, R, C, Bash, Slurm
- **Laboratory:** fMRI, scalp/intracranial EEG, eye-tracking, pupillometry, sensory/behavioral task administration
- **Spoken Languages:** Spanish (proficient), Hebrew (proficient), French (familiar)
- **Hobbies:** Classical and jazz piano, rec sports (basketball, tennis), strategy games (chess, poker)