Sam **Zorowitz**

PhD Candidate at the Princeton Neuroscience Institute

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Education

Princeton University — *Princeton, NJ*

PhD Candidate in Neuroscience — *Sep. 2017 - Present*

- Advisors: Yael Niv, Nathaniel Daw
- Cumulative GPA: 3.90
- Supported by National Science Foundation Graduate Research Fellowship (NSF GRF)

Johns Hopkins University — *Baltimore, MD*

BA in Psychological & Brain Sciences — *Sep. 2010 - May 2014*

- Cumulative GPA: 3.91
- Phi Beta Kappa, General University Honors

Skills

Quantitative	Bayesian data analysis, cognitive modeling, item factor modeling, item response theory, psychometrics
Programming	Python, R, Matlab, HTML, JavaScript, CSS, Bash
Software	Stan, JAGS, Jax, Pytorch, jsPsych

Research Experience

Princeton University — *Princeton, NJ*

PhD Candidate in Neuroscience — *Sep. 2017 - Present*

- Developed a gamified and psychometrically-validated battery of reinforcement learning & decision-making tasks to characterize learning and choice strategies in healthy and clinical populations.
- Devising & validating Bayesian factor models for the joint analysis of task- and self-report symptom data in a sample of N=1000 adult participants who completed the aforementioned task battery.
- Formalized clinical theories on the origin and maintenance of anxiety using Bayesian decision theory, and designed behavioral experiments to test novel predictions resulting from our models.
- Utilized item response modeling to validate and refine clinically-relevant behavioral and self-report measures, including a non-proprietary version of the Raven's progressive matrices and a retrospective assessment of childhood maltreatment.
- Built and released multiple open source softwares for the behavioral scientists, including an application for collecting online data and a collection of gamified decision-making tasks programmed with jsPsych.

Massachusetts General Hospital / Harvard Medical School — *Boston, MA*

Clinical Research Coordinator — *Jun. 2014 - Jun. 2017*

- Lead analyst on study investigating the effects of DBS on executive control in patients with severe depression. Found that DBS improved patients' performance on a Stroop-like task, which was indirectly predictive of patients' clinical response to DBS.
- Devised hierarchical Bayesian model of decision making conflict, integrating both choice and reaction time data, in an approach-avoidance gambling task for use in predicting conflict-related signals in fMRI & EEG neural data.
- Adapted Bayesian state space models of associative learning to a reversal learning paradigm and demonstrated its efficacy in improving fMRI signal-to-noise ratio.

Publications

Journal Articles

Zorowitz, S., Tuominen, L. (under review). Confirmatory factor analysis of the Maltreatment and Abuse Chronology of Exposure (MACE) scale: Evidence for essential unidimensionality. https://psyarxiv.com/uexgy/

Bennett, D., Radulescu, A., **Zorowitz, S.**, Felso, V., Niv, Y. (under review). Affect-congruent attention drives changes in reward expectations. https://psyarxiv.com/vu2cw

Zorowitz, S., Solis, J., Niv, Y., Bennett, D. (2023). Inattentive responding can induce spurious associations between task behavior and symptom measures. Nature Human Behavior. https://doi.org/10.1038/s41562-023-01640-7

Zorowitz, S., Chierchia, G., Blakemore, S. J., Daw, N. D. (2023). An item response theory analysis of the matrix reasoning item bank (MaRs-IB). Behavior Research Methods. https://doi.org/10.3758/s13428-023-02067-8

Zorowitz, S., Niv, Y. (2023). Improving the reliability of cognitive task measures: A narrative review. Biological Psychiatry: Cognitive Neuroscience and Neuroimaging. https://doi.org/10.1016/j.bpsc.2023.02.004

Cox, J.M., Minerva, A.R., Fleming, W., Zimmerman, C.A., Hayes, C., **Zorowitz, S.**, Bandi, A., Ornelas, S., McMannon, B., Parker, N.F. and Witten, I.B. (2023). A neural substrate of sex-dependent modulation of motivation by value. Nature Neuroscience. https://doi.org/10.1038/s41593-022-01229-9

Weber, I., **Zorowitz, S.**, Niv, Y., Bennett, D. (2022). The effects of induced positive and negative affect on Pavlovian-instrumental interactions. Cognition and Emotion, 1-18. https://doi.org/10.1080/02699931.2022.2109600

Barbosa, J., Stein, H., **Zorowitz, S.**, Niv, Y., Summerfield, C., Soto-Faraco, S., Hyafil, A. (2022). A practical guide for studying human behavior in the lab. Behavior Research Methods. https://doi.org/10.3758/s13428-022-01793-9

Zorowitz, S., Bennett, D., Choe, G., Niv, Y. (2021). A Recurring Reproduction Error in the Administration of the Generalized Anxiety Disorder Scale. Lancet Psychiatry. 8(3), P180-181. https://doi.org/10.1016/S2215-0366(21)00001-8

Zorowitz, S., Momennejad, I., & Daw, N. D. (2020). Anxiety, avoidance, and sequential evaluation. Computational Psychiatry, 4, 1-17. https://doi.org/10.1162%2Fcpsy_a_00026

Zorowitz, S., Rockhill, A. P., Ellard, K. K., Link, K. E., Herrington, T., Pizzagalli, D. A., Widge, A. S., Deckersbach, T., Dougherty, D. D. (2019). The Neural Basis of Approach-Avoidance Conflict: A Model Based Analysis. eNeuro. 10.1523/ENEURO.0115-19.2019

Langdon, A. J., Hathaway, B. A., **Zorowitz, S.**, Harris, C. B. W., Winstanley, C. A. (2019). Relative insensitivity to time-out punishments induced by win-paired cues in a rat gambling task. Psychopharmacology, 236(8), 2543-2556. https://doi.org/10.1007/s00213-019-05308-x

Widge, A. S., **Zorowitz, S.**, Basu, I., Paulk, A. C., Cash, S. S., Eskandar, E. N., Deckersbach, T., Miller, E. K., Dougherty, D. D. (2019). Deep Brain Stimulation of the Internal Capsule Enhances Human Cognitive Control and Prefrontal Cortex Function. Nature Communications, 10(1), 1-11. https://doi.org/10.1038/s41467-019-09557-4

Widge, A. S., Ellard, K. K., Paulk, A. C., Basu, I., Yousefi, A., **Zorowitz, S.**, … Eskandar, E. N. (2017). Treating refractory mental illness with closed-loop brain stimulation: Progress towards a patient-specific transdiagnostic approach. Experimental Neurology, 287, 461-472. https://doi.org/10.1016/j.expneurol.2016.07.021

Klein, E., Goering, S., Gagne, J., Shea, C. V., Franklin, R., **Zorowitz, S.**, … & Widge, A. S. (2016). Brain-computer interface-based control of closed-loop brain stimulation: attitudes and ethical considerations. Brain-Computer Interfaces, 3(3), 140-148. https://doi.org/10.1080/2326263X.2016.1207497

Rodriguez-Hart, C., Liu, H., Nowak, R. G., Orazulike, I., **Zorowitz, S.**, Crowell, T. A., … Charurat, M. (2016). Serosorting and Sexual Risk for HIV Infection at the Ego-Alter Dyadic Level: An Egocentric Sexual Network Study Among MSM in Nigeria. AIDS and Behavior, 20(11), 2762-2771. https://doi.org/10.1007/s10461-016-1311-3

Widge, A. S., Licon, E., **Zorowitz, S.**, Corse, A., Arulpragasam, A. R., Camprodon, J. A., … Dougherty, D. D. (2016). Predictors of Hypomania During Ventral Capsule/Ventral Striatum Deep Brain Stimulation. The Journal of Neuropsychiatry and Clinical Neurosciences, 28(1), 38–44. https://doi.org/10.1176/appi.neuropsych.15040089

Widge, A. S., **Zorowitz, S.**, Link, K., Miller, E. K., Deckersbach, T., Eskandar, E. N., & Dougherty, D. D. (2015). Ventral Capsule/Ventral Striatum Deep Brain Stimulation Does Not Consistently Diminish Occipital Cross-Frequency Coupling. Biological Psychiatry, 80(7), e59-e60. https://doi.org/10.1016/j.biopsych.2015.10.029

Franklin, R., **Zorowitz, S.**, Corse, A. K., Widge, A. S., & Deckersbach, T. (2015). Lurasidone for the treatment of bipolar depression: an evidence-based review. Neuropsychiatric Disease and Treatment, 11, 2143–2152. https://doi.org/10.2147%2FNDT.S50961

Lorince, J., **Zorowitz, S.**, Murdock, J., & Todd, P. M. (2015). The Wisdom of the Few? "Supertaggers" in Collaborative Tagging Systems. The Journal of Web Science: Vol. 1: No. 1, pp 16-32. https://doi.org/10.1561/106.00000002

Conference Proceedings

Zorowitz, S., Momennejad, I., & Daw, N. D. (2019). Anxiety, avoidance, and sequential evaluation. Reinforcement Learning and Decision Making.

Langdon, A. J., Hathaway, B. A., **Zorowitz, S.**, Harris, C. B. W., Winstanley, C. A. (2019). Insensitivity to time-out punishments induced by win-paired cues in a rat gambling task. Reinforcement Learning and Decision Making.

Lorince, J., **Zorowitz, S.**, Murdock, J., & Todd, P. M. (2014). Supertagger behavior in building folksonomies. In Proceedings of the 2014 ACM conference on Web science (pp. 129–138). ACM.

Conference Posters

Zorowitz, S., Tuominen, L. (2022). Adverse Childhood Events and Negative Symptoms in the General Population. Presented at Schizophrenia International Research Society.

Zorowitz, S., Lane, P. L., Daw, N. D. (2021). The value of free choice in anxiety. Presented at Society of Biological Psychiatry.

Paredes, N., **Zorowitz, S.**, Niv, Y. (2021). The psychometric properties of the Pavlovian Instrumental Transfer task in an online adult sample. Presented at Society of Biological Psychiatry.

Zaller, I., **Zorowitz, S.**, Niv, Y. (2021). Information seeking on the horizons task does not predict anxious symptomatology. Presented at Society of Biological Psychiatry.

Paredes, N., **Zorowitz, S.**, Niv, Y. (2021). The psychometric properties of the Pavlovian Instrumental Transfer task in an online adult sample. Presented at Society for Neuroscience Global Connectome.

Zaller, I., **Zorowitz, S.**, Niv, Y. (2021). Information seeking on the horizons task does not predict anxious symptomatology. Presented at Society for Neuroscience Global Connectome.

Zorowitz, S., Bennett, D., Niv, Y. (2020). The Relation between Probability Weighting and Subclinical Anxiety in Decisions under Uncertainty. Presented at Society for Biological Psychiatry. New York City, New York.

Bennett, D., Radulescu, A., **Zorowitz, S.**, Niv, Y. (2019). Assessing mood's effects on attention in value-based decision making. Presented at Society for Affective Science. Boston, Massachusetts.

Widge, A. S., **Zorowitz, S.**, Afzal, A., Farnes, K., Paulk, A. C., Miller, E. K., Deckersbach, T., Cash, S. S., Dougherty, D. D. (2016). Deep Brain Stimulation of Striatal White Matter Alters Top-Down Control Signals in Cingulate and Prefrontal Cortices. Presented at the American College of Neuropsychopharmacology, Hollywood, Florida.

Sitnikova, T. A., **Zorowitz, S.**, Afzal, A., Gilmour, A. L., Ellard, K. K., Herrington, T. M., … Deckersbach, T. (2016). Oscillatory synchronization enables dynamic information processing to resolve reward seeking vs. risk avoidance conflict. Poster presented at the Society for Neuroscience, San Diego, CA.

Zorowitz, S., Afzal, A., Deckersbach, T., Ellard., K. K., Gilmour, A. L., Dougherty, D. D., Eskandar, E. N., Widge, A. W. (2016). Bayesian State-Space Modeling of Reversal Learning. Poster presented at the Society for Neuroscience, San Diego, CA.

Afzal, A., **Zorowitz, S.**, Ellard, K. K., Widge, A. S., Gilmour, A. L., Dougherty, D. D., Eskandar, E. N., Deckersbach, T. Neural Correlates of Approach-Avoidance Behavior in Decision Making. Poster presented at the Society for Neuroscience, San Diego, CA.

Afzal, A., **Zorowitz, S.**, Ellard, K. K., Widge, A. S., Gilmour, A. L., Dougherty, D. D., Eskandar, E. N., Deckersbach, T. Neural Correlates of Approach-Avoidance Behavior in Decision Making. Poster presented at the Society of Biological Psychiatry, Atlanta, GA.

Zorowitz, S., Franklin, R., Kunwar, P. S., Greve, D. N., Block, S., Moran, L. R., Schwartz, C. E. (2016). A High-reactive Temperamental Profile in 4 Month-Old Infants Predicts Reduced Amygdala Volume and Increased Amygdala Reactivity in Adults. Poster presented at the Society of Biological Psychiatry, Atlanta, GA.

Widge, A. S., **Zorowitz, S.**, Tang, W., Miller, E. K., Deckersbach, T., & Dougherty, D. D. (2015). Behavioral and neural biomarkers of improved top-down control mediate clinical response to ventral capsule/ventral striatum deep brain stimulation in major depression. Poster presented at the Society of Biological Psychiatry, Toronto, Canada.

Teaching

Princeton University — *Princeton, NJ*

Graduate Student Bootcamp Instructor — *Summer 2021*

- Designed and taught lecture on fMRI principles.

Graduate Student Bootcamp Leader — *Summer 2020*

- Organized and oversaw 3 week long math and programming bootcamp for incoming graduate students.
- Lectured on python programming, model fitting, and significance testing.

Assistant Instructor for Laboratory in Principles of Neuroscience — *Spring 2020*

- Taught scientific python programming to undergraduate students.
- Designed in-class exercises and problems sets on fMRI preprocessing and mass univariate analysis.

Graduate Student Bootcamp Instructor — *Summer 2019*

- Designed and taught a three day Intro to Python for Neuroscience series for the PNI Graduate Bootcamp.
- Bootcamp materials covered core Python, numeric computing, statistics, and vizualization.

Assistant Instructor for Graduate Methods in Cognitive Neuroscience — *Spring 2019*

- Designed lecture materials for teaching neuroimaging analysis (fMRI, EEG) in python.
- Designed novel problem sets for teaching neuroimaging analysis and computational reproducibility.

Assistant Instructor for Fundamentals of Neuroscience — *Fall 2018*

- Taught three undergraduate precepts per week.
- Co-designed lecture materials, wrote exam questions, and organized review sessions.

Columbia University — *New York City, NY*

Workshop Organizer — *Summer 2017*

- Designed and taught a two-week Intro to Python for Data Science workshop for the QMSS Masters Program.
- Workshop materials covered scientific computing, machine learning, statistical analysis, and webscraping.

Invited Talks

2023 **Tel Aviv University**, Workshop for online neuroscience experiments (May 2023)
2023 **National Institutes of Mental Health**, Neural Computations in Learning Lab meeting (March 2023)
2022 **McGill University**, Psychiatric epidemiology journal club (October 2022)
2022 **Yale University**, Rutledge Lab meeting (June 2022)
2022 **Alena**, Science team meeting (May 2022)
2021 **University of Cambridge**, Blakemore Lab meeting (December 2021)
2021 **University of Amsterdam**, Theory Construction Lab meeting (October 2021)
2021 **Princeton University**, Parallel Distributed Processes meeting (March 2021)
2021 **Transcontinental Computational Psychiatry Workgroup**, (March 2021)

Mentoring

2023 **Allison Yang**, Junior project and senior thesis at Princeton University (co-advised with Nathaniel Daw)
2022 **Jen No**, Junior project and senior thesis at Princeton University (co-advised with Laura Bustamante)
2020 **Kiersten Marr**, Junior project and senior thesis at Princeton University
2020 **Livia Qoshe**, Junior project and senior thesis at Princeton University
2020 **Isabel Zaller**, Independent work at Princeton University
2020 **Natalie Paredes**, Summer internship at Princeton University
2017 **Katherine Link**, Summer internship at Harvard Medical School

Fellowships & Awards

2019 **Graduate Research Fellowship**, National Science Foundation
2019 **Student Travel Award**, Conference on Reinforcement Learning & Decision Making
2017 **Centennial Fellowship**, Princeton University
2016 **Top Poster in Translational Research**, Society of Biological Psychiatry