Samuel Zorowitz, PhD

Clinical Biostatistician

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Summary

I am a clinical biostatistician with nearly a decade of experience in designing and executing studies of patient mental health outcomes and digital psychiatry. My research centers on the development and validation of measures of patient outcomes using statistical methods such as cognitive modeling and item response theory.

Education

Princeton University — Princeton, NJ

PhD in Computational Neuroscience — Sep. 2017 - Aug. 2023

- Advisors: Yael Niv, Nathaniel Daw
- Dissertation: The Factor Structure of Reinforcement Learning Behaviors
- Supported by a National Science Foundation Graduate Research Fellowship

Johns Hopkins University — Baltimore, MD

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

- Phi Beta Kappa, General University Honors

Skills

Quantitative	Bayesian data analysis, generalized & hierarchical linear models, time series analysis, factor analysis, item response theory, structural equation models, computerized adaptive testing, cognitive modeling, reinforcement learning, optimal experiment design
Programming	Python, R, Julia, SQL, HTML, JavaScript, CSS, Bash
Software	Stan, R{lavaan}, R{psych}, Python{Scikit-learn}, Python{Jax}, Python{Pytorch}, MS Office Suite

Research Experience

National Institute of Mental Health — Bethesda, MD

Clinical biostatistician — Aug. 2023 - Present

- Lead the design and analysis of human subjects research in an interdisciplinary clinical neuroscience group.
- Design optimized digital assessments of patient health outcomes (e.g., cognition, mental health) using computerized adaptive testing and optimal experiment design.
- Develop novel Bayesian models to jointly analyze multiple streams of data including behavior, questionnaire, and sensor time series data.
- Collaborate with, and provide statistical consultations to, other members of the NIH research program.
- Supervise and mentor multiple research assistants.

Princeton University — Princeton, NJ

Doctoral researcher — Sep. 2017 - Aug. 2023

- Designed questionnaire measures of internalizing disorders (e.g., depression, generalized anxiety) and adverse childhood experiences using item response theory (i.e., bifactor models, MIMIC models).
- Designed a battery of digital assessments of cognition (e.g., executive functioning, decision-making) and

led multiple research studies to validate their use for psychiatric phenotyping and clinical trials.
- Developed novel Bayesian multilevel item structure models to calibrate and validate a novel assessment of executive functioning in adults.
- Summarized and communicated study results in articles published in refereed journals, professional meetings, and presentations to diverse audiences including funding agencies and other stakeholders.
- Supervised and mentored multiple research assistants, study coordinators, and junior graduate students.

Massachusetts General Hospital / Harvard Medical School Boston, MA

Clinical research coordinator Jun. 2014 - Jun. 2017

- Evaluated behavioral predictors of severe depression-remission after treatment with deep brain stimulation using nonparametric time series regression.
- Developed hierarchical Bayesian models to quantify patient anxious-avoidance behaviors for use in clinical trials of deep brain stimulation for psychiatric disorders.
- Prepared sections of biweekly progress reports and presentations for government funding agencies (DARPA) and military stakeholders.

Publications

Preprints

Nussenbaum, K., Katzman, P., Lu, H., **Zorowitz, S.,** & Hartley, C. A. (under review). Sensitivity to the instrumental value of choice increases across development. https://doi.org/10.31234/osf.io/exps6

Zorowitz, S., Karni, G., Paredes, N., Daw, N. D., Niv, Y. (under review). Improving the reliability of the Pavlovian go/no-go task. https://psyarxiv.com/eb697

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

Journal articles

Bennett, D., Radulescu, A., **Zorowitz, S.,** Felso, V., Niv, Y. (2023). Affect-congruent attention modulates generalized reward expectations. PLOS Computational Biology. https://doi.org/10.1371/journal.pcbi.1011707

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. https://doi.org/10.1523%2FENEURO.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

Golway, N., Solomyak, L., Karni, G., **Zorowitz, S.,** ..., Eldar, E., Niv, Y., Hartley, C. (2023). Reliability of a Reinforcement-Learning Task Battery for Computational Phenotyping of Decision-Making in Adolescent Psychopathology. Presented at Computational Psychiatry Conference.

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.

Invited Talks

2024 **National Institute of Mental Health,** Neurodevelopmental and Behavioral Phenotyping Service (January 2024)

2023 **National Institute of Mental Health,** Data Science and Sharing Team (October 2023)

2023 **University of Tokyo,** IRCN science salon (September 2023)

2023 **Tel Aviv University,** Workshop for online neuroscience experiments (May 2023)

2023 **National Institute 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

2024 **Esha Dadbhawala,** Postbaccalaureate research at National Institute of Mental Health

2024 **Ashley Lo,** Postbaccalaureate research at National Institute of Mental Health

2023 **Gili Karni,** Junior graduate student research at Princeton University

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)

2021 **Branson Byers,** Study coordinator research at Princeton University

2021 **Sean Allen,** Study coordinator research at Princeton University

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