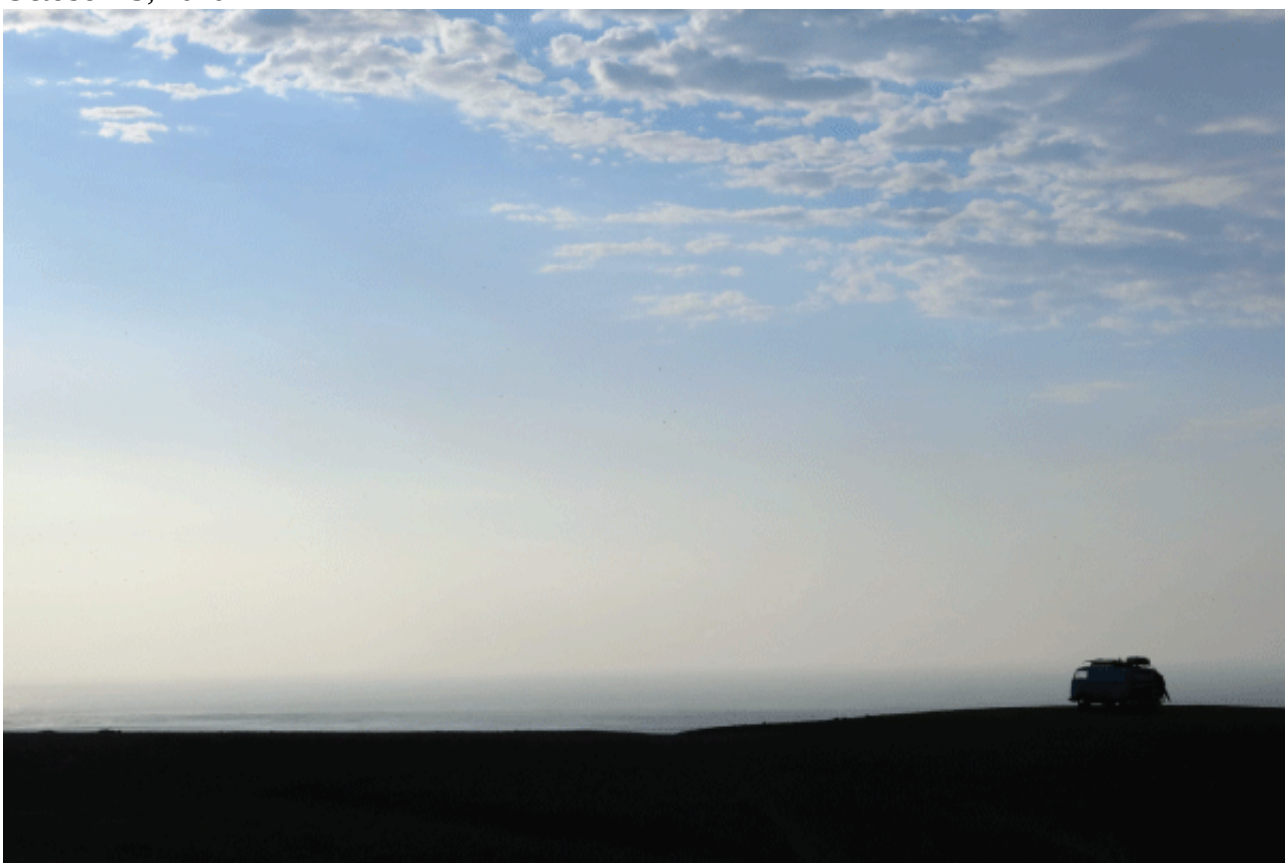
Cattell Fund Projects Explore Prenatal Maternal Distress, High-Stakes Decision-Making, Neuroscience of Reading

October 29, 2020



The 2020–2021 James McKeen Cattell Fund Fellowships have been awarded to Elisabeth Conradt, Ian Krajbich, and Nicole Landi. Presented in partnership with APS, the fellowships allow recipients to extend their sabbatical periods from one semester to a full year. During that time, the researchers plan to pursue the research projects outlined below.

Elisabeth Conradt

University of Utah

A major barrier to progress in the field of prenatal programming is that the vast majority of research is observational, and no claims of causality can be inferred. An ethical method of partially overcoming this limitation is to conduct intervention research to reduce prenatal maternal distress (Poggi Davis, Hankin, Swales, & Hoffman, 2018). When pregnant women experience improvements in mood, the health of two generations can be affected: mother and infant. We can also test causal assumptions about the influence of prenatal maternal psychological distress on newborn neurodevelopment. During this sabbatical year, my colleagues and I are developing a series of studies to (1) use computational approaches to identify families at risk for mood disorders from a database of over 11 million families in Utah, (2) use virtual data collection methods piloted during this pandemic to deeply phenotype a subset of families, and (3) intervene during pregnancy to determine whether alleviating maternal distress is related to improvements in newborn neurobehavior.

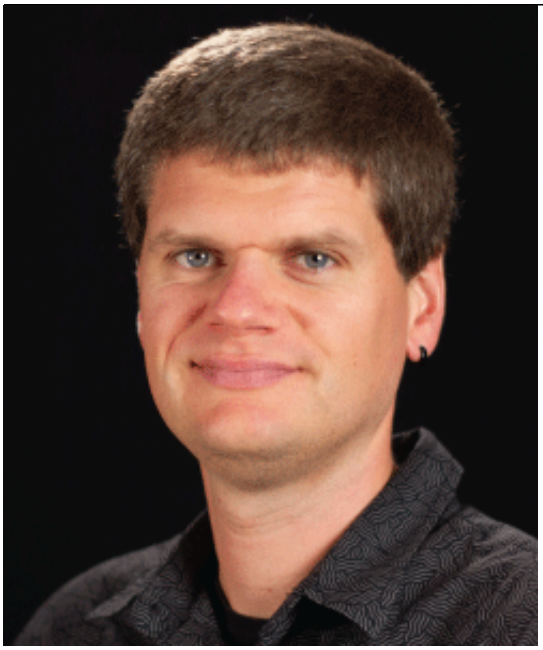
A second barrier hampering progress for the prenatal programming field is the lack of consideration for how prenatal exposure to racism and racial discrimination can become biologically embedded in the pregnant woman and her fetus (Chaney, Lopez, Wiley, Meyer, & Valeggia, 2019). This year, my colleagues Sierra Carter, Sheila Crowell, and I are using novel methods of collecting fetal and maternal heart rate and heart rate variability to uncover how everyday discrimination can affect the health of mother and fetus. This study could reveal how prenatal exposure to racial discrimination is related to preterm birth and birth complications for mother and baby. We will also have a better understanding of whether multiple forms of racism-related stress get under the maternal and fetal skin to increase risk for preterm birth and low birth weight.

References

Chaney, C., Lopez, M., Wiley, K. S., Meyer, C., Valeggia, C. (2019). Systematic review of chronic

discrimination and changes in biology during pregnancy among African American Women. *Journal of Racial and Ethnic Health Disparities, 6,* 1208–1217. doi:10.1007/s40615-019-00622-8

Poggi Davis, E., Hankin, B. L., Swales, D. A., & Hoffman, M.C. (2018). An experimental test of the fetal programming hypothesis: Can we reduce child ontogenetic vulnerability to psychopathology by decreasing maternal depression? *Development and Psychopathology, 30,* 787–806. doi: 10.1017/S0954579418000470



Ian Krajbich

The Ohio State University

Decision-making is not instantaneous. Instead, decisions emerge over time as information is collected, evaluated, and compared. To gain better insight into the choice processes involved in decision-making, my work uses choice-process data such as eye tracking, mouse tracking, neuroimaging, and response times to develop and test dynamic computational models of behavior. In particular, my research builds on the idea that many decisions are made via an attention-guided sequential-sampling model (SSM) process, akin to a mental tug-of-war. Gaze amplifies value in the decision process (Smith & Krajbich, 2019), while mouse trajectories and response times reflect the strength of preference/belief (Konovalov & Krajbich, 2019). A related topic we are working on is how well people understand these patterns and use them to extract information from each other (Frydman & Krajbich, 2019; Konovalov & Krajbich, 2020).

Despite the predominance of SSMs in neuroeconomics and decision neuroscience, they have yet to see widespread use in research on judgment and decision-making or behavioral economics. The aim of my sabbatical is to expand the scope of these models to complex, multi-attribute, high-stakes decisions in an effort to bridge that gap. To this end, the bulk of my sabbatical will be spent in collaboration with researchers in marketing and finance.

My sabbatical year will be divided between the University of California, Berkeley Haas School of Business and the University of Melbourne. With collaborators at Haas, I will study stereotypes (Jenkins et al., 2018), multi-attribute ("conjoint") consumer decisions, and decision from memory. With collaborators in Melbourne at the Brain, Mind, and Markets Laboratory, I aim to expand my lab's research to financial markets. A focus of this research is on the complexity of decisions: how to model it, how people handle it, and its impact on markets.

I am extremely grateful to the James McKeen Cattell Fund for allowing me to pursue these new directions in my research program.

References

Frydman: Frydman, C., & Krajbich, I. (2019). *Using response times to infer others' beliefs: An application to information cascades*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2817026

Jenkins, A. C., Karashchuk, P., Zhu, L., & Hsu, M. (2018). Predicting human behavior toward members of different social groups. *Proceedings of the National Academy of Sciences*, *115*(39), 9696–9701.

Konovalov, A., & Krajbich, I. (2019). Revealed strength of preference: Inference from response times. *Judgment and Decision Making*, *14*(381–394).

Konovalov, A., & Krajbich, I. (2020). *Decision times reveal private information in strategic settings: Evidence from bargaining experiments*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3023640

Smith, S. M., & Krajbich, I. (2019). Gaze amplifies value in decision making. *Psychological Science*, *30*(1), 116–128.

Nicole Landi

University of Connecticut and Yale University

My lab examines the neurobiological basis of reading and other skills that support reading (e.g., language). For example, we use neuroimaging techniques such as MRI and EEG to better understand the etiology of individual differences in reading (Perdue et al., 2020; Ryherd et al., 2018), and we look at how genetic variation influences brain development and reading performance (e.g., Landi et al., 2013; Mascheretti et al., 2020; Perdue et al., 2018).

Over the past decade, neuroscience techniques have become common in educational research, including studies of reading and reading disability. This merging of fields has helped to elucidate the brain basis of reading disability and, more recently, of reading intervention response; however, there is often limited translation of this knowledge to the broader scientific and educational communities (see Landi et al., 2019). While work in this area has been successful in identifying neurobiological correlates of

intervention outcomes at the group level (e.g., responders and nonresponders), it is not yet possible to use this information to inform at the individual student level. Moreover, this work is primarily lab-based and typically siloed from classroom practices, which limits ecological validity and translational potential.

With increasing awareness of the neurobiological origins of reading disabilities and gaining popularity of putative "brain-based" instructional approaches in clinics and classrooms, it is imperative that we create more bidirectional communication between scientists and practitioners. My sabbatical research will build upon recently established collaborative partnerships with specialized schools for children with reading disabilities that include in-school cognitive neuroscience laboratories. This work will afford frequent and ecologically valid neurobiological assessment as children's reading improves in response to remedial reading instruction.

Additionally, I will work directly with teachers to characterize and codify effective instructional practices. The aims of this work are to identify predictors of intervention response that are sensitive and reliable at the student level and establish bidirectional researcher-practitioner partnerships, with the longer-term goal of creating more individualized methods for intervening in the classroom.

References

Landi, N., Ashton, G., Coyne-Green, A., Kleinman, D., Sarles-Wittlesey, H., Roberts, P., Blair, N., Pugh, K.R. & Hoeft, F. (2019). What's the promise of in-school neuroscience? *International Dyslexia Association Examiner, 8(3).*

Landi, N., Frost, S. J., Mencl, W. E., Preston, J. L., Jacobsen, L. K., Lee, M., Yrigollen, C., Pugh, K. R., & Grigorenko, E. L. (2013). The *COMT* Val/Met polymorphism is associated with reading-related skills and consistent patterns of functional neural activation. *Developmental Science, 16*(1),13–23.

Mascheretti, S., Perdue, M. V., Feng, B., Andreola, C., Dionne, G., Jasi?ska, K. K., Pugh, K. R., Grigorenko, E. L., & Landi, N. (2020). From BDNF to reading: Neural activation and phonological processing as multiple mediators. *Behavioural Brain Research, 396,* Article 112859.

Perdue, M. V., Mascheretti, S., Kornilov, S. A., Jasi?ska, K. K., Ryherd, K., Mencl, W. E., Frost, S. J., Grigorenko, E. L., Pugh, K. R., & Landi, N. (2019). Common variation within the SETBP1 gene is associated with reading-related skills and patterns of functional neural activation. *Neuropsychologia, 130,* 44–51

Perdue, M.V., Mednick, J., Pugh, K. & Landi, N. (2020). Gray matter structure is associated with reading skill in typically developing young readers. *Cerebral Cortex, 30* (10), 5449–5459

Ryherd, K., Jasinska, K., Van Dyke, J.A., Hung, Y.-H., Baron, E., Mencl, W.E., Zevin, J., Landi, N. (2018). Cortical regions supporting reading comprehension skill for single words and discourse. *Brain and Language, 186,* 32–43