



Boston Children's Hospital



Harvard University

October 12, 2019

Professor Art Kramer
Department of Psychology
Northeastern University
805 Columbus Ave
Boston, MA 02118

Dear Dr. Kramer and Members of the Search Committee:

I am writing to apply for the Assistant Professor position in brain and cognitive health at Northeastern University. I am currently a postdoctoral fellow at Harvard University in the Labs of Cognitive Neuroscience, working with Drs. Charles A. Nelson and Takao K. Hensch. I have previously completed my Ph.D. in Developmental Psychology with Dr. Nim Tottenham at Columbia University.

My research program *examines how our experiences interact with brain plasticity across development to shape our brains, minds, and behavior*. I seek to provide a mechanistic account of development by combining behavioral paradigms with physiology, neuroimaging (fMRI and EEG), and computational approaches. The ultimate aim of this research program is to identify at-risk individuals who would benefit from interventions, the developmental timing when interventions may be most effective, and the brain mechanisms through which interventions promote resilient brain and cognitive health. I examine both cognitive and affective domains to best answer my research questions:

- 1) How and when do experiences shape development?
- 2) What are the brain plasticity mechanisms that support this experience-driven development?
- 3) How do interactions between experiences and brain plasticity produce healthy, resilient, or maladaptive outcomes?

I have addressed these questions in typical experience-driven development, and tested how negative experiences (e.g. caregiving adversity) or disrupted plasticity (e.g. in disorders) alter development. For example, I have demonstrated how typical daily experiences, including caregiving and music, become embedded in brain function to shape development and influence adult self-regulation behavior. I have also shown how adversity or atypical plasticity may shift the timing of experience-driven development in these domains to generate both resilient and maladaptive mental health outcomes. My ongoing work translates computational measures (e.g. signal-to-noise ratios) from models into empirical contexts to inform principles of brain plasticity in human development. My future research will complement these areas by 1) examining positive factors, including *sleep and exercise, that promote brain plasticity and typical or resilient brain and cognitive health*, and 2) *integrating computational approaches (e.g. Bayesian frameworks, machine-learning) to identify new mechanisms of plasticity in development and to predict individual health trajectories while there is time to intervene effectively*.

My research examining how experiences interact with brain plasticity to shape development complements Northeastern's existing strengths across the health, clinical, and cognitive neuroscience areas. I would be eager to collaborate on projects using EEG and/or MRI to examine how sleep and exercise factors impact neuroplasticity mechanisms across different brain circuitry and ages. I would also seek out opportunities to ask how adverse environments become biologically embedded during development, and how interventions promote resilient brain and behavior development at different

developmental stages (e.g. how do sleep or caregiver interventions promote healthy brain function in children compared with adolescents?). I would welcome the chance to collaborate on projects using neuroimaging markers and artificial intelligence to predict individual mental health outcomes as well. My research examining developmental music experiences at the nexus of self-regulation, decision-making, and memory also provides opportunities to collaborate with research in the department focusing on emotion regulation in both healthy and clinical populations. I would generate additional perspectives for the department through: 1) my research on brain plasticity mechanisms from infancy through adolescence, 2) my research in populations with atypical development, including caregiving disruption, autism, and extended hospital NICU stays, 3) my research testing how we use music to regulate our emotions, and 4) my development of open-source, original methods for performing EEG processing and analyses. I would appreciate the ability to conduct my research with the University's Center for Cognitive and Brain Health, which already includes equipment to assess physical activity and fitness as well as both MRI and EEG setups that are compatible with developmental research.

I believe that I could contribute to Northeastern University as an impactful researcher, collaborator, teacher, and mentor. My research program has produced 32 publications to date, including first-authored publications in journals with broad readership such as *Nature Communications*, *Psychological Science*, *NeuroImage*, and *The Journal of Neuroscience*, with a manuscript currently under review at *Science*. I have successfully obtained research grants with funding totaling over \$250,000 as well. I enjoy collaboration, and I am proud to have formed partnerships to address questions across species and disciplines in both basic and translational science contexts. I am equally dedicated to my teaching and mentoring, and I am honored to have received top teaching effectiveness ratings from the students in each of my courses. As a mentor, I have had the privilege of working with students from diverse ethnic and sociocultural backgrounds, and I have sought out opportunities with outreach organizations to support and encourage underrepresented groups' advancement in STEM fields. I eagerly anticipate continuing these outreach efforts as a principal investigator and inclusive mentor.

I am committed to furthering open and reproducible science. To date, I have publically posted data sets, and contribute data to public repositories. I have also shared several open-source software packages with the community that I would continue to develop as faculty. I publish open-access manuscripts as well. I look forward to pre-registering and sharing code for my studies and analyses as a principle investigator.

Enclosed please find my curriculum vitae, research, teaching, and diversity statements, and three selected publications. Letters of reference are forthcoming from Drs. Charles A. Nelson, Nim Tottenham, and Kate McLaughlin.

Thank you for your time. Should you require any additional information, please do not hesitate to contact me. I very much appreciate the search committee's consideration of my application.

Sincerely,



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