Gabriel Kreiman
Associate Professor
gabriel.kreiman@tch.harvard.edu
http://kreiman.hms.harvard.edu
Children's Hospital, Harvard Med. School
Center for Brain Science @ Harvard
Swartz Center for Theoretical Neuroscience @ Harvard
1 Blackfan Circle, Boston, MA 02115. 617-919-2530

April 23, 2012

Faculty Search Committee
Computational Neuroscience
Brown University

Dear Members of the Selection Committee,

I am writing this letter to strongly recommend Dr. Ethan Meyers for the tenure-track faculty position in Computational Neuroscience at Brown University. I have known Ethan for over six years now, since the beginnings of his studies at MIT. Ethan was a graduate student in Tommy Poggio's laboratory and we overlapped while I was pursuing postdoctoral work at MIT. I have collaborated with Ethan and I was also part of Ethan's Ph.D. thesis defense committee.

Ethan comes from a strong quantitative background. This has enabled him to develop algorithmic solutions and tackle problems in Systems Neuroscience from a unique perspective. Throughout his Ph.D. Ethan focused on the development and application of quantitative algorithms to study neural coding in neocortical neuronal circuits in macaque monkeys. Through his collaborative efforts with several neurophysiology groups at MIT (most notably Earl Miller's group and Bob Desimone's group), he has pioneered the use of machine learning algorithms to decode the activity of populations of neurons in single trials during visual recognition and categorization tasks. Given the strong interest from multiple neurophysiology groups in decoding neural signals, he has also developed independent collaborations with other groups outside MIT to read out the activity of neural ensembles in macaque monkey's pre-frontal cortex during delayed visually guided tasks. Ethan has significant experience and has devoted much effort and thought to understand how circuits of neurons encode and transfer information in neocortex. He has extensive knowledge of machine learning techniques, he can interact with experimentalists and he also has extensive experience with computational models of neocortical function, particularly in the domain of visual object recognition.

Through complex non-linear processing the primate visual system forms a representation of objects and the environment that is highly selective and yet also robust to strong modifications in the input. The trade-off between selectivity and invariance remains a daunting challenge for computer vision. In addressing this challenging problem, Ethan has investigated the activity of populations of neurons in macaque visual areas V4, inferior temporal cortex (ITC) and pre-frontal cortex (PFC) during visual object recognition and categorization. Early on in his work at MIT, he used machine-learning techniques to decode the activity of large arrays of voxels in functional imaging measurements (work published in Science 2004). Neurons must compute using input activity from other neurons, not blood flow and voxels. To understand how neurons encode and decode information, it is necessary to delve into the fascinating but also challenging world of electrophysiological recordings. Consequently, Ethan shifted his focus to unraveling the codes employed by neocortical circuits by quantitatively characterizing the activity of populations of neurons. He started by analyzing a delay-match-to-category task. While previous studies had

focused on static measures of neural response, Ethan brought our understanding of the process of visual categorization to a new level by considering the millisecond-by-millisecond dynamics of the responses in ITC and PFC. In contrast to previous assumptions, he showed that ITC neurons show responses that help both identify and categorize objects and he showed that PFC adds additional information about abstract concepts and categories. By considering individual trials and milliseconds dynamics, the work provided a brain-centered perspective of the task by focusing the questions on the type of data and constraints that the brain must solve (as opposed to other efforts in the field that aim to decode information without respecting physiological constraints). This work was published in Journal of Neurophysiology 2008. Part of the algorithms and computational methods developed for this work were described in detail in a book chapter that Ethan wrote which also includes a tutorial on the usage of machine learning techniques in Neuroscience (MIT Press 2011).

Another important contribution from this line of work is Ethan's recent publication with Tomaso Poggio and Bob Desimone (PNAS 2011). Here Ethan revisited our understanding of the challenges involved in recognizing objects in clutter. The presence of clutter in visual scenes is known to significantly impair recognition at the behavioral level and also to strongly reduce the responses of neurons throughout visual cortex. Reasoning that the problem could be alleviated through filtering mechanisms involving attention, Ethan collaborated with researchers in the Desimone lab to record the activity of populations of neurons and characterize the neural code for objects in clutter in the presence and absence of attention. They were able to show that attention plays a critical role in ameliorating or eliminating the problem of clutter in single trials. The work is consistent with a biased-competition model of attention and reconciles several other studies involving the effect of visual clutter in macaque monkeys and humans.

In addition to the work just described, Ethan has also performed computer vision studies and computational models of neocortex. He has recently set up novel collaborations also to examine the role of pre-frontal cortex during task switching. Ethan is capable of independent work while at the same time has proven to be a strong team worker in collaborative efforts. I am always impressed by his sharp thinking, his rigorous logic and his tenacious and perseverant attitude towards science. He is a perfectionist and he works hard to repeat all the coding, models and analyses as many times as necessary until every aspect of the work has zero flaws. Ethan does not jump to conclusions without carefully ruminating about all the assumptions, logic, analyses and statistics involved in the process. It is important to stress his strong scientific method and his integrity to pursue the analyses and studies if the conclusions go against traditional wisdom or established paradigms. Another aspect that I should highlight is that Ethan has played a key role in the experimental design for many of the projects that he pursued. He has lots of independent ideas and shows a strong motivation towards independent research. I think that Ethan would be an excellent candidate for this computational neuroscience position at Brown. I am positive that he will be very successful in his academic career and therefore I strongly support his application for this position. Should you have any questions, do not hesitate to contact me,

Sincerely yours,

Gabriel Kreiman
Gabriel.Kreiman@tch.harvard.edu
617.919.2530