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April 30, 2012

Dear Chair of the Search Committee,

This is a letter of recommendation in support of Dr. Tsvi Achler's application for a faculty position at Brown University.

Tsvi is a special young scientist with an unusual passion for his research and a very unique training. He holds an undergraduate degree in Electrical Engineering and Molecular & Cellular Biology from UC Berkeley and an MD (Neurology Rotations at UIUC, UCSF and Harvard) and PhD in Neuroscience, followed by two postdocs in Computer Science at the University of Illinois Urbana-Champaign and in my own "synthetic cognition" team ([synthetic-cognition.lanl.gov](http://synthetic-cognition.lanl.gov)) at Los Alamos National Laboratory.

I hired Dr. Achler in early 2010 as a postdoctoral fellow as we were interested in developing our large-scale models of primate visual cortex, at the time based on our (high-performance computing) version of HMAX, into models that include feedback and horizontal neural dynamics. Tsvi's research has been centered on the problem of feedback dynamics and on the cognitive tasks that can be achieved under these conditions, but not in feed-forward models. The consideration of these issues is fundamental for the creation of systems level models of (visual) cognition that approach human performance.

In his work before coming to LANL, Tsvi proposed a model of neural dynamics that addresses the issue of the "superposition catastrophe", which occurs in models of feed-forward dynamics without regularization. The superposition catastrophe is a long-standing problem (defined by Rosenblatt in 1961) for models of computer vision that, like the brain, rely on intermediate representations of features that form more complex objects and situations. How are the combinatorially large numbers of composition of features to be identified by the system without having to invoke a correspondingly large number of states? Dr. Achler's work showed how feedback inhibition can help solve the superposition catastrophe and contribute towards achieving binding of low level features into complex objects dynamically.

For his postdoctoral fellowship at LANL, Tsvi has worked to integrate his approach

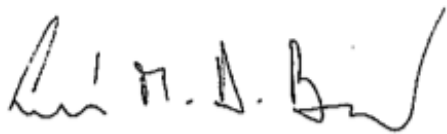
in the context of sparse coding models for image reconstruction and integrate the consequences of these general neural dynamics with several psychophysics experiments in object identification and visual pattern search. In particular he has been able to show that feedback dynamics across visual areas can account in a unified way for both asymmetries in search and sequential (masked) object identification.

These ideas are promising to test and improve the current systems-level models of visual cortex, as they show how higher visual areas modulate lower ones and help condition neural response to contextual information. They also show how sensory cortex may naturally be conceived as a generative model for its inputs. These insights are now being pursued by a variety of labs – as de-convolution models, deep belief networks and as other deep generative models. Dr. Achler's research shows how these models can be used to achieve cognitive functions that are beyond what's possible in feed-forward models – such as HMAX – and how to test these ideas systematically using behavioral experiments. I believe that this is the correct strategy to uncover the quantitative properties of neural dynamics that will allow us to create systems-level models of (visual) cognition.

Dr. Achler is a warm and social person with a rare passion for his research. He is very pleasant to work with and brings to our weekly interdisciplinary group meetings his medical knowledge of the brain and his strong intuition and models for how these can be achieved.

I recommend him strongly. Please don't hesitate to contact me if I can be of any further help.

Sincerely,  
Luis M. A. Bettencourt, PhD

A handwritten signature in black ink, appearing to read 'L. M. A. Bettencourt', with a stylized, flowing script.

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Professor - Santa Fe Institute