Stanford University

Professor Brian A. Wandell
Psychology
Stanford Center for Cognitive and Neurobiological Imaging
Stanford University

wandell@stanford.edu
Phone: 650 725 2466
http://white.stanford.edu

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I am pleased to write this strong letter supporting Kendrick Kay.

Kendrick is an exceptionally thoughtful and skilled investigator. His greatest strengths are his intuitions and skills with quantitative methods. He also has a very high degree of skill with MR instrumentation and the general methods of cognitive neuroscience. Kendrick's clarity of thought and skills make him an outstanding scientist.

I first noticed Kendrick's work when I reviewed a paper he co-authored with his Ph.D. adviser. The paper was an interesting analysis of the fMRI (BOLD) response to natural images. What particularly drew my attention was that Kendrick implemented a detailed model of how visual stimuli would drive the BOLD response in V1. He made creative use of the model to identify which image- of thousands - the subject was seeing (Kay et al., Nature 2008).

Some months after the paper was published, Kendrick contacted me to explore joining my lab as a post-doctoral fellow. We had several long discussions about scientific topics. I enjoyed these exchanges, and I was pleased when he chose to come to Stanford.

During his three years in our lab, I have come to admire him in many ways. First, he is enormously attentive to experimental methodology and statistical analyses. We pride ourselves on trying to advance the quality of MR data analysis. Frequently this is a topic I have to urge students to attend to, but in Kendrick's case he was as fanatical as or even more so than my standards. It was a pleasure to behold. As part of his work here Kendrick made substantial contributions to the way in which we collect and analyze MR data. He was particularly concerned about the spatial irregularities in MR data caused by imperfections in the B0 field. We had been concerned about this in the past, but it was really Kendrick who showed the way to estimate this inhomogeneity and to implement reconstruction methods that account it. Based on his work, we can now obtain MR images in occipital cortex across sessions with very little (sub-millimeter) spatial distortion. He manages his data carefully in many other ways. For example, he is deeply knowledgeable about pulse sequences and MR physics. I view this as an important aspect of a young scientist's development and an urgent matter if our field is to advance. In this aspect of his work, Kendrick is first-rate.

While he pays much attention to data acquisition and statistical analysis (more on this later), Kendrick is principally interested in how the visual system extracts structure from natural images. He has had a longstanding interest in the computational modeling of object perception, such as the work from Poggio's group at MIT and the work from Simoncelli's group at NYU. Kendrick led efforts at Stanford to understand that work and to find ways to explore what we might test whether the principles in that work can be found – or denied – in human visual cortex as measured by fMRI. Over the past several years, he aimed to test models of the fMRI responses in human visual cortex to probe how we see objects and forms.

In the main body of work he has done at Stanford, Kendrick focused on how responses to contrast patterns are combined across the visual field. His goal has been to develop models of the responses to simple stimuli and their mixtures, and to use these basic models to understand how we achieve position- and size-tolerant visual perception. Kendrick has used fMRI (BOLD) measurements to characterize spatial contrast summation across an array of visual field maps, and he has developed an extensive theoretical modeling framework. This work is summarized in a manuscript that is currently under review

(Compressive spatial summation in human visual cortex, Kay et al.). A second manuscript on this topic is in preparation.

The main finding from that work is to show that our ideas about how visual cortex combines information across the visual field needs to be improved. Work from my lab and others has used a simple model in which visual cortex BOLD responses are modeled as a weighted linear sum of the contrast patterns measured across space. Typically, it is assumed that the weighting across the visual field is Gaussian. Kendrick has shown that the quality of this approximation is fair in V1/V2 but increasingly problematic in V3, hV4, and other relatively anterior maps. While in primary visual cortex, the linear summation rule was imperfect, but not very far off the spatial summation rule needs substantial revision elsewhere. In some maps, the 'max' rule is a far better approximation: he measured the responses to contrast patterns in complementary parts of the visual field and then to the combined pattern. He found that the response to either pattern alone was equal to the response to the sum of the two patterns. Kendrick found a simple modification of the original model, that includes a compressive spatial nonlinearity, and that provides a substantially better prediction of the data.

Kendrick has co-authored several papers using Bayesian methods to classify and reconstruct images from neuroimaging data (papers in Nature and Neuron), as well as papers concerning the statistical analysis of data.

Here, I would like to emphasize that he is almost uniquely passionate about quantitative and statistical thinking. This passion is reflected in part in the blog he maintains with a running conversation about statistical methods (http://randomanalyses.blogspot.com/). Beyond the normal commitment, he also decided to teach a statistical analysis course to in our department this spring. The course has a very large enrollment, and it is the talk of the town. He is guiding people to think about general linear methods, statistical inference, and computational programming methods. He has always done this within the context of my lab, where has been an excellent colleague and mentor. I believe that any teaching program would benefit enormously by having Kendrick guide graduate students and post-docs in their theoretical thinking and analyses.

Kendrick is thoughtful, curious and open-minded. He is a skilled young computational investigator, capable of setting up compute clusters and grid engines, analyzing and proposing MR pulse sequences, carefully thinking through experimental designs, and developing new statistical analyses. He will be a very good teacher and consultant to colleagues on ideas and applications. I think very highly of him and I am glad to write this strong and positive recommendation.

Sincerely,

Brian A. Wandell
Stein Family Professor