

Japan-US Brain Research Cooperation Program
The Dispatch of Joint Researcher Report in 2007 fiscal year

[field: 4]

1. Affiliation/ Title/ Name: Graduate School of Information Science and Technology, The University of Tokyo, Dr. Naoki Masuda
2. The Project Title: A computational study of improvement in behavioral performance by attention
3. U.S. Investigator's Name, Title, and Affiliation: Dr. Brent Doiron, Center for Neural Science, New York University,
4. The Term of Research: From 2007/04/26 To 2007/05/26 (1 month)
5. The Abstract, the Result and the Significance of Research(300 Words):

First of all, I would express sincere thanks the financial aid given by the program. Selective attention is an important filter for complex environments where distractions compete with signals. Attention increases both the gamma-band power of cortical local field potentials and the spike-field coherence within the receptive field of an attended object. However, the mechanisms by which gamma-band activity enhances, if at all, the encoding of input signals are not well understood. We propose that gamma oscillations induce binomial-like spike-count statistics across noisy neural populations. Using simplified models of spiking neurons, we show how the discrimination of static signals based on the population spike-count response is improved with gamma induced binomial statistics. These results give an important mechanistic link between the neural correlates of attention and the discrimination tasks where attention is known to enhance performance. Further, they show how a rhythmicity of spike responses can enhance coding schemes that are not temporally sensitive.

I conducted the main numerical simulations. Dr. Doiron and I worked together on the other parts of the project, namely, designing the research, building the theory, producing the figures, writing the manuscript. In fact, a rough sketch of the research and preliminary numerical results had been obtained before I visited NYU this time. However, my visit this time made it possible for us to discuss critical as well as technical points of the project face-to-face, literally every day, which led to a smooth completion of the project.

The upshot of this project was submitted to PLoS Computational Biology after I came back to Japan. This new journal (IF=4.914) actually publishes a lot of studies in theoretical and data-oriented neuroscience. The paper was accepted in October 2007.

6. The Others (Practical Issues, Special Mention Matters):
None.