Title: In search of allocentric coordinates–where they are and how they emerge

Name: Shigeru Kitazawa
Affiliation: Graduate School of Frontier Biosciences, Osaka University

Abstract

Why the external world remains stable while we move our eyes has been a matter of debate for many, at least 1000, years. The phenomenological experience argues for the existence of some allocentric (world-centered) coordinate in the brain. However, up until recently, it has been questioned if there is any such allocentric representation that works fast enough to stabilize the external world every time we move our eyes.

To address the issue, we hypothesized that the brain is able to instantly extract the “background” from our rather wide visual field, and automatically represents objects relative to the background (background coordinate). We have recently shown in human that the background coordinate is actually working automatically [1], and that it is located in the right precuneus [2]. We further confirmed in monkeys that there are such neurons in the precuneus whose receptive fields move with the background. Now that we have solved the where problem, we are trying to elucidate how allocentric representation emerges in the precuneus, which reportedly constitutes a central hub as well as a central timer of the entire cortical network [4]. To address the how issue, we are now using artificial neural nets that reflect the gist of the actual network and testing a hypothesis that an allocentric coordinate emerges from predictive auto-encoding. Our most recent results from the artificial neural net approach will be presented in comparison with actual neurophysiological data obtained from the monkeys.