

Japan-U.S. Brain Research Cooperation Program  
Researchers Dispatched to the U.S. Program FY2013: Report

Field: 3

1. Researcher

Name: Ai Koizumi

Title: Researcher

Affiliation: Tokyo University, Graduate School of Humanities and Sociology

2. Research Title: Interaction between bottom-up and top-down information processing among anxious individuals.

3. U.S. Joint Researchers/Institutes

Hakwan Lau, Associate Professor, Columbia University, Psychology Department.

4. Research Period, from/to (mm/dd/yyyy): 7/1/13 – 3/12/14

5. Abstract, Results, and Research Significance (300 Words):

When sensory input is processed in a bottom-up fashion, how does it trigger top-down processing such as inhibitory control? The interplay between bottom-up and top-down processing may partly depend on the extent to which the sensory input is brought into awareness. This is because previous studies have shown that the sensory inputs that lead to higher awareness trigger stronger activities in the prefrontal regions, which are known to be the primary sites for executing top-down control. This project addressed 1) how 'awareness' of visual information mediates the interplay between bottom-up and top-down processing, and 2) how awareness itself may be altered among high anxious individuals who often show difficulties in implementing top-down control.

In a first series of experiments, we manipulated 'metacognitive awareness' which refers to higher-order self-monitoring of ongoing perception, as reflected by e.g. confidence ratings one gives in perceptual tasks. The results showed that awareness has little impact on how bottom-up processing triggers top-down control overall. Yet, awareness did strengthen the recruitment of top-down control among the individuals with larger prefrontal volumes. In a next series of experiments, we examined how visual awareness itself may vary across individuals depending on their anxiety levels. The perceptual accuracy was experimentally matched across individuals, so as to selectively tap on to the individual differences in metacognitive awareness. Preliminary results revealed some effects of anxiety on metacognitive awareness. Further analyses with Voxel Based Morphometry showed that the gray matter volumes in the prefrontal regions account for some of the anxiety effects. It has been previously shown that high anxiety affects top-down control. Although it has been neglected, based on the current findings we conclude that metacognitive awareness may be one mediator for the anxiety related changes in top-down control.

6. Other (Research concerns, particular points of note):