

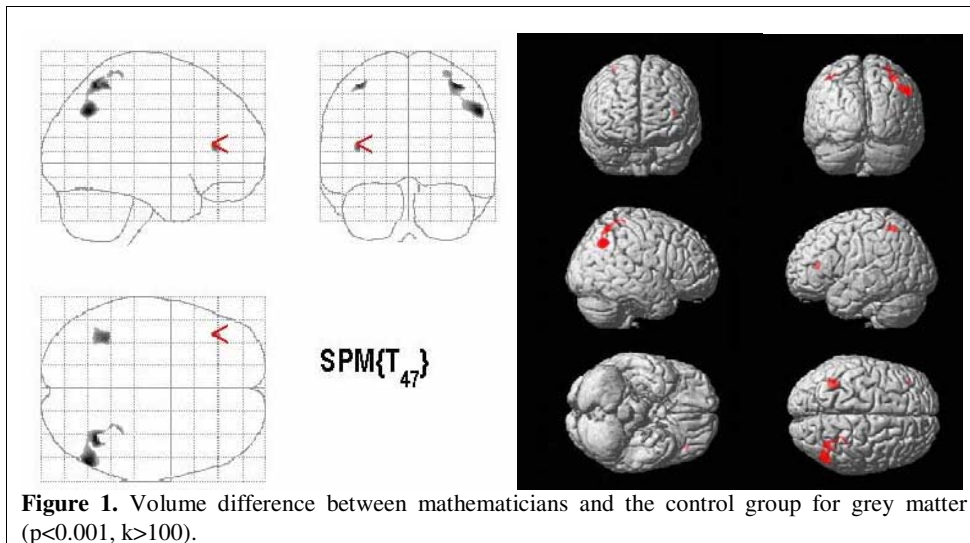
Morphological Differences in the Grey Matters of Mathematicians: A Voxel-Based Morphometry Study

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INTRODUCTION: Use-dependent cortical plasticity has been the subject of some previous studies [1], [2]. However, there is not any study on the structural changes due to the academic occupation of mathematicians. Voxel Based Morphometry (VBM) permits us to make a voxel-based comparison of the local concentration of grey matter between two groups. In this study, we present a preliminary result of a part of an ongoing research. We performed an optimized VBM algorithm on grey matter volumes of mathematicians and the control group to determine whether academic career on mathematics changes the brain morphology.

METHODS: 26 mathematicians and 23 controls underwent an MRI imaging process. All subjects were scanned with 2D Flash sequence (TE/TR 5/20ms, 280x280mm FOV, 10mm slice thickness) on a Siemens 1.5 Tesla Symphony scanner. Study specific template and prior images were created for Voxel-Based Morphometry (VBM) study using SPM2 (<http://www.fil.ion.ucl.ac.uk/spm/spm2.html>). All images were segmented into gray matter (GM), white matter (WM) and cerebrospinal fluid (CSF) using an optimized VBM procedure and the customized T1-weighted template [3]. Then the images were smoothed by 12 mm Gaussian kernel. Finally, statistical inferences were calculated by again SPM2.



RESULTS: We found significantly increased gray matter density in bilateral inferior parietal lobules and left inferior frontal gyrus of the mathematicians (Figure 1). The simple regression analysis performed to investigate the association between gray matter density and the duration of academic occupation of mathematicians revealed the significant correlation in the right inferior parietal region.

DISCUSSION: Although, there are some studies [4] about the brain regions responsible for the simple arithmetic calculations, studies revealing the regions responsible for the advanced level mathematical skills have not been performed yet. As Sluming et al reported that [2] orchestral musicians possess a region of significantly increased gray matter density within the left inferior frontal gyrus including Broca's area, a region known to be critically important for language, we speculate that in the brains of mathematicians, there is an increase of grey matter in the left inferior frontal gyrus which might show that there might be an association or interaction between the regions of mathematics and language in human brains.

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