Fractal dimensional analysis: Relationship to cognition in a clinically normal community-based cohort.

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INTRODUCTION
The intricate folding of the human cerebral cortex are amenable to study using a measure of shape complexity known as fractal dimension (FD). This measurement is potentially complementary to conventional measures of the human cerebral cortex such as measures of volume or cortical thickness.

It is not known whether this measure of global brain complexity has any relationship with neuropsychological assessments of cognitive function.

The purpose of this study is to examine the relationship between FD and measures of cognition of community-based non-demented subjects. We also intend to determine the existence of any relationship between brain structure and neuropsychological testing.

HYPOTHESIS
We expect to see a correlation between human cerebral cortex complexity and neuropsych measures of episodic memory and crystallized knowledge.

METHODS
Source Data: Data was obtained from a community cohort of non-demented healthy adults with mild subjective cognitive complaints (N = 19). The subjects underwent high resolution Magnetic Resonance Imaging (MRI) and neuropsychological evaluation including measures of learning and memory, processing speed, verbal fluency, naming, and executive functioning.

Image Segmentation: 3D surface were generated from the MR images through a semi-automated segmentation software suite called FreeSurfer (Martinos Imaging Center, Massachusetts General Hospital, Boston).

Neuropsychological Assessments: The neuropsych assessment data assessed the 4 measures of cognition: memory, attention, language and judgment. The assessments included Practice Effects (PE) assessment, Trails test, Controlled Oral Word Association (COWA) test, Category Fluency test, Boston Naming Test, Symbol Digit Modalities Test (SDMT), Brief Verbal Memory Test (BVMT) and the Hopkins and the Verbal Learning Test (HVLT).

RESULTS
Strong and statistically significant correlations existed between FD and measures of processing speed (r=0.52, p=0.03) and semantic fluency (r=0.64, p=0.004).

No strong correlation is observed between FD and PE (r=0.088, p=0.689), RBANS (r=0.276, p=0.203), BNT (r=0.157, p=0.533), or BVMT (r=0.229, p=0.346).

CONCLUSIONS
These preliminary results provide a reason of interest to further investigate the relationship between local and global fractal dimension and neuropsychological assessments.

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