



Neuroanatomical correlates of developmental dyscalculia: combined evidence from morphometry and tractography

Elena Rykhlevskaia^{1,2}, Lucina Q. Uddin¹, Leeza Kondos¹ and Vinod Menon^{1,3,4*}

¹ Department of Psychiatry and Behavioral Sciences, Stanford University, CA, USA

² Department of Psychology, Stanford University, CA, USA

³ Program in Neuroscience, Stanford University, CA, USA

⁴ Symbolic Systems Program, Stanford University, CA, USA

Edited by: Silvia A. Bunge, University of California Berkeley, USA

Reviewed by: Roland Grabner, Swiss Federal Institute of Technology Zurich, Switzerland
Susan M. Rivera, University of California, USA

*Correspondence: Vinod Menon, Program in Neuroscience and Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, 780 Welch Rd, Room 201, Stanford, CA 94305-5778, USA. e-mail: menon@stanford.edu

Received: 01 September 2009; paper pending published: 05 October 2009; accepted: 02 November 2009; published online: 24 November 2009.

Citation: Rykhlevskaia E, Uddin LQ, Kondos L and Menon V (2009) Neuroanatomical correlates of developmental dyscalculia: combined evidence from morphometry and tractography. *Front. Hum. Neurosci.* 3:51. doi: 10.3389/neuro.09.051.2009

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VISUALIZING NETWORKS OF DETERMINISTIC PATHWAYS WHICH TRAVEL VIA WM ROI AND CONNECT 58 APRIORI ROIS.

The network of 58 projection targets and their direct connections was visualized using the following rule: a pathway between two regions is displayed if the majority of participants have at least one fiber pathway connecting the two regions. The number of participants constituting a “majority” is determined as a critical value for binomial distribution with probability of success $p = 0.5$. For example, the binomial probability of observing at least 30 of 47 in trials with probability of success $p = 0.5$ is less than 0.04. Therefore, observing a connection in 30 of 47 participants suggest that there is not a chance likelihood of observing this connection. Hence, the connection is displayed. Following this same binomial rule, we visualized the network of major WM ROI projection targets separately in TD and DD participants, where a link was drawn whenever there were, correspondingly, 17 of 24 or 16 of 23 participants spotting pathway between two regions.

Out of 58 key projection targets of interest, 19, in fact, were strongly linked with each another, forming a densely-interconnected network in the right hemisphere (**Figure S1**). Each participant showed, on average, 237 fascicle connections directly linking the 19 key projection targets. Two types of connections patterns appear noteworthy: (1) intra-hemispheric connections between both lateral and medial occipital and parietal cortices and (2) connections along ventral stream traveling along inferior temporal lobe from occipital lobe hippocampus and parahippocampal cortex. In terms of group differences, TD children showed stronger inter-hemispheric (superior parietal, calcarine and cuneus) and stronger connections in the inferior temporal cortex. Children with DD showed stronger connections from right superior occipito-parietal cortex to thalamus. TDs also showed a stronger link from right superior occipital cortex to the cerebellum. These exploratory analyses provide specific pathways for more targeted investigation in future studies.

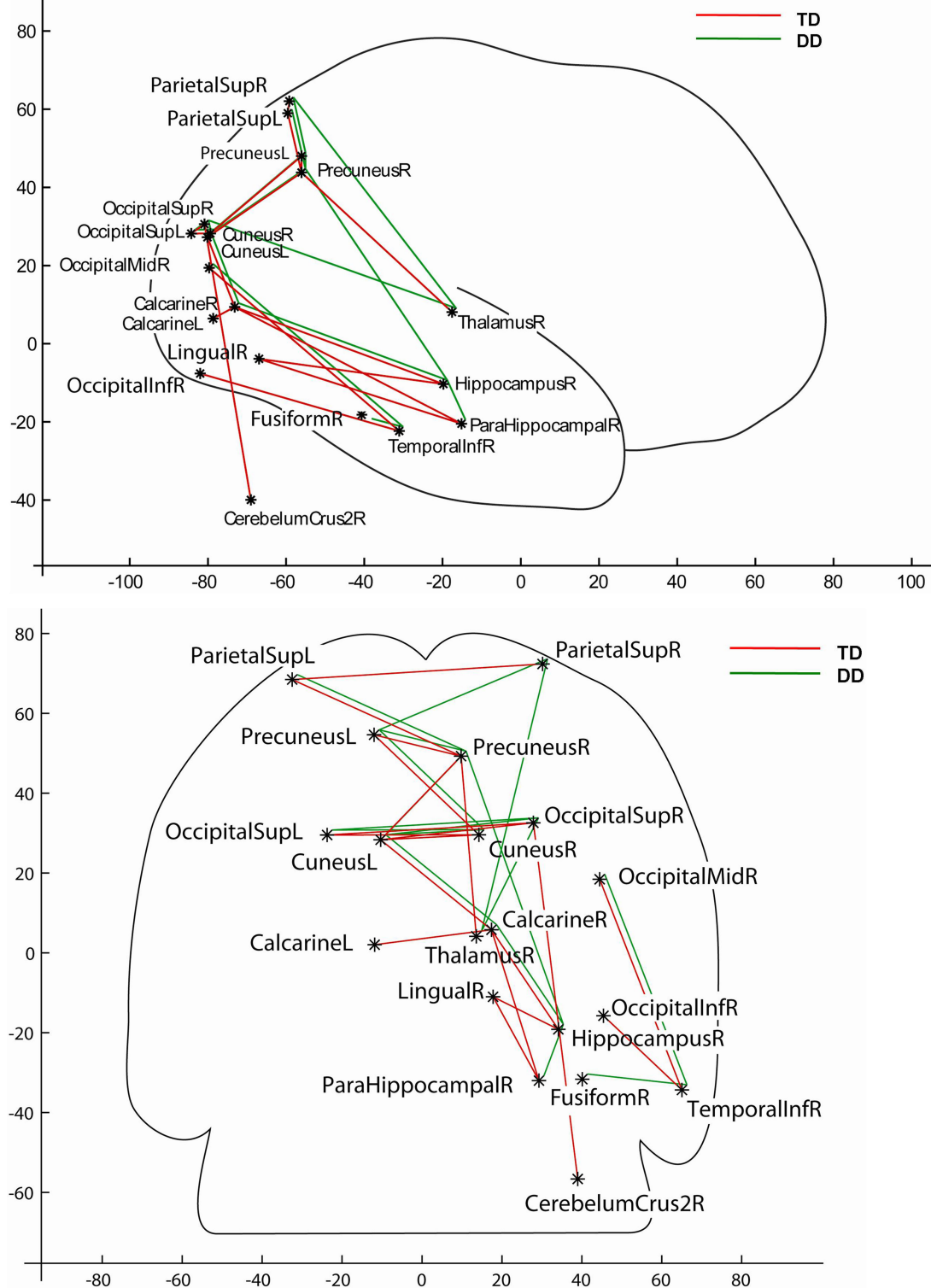


FIGURE S1 | (Top) Sagittal and (Bottom) Coronal views of a network of grey matter ROIs linked by deterministic pathways passing through the right temporal-parietal WM ROI where children with DD showed significant WM deficits. The target locations are marked with asterisks at the center-of-mass location of the corresponding AAL ROI. *A-priori* target

locations that were not linked significantly to any other location in either of the subject groups are not displayed. An edge connecting two nodes is included if at least 16 of 23 or 17 of 24 participants (binomial majority) for DD and TD groups, respectively, had at least one fiber pathway traveling through both target ROIs.