VOLUMETRIC ANALYSIS OF CORTICAL AND SUBCORTICAL REGIONS IN CONGENITAL DEAFNESS

Lénia Amaral1,2, Ana Ganho1,2,3, Dongjun He4, Quanjing Chen5, Bradford Z. Mahon4,6,7, Oscar F. Gonçalves3,8,9, Fang Fang4,10,11, Yanchao Bi12, Jorge Almeida1,2

1Faculty of Psychology and Education Sciences, University of Coimbra, Portugal. 2Proaction Lab, Faculty of Psychology and Education Sciences, University of Coimbra, Portugal. 3School of Psychology, University of Minho, Braga, Portugal. 4Department of Psychology and Key Laboratory of Machine Perception (Ministry of Education), Peking University, Beijing, PR China. 5Department of Brain and Cognitive Sciences, University of Rochester, NY, USA. 6Department of Neurosurgery, University of Rochester, NY, USA. 7Center for Visual Science, University of Rochester, NY, USA. 8Neuropsychophysiology Laboratory, CiPsi, School of Psychology, University of Minho, Braga, Portugal. 9Bouvé College of Health Sciences, Northeastern University, Boston, MA, USA. 10Peking-Tsinghua Center for Life Sciences, Peking University, Beijing, PR China. 11PKU-IDG/McGovern Institute for Brain Research, Peking University, Beijing, PR China. 12National Key Laboratory of Cognitive Neuroscience and Learning, Beijing Normal University, Beijing, PR China.

Grant 112/12

Objectives: Sensory cortices of individuals who are congenitally deprived of a sense can undergo considerable plasticity and be recruited to process information from the senses that remain intact. How information that is rerouted to the neuroplastically changed cortex is still under debate. Here we explore the volumetric changes in auditory and visual subcortical areas of the congenitally deaf, when compared to the hearing, to uncover the circuitry involved in relaying visual information to the auditory cortex (AC).

Methods: We used MRI to perform volumetric analysis. Individual brain images were manual segmented to determinate the regions of interest (ROIs). The ROIs were the inferior colliculi, superior colliculi, and the thalamus. Within the thalamus we further defined the pulvinar, the lateral geniculate nucleus (LGN) and the medial geniculate nucleus. Each ROI was traced based on its anatomical borders, and the total volume of ROIs was calculated. These volumes were compared, within-subjects, in order to investigate the volumetric differences between left and right hemisphere per ROI and per group (deaf and hearing), because of the known right hemisphere AC biases in neuroplasticity.

Preliminary results: We show hemispheric asymmetries in the deaf but not in the hearing for the Thalamus and the Inferior Colliculus, such that the right counterpart was larger than the left. Since the Thalamus can be divided in different nucleus we also analyze the volume of different thalamic nuclei. We show a marginally significant difference between the right and left LGN for the deaf participants, such that the right counterpart was also larger than the left.

Conclusion/discussion: These results suggest that subcortical regions like the Thalamus and Inferior Colliculi can be responsible for neuroplastically rerouting visual information to the AC. That is, visual information may reach the AC from an auditory structure – the inferior colliculi – and/or from a visual structure – the LGN.

Keywords: Congenital deafness, Neuroplasticity, Volumetric analysis