DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Scientific research indicate that organization of human brain is affected both by nature (inborn specializations) and nurture (i.e. sensory deprivation or training of new skills). One formidable example of nurture shaping would be congenital blindness, as it provides unique insights into how experience contributes to functional specialization of the visual cortex during development. Without visual input, brain areas classically processing visual information in non-deprived population are engaged in tasks in different sensory modalities like sound localization and tactile Braille reading. They can even change their cognitive role and participate in numerical thinking. This phenomenon is referred to as cross-modal plasticity. Currently there are two main models trying to explain such cortical reorganization processes regarding visual cortex. First one assumes that cortical areas are specialized for certain tasks independently from sensory input modality, i.e. retain their category-specific information processing (like reading, number or body shape identification). Second model expects visual cortex to be pluripotent (capable of executing various neuronal operations related to different cognitive processes), colonialized by higher cognitive functions in congenital blindness. The goal of my project is to test predictions from these models with a series of experiments conducted on blind and sighted subjects with the use of neuroimaging methods.

In the proposed research subjects will participate in experiments with the use of functional magnetic resonance imaging (fMRI), measuring indirectly neuronal activation and transcranial magnetic stimulation (TMS). TMS is a non-invasive method which allows to indicate whether (and when) targeted structure is crucial for performed task. During designed experiments participants will perform language processing tasks in different modalities: auditory and tactile (congenitally blind subjects) or visual (sighted controls). Results will indicate whether visual cortex of blind people retains its specialization towards reading (task-selective model) or becomes general language processing area (pluripotent model).

Studies over last decades have shown that human brain can undergo extensive reorganization, both in terms of its function and structure. However, mechanisms underlying brain plasticity are still puzzling researchers. Currently two theoretical frameworks trying to explain brain (re)organization are proposed. Testing validity of their assumptions will help us to understand nature of human brain cortex functions.