

How do prior experiences affect brain development, and to what extent can brain organization be modified by specific experiences early in life?

The proposed project aims to study the plasticity of the human brain in a group of people who are deaf from birth with different language experiences. Previous studies using functional magnetic resonance imaging (fMRI) suggest that auditory areas in the temporal cortex undergo intermodal plasticity, adopting functions related to the senses of sight and touch. The functional specialization of the reorganized areas and the extent of plasticity in this population remain largely unexplored. It is unclear which functions are taken over by "auditory" areas and why.

Answering these questions is difficult to achieve with traditional fMRI methods. Most traditional task-based experiments involve studying one or two specific functions (tasks) and their neuronal correlates. This assumes specific hypotheses about what functions are and are not represented in auditory areas. In addition, traditional fMRI studies are based on group analyses and do not take into account anatomical and functional variation among subjects.

The project uses two complementary approaches. First, naturalistic stimuli will be used: subjects watch a silent movie while their brains are scanned. In this way, we are able to study the cortex's responses to diverse aspects of the film being watched: from purely sensory to those related to social interactions (such as theory of mind) and making sense of the narrative (such as causal connections). The use of machine learning-based fMRI analysis will explore how the above different aspects of the presented film are decoded in the auditory and linguistic areas of deaf people.

Secondly, tasks will be used to localize specific functions in the individual participant's brain (language, visual semantics). In this way, analysis of fMRI data in a group of individuals will be based not on anatomically equivalent areas, but areas that have a similar functional profile in each subject.

The project also takes into account the influence of individual deaf people's experiences, including language exposure and sensory experiences, by integrating naturalistic fMRI measurements with behavioral data.

We hypothesize that at least some of the plasticity effects in the temporal cortex are related to the plasticity of the language network rather than the sensory network. The language network in the auditory cortex may process the meaning of visual narratives (video) to a greater extent than it does in hearing subjects.