



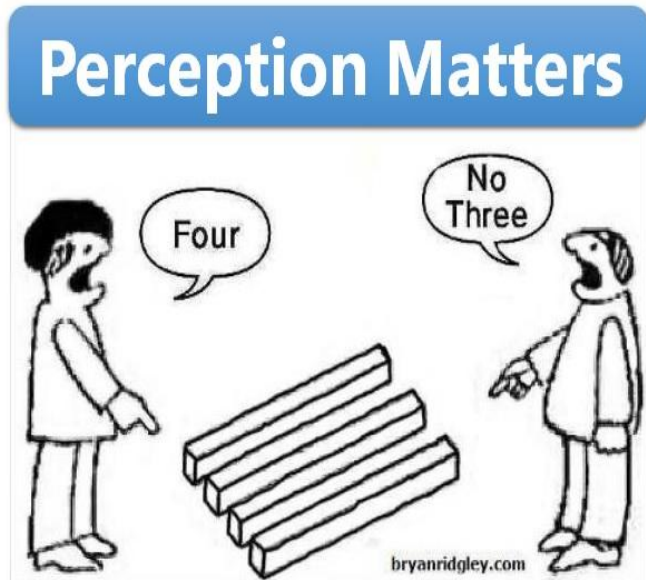
Perception and Cognition Laboratory (PCL)

Prof Norbert Kopčo

<http://pcl.upjs.sk>

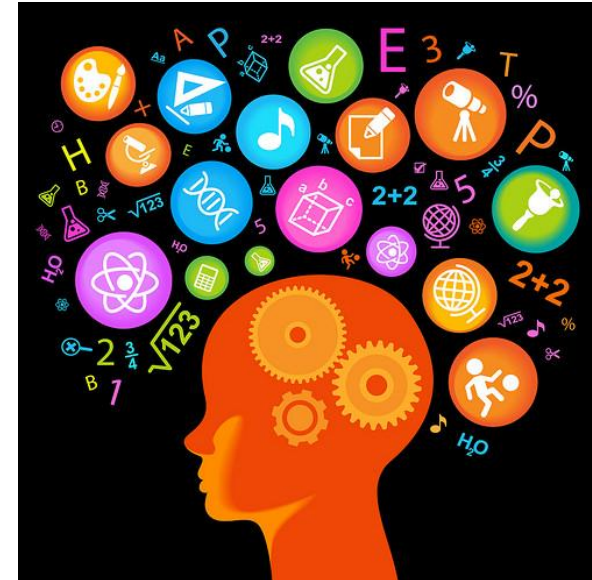
Perception

Perception is the process of getting, interpreting, selecting, and organizing sensory information.

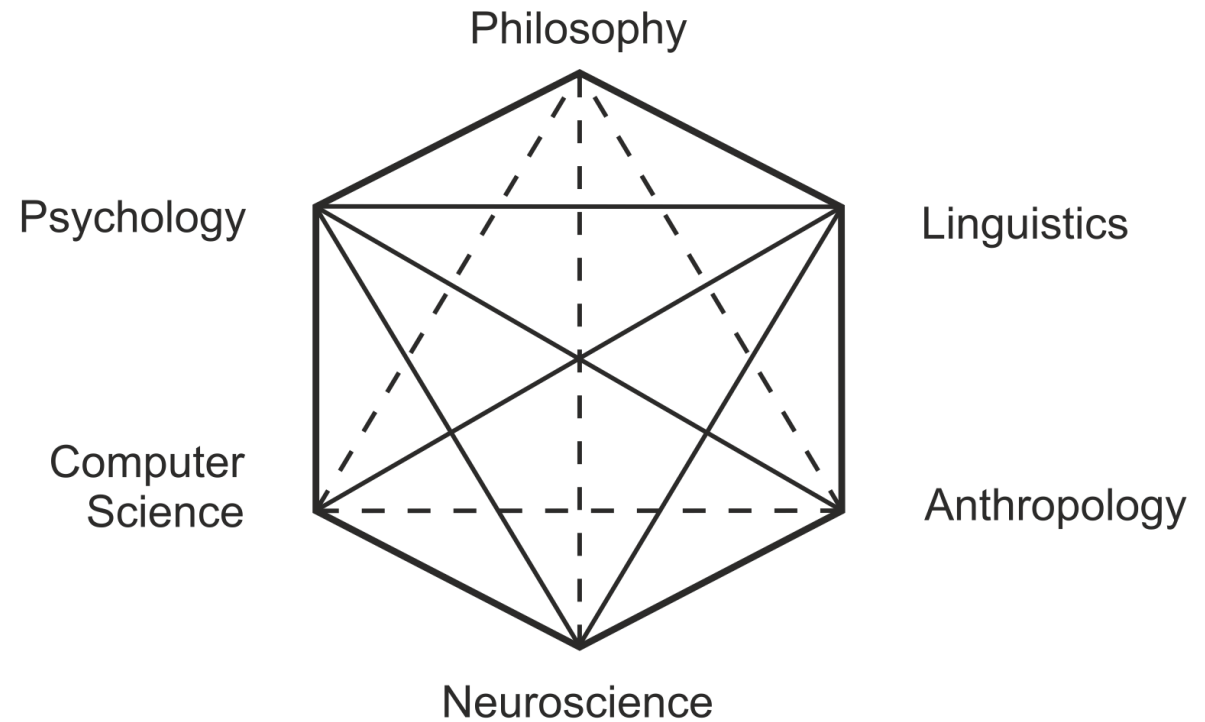


Cognition

Cognition refers to "the mental action or process of acquiring knowledge and understanding through, experience, and the senses".



Cognitive Science



Adapted from Gardner, Howard (1985).
The mind's new science: A history of the cognitive revolution.
New York: Basic Books, Inc.

Our Research



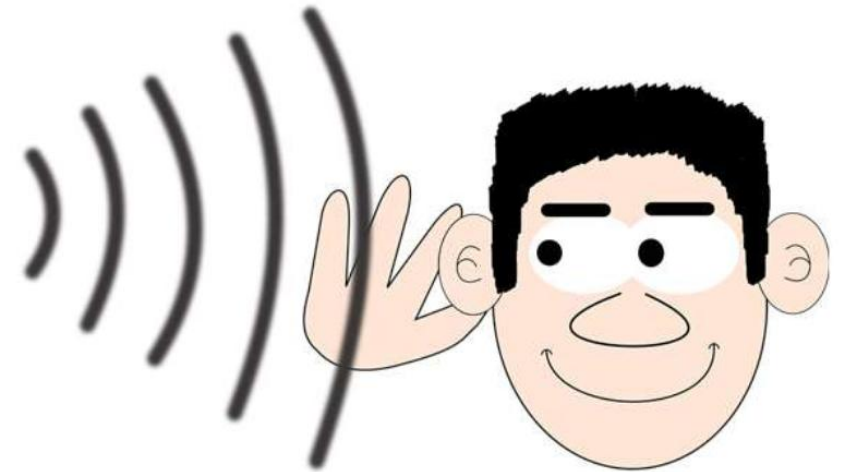
Auditory perception (mainly spatial hearing)



Sound localization, separation of sounds and speech intelligibility



Related topics: audio-visual interactions, attention, ventriloquism, etc.



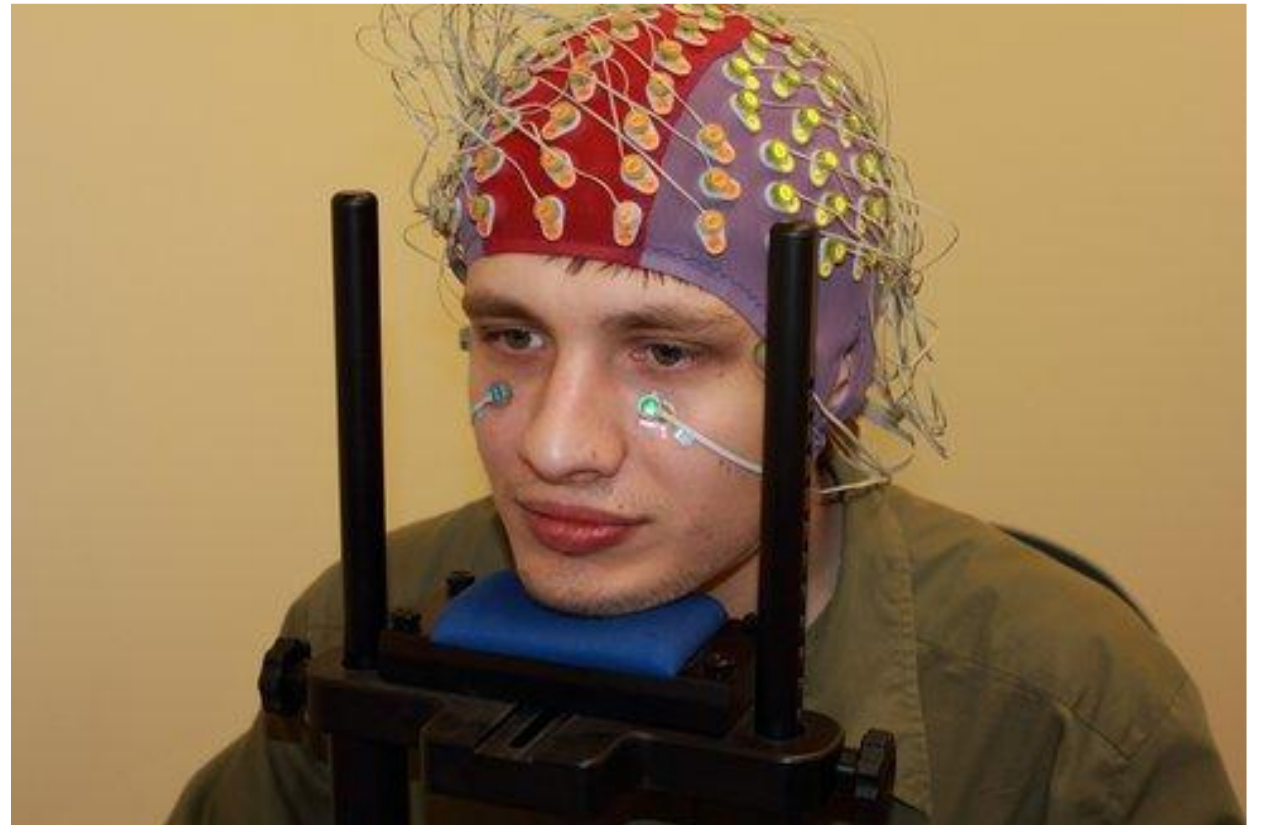
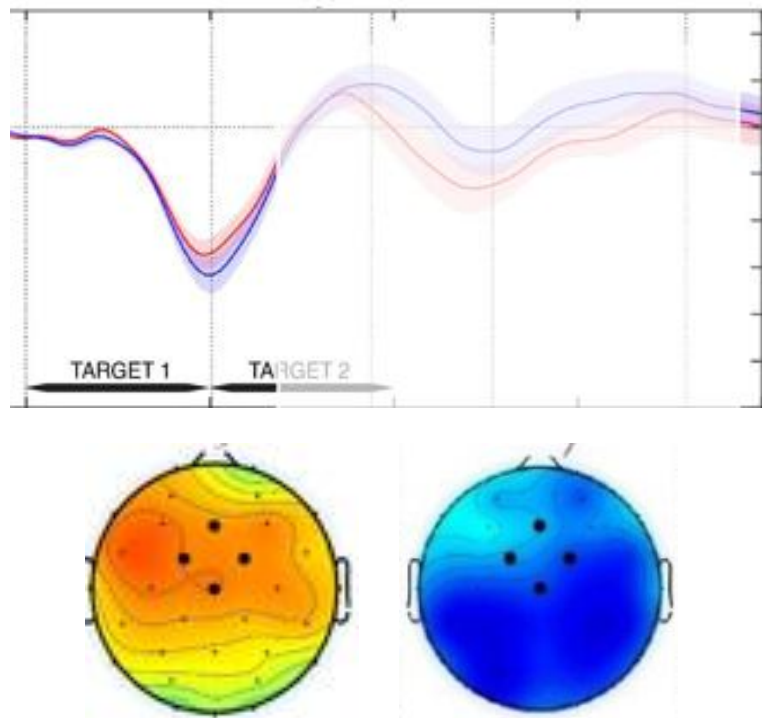
Method 1:

Behavioral Experiments



Method 2:

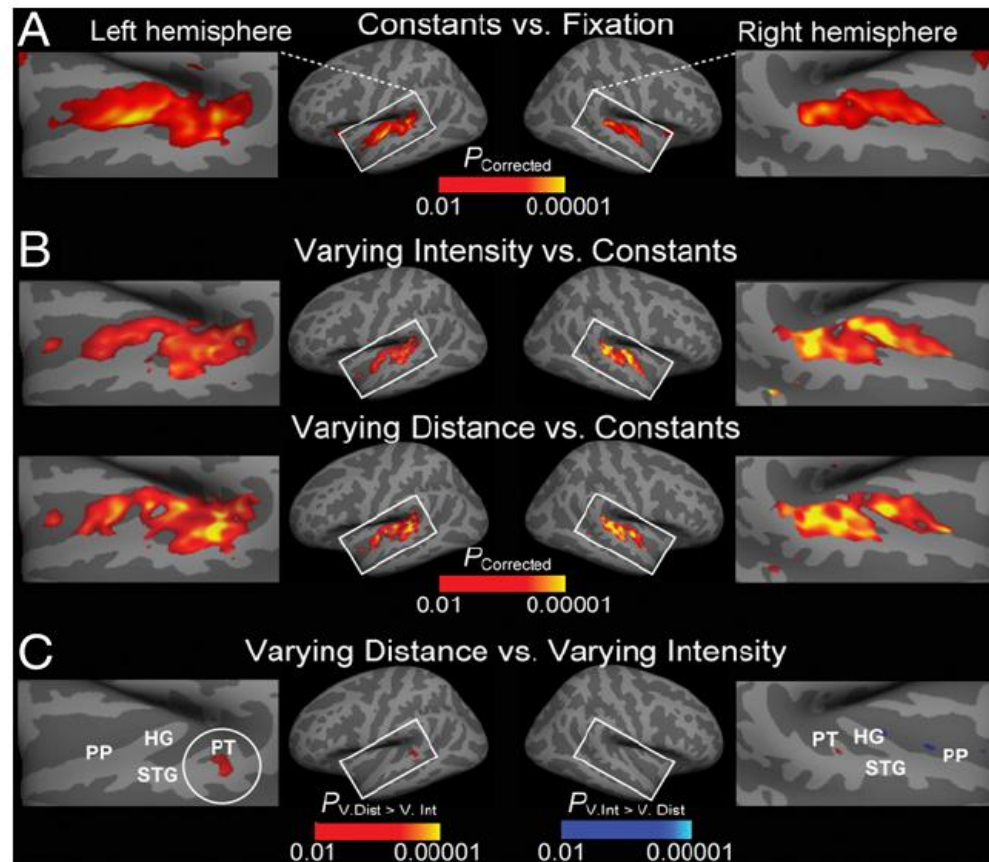
EEG (Electroencephalogram)



Šebeňa, R., Kopčo, N., (2026) "Modality-Dependent Involuntary Attention and Eye Gaze Direction Affect Auditory Spatial Discrimination", Attention, Perception, & Psychophysics

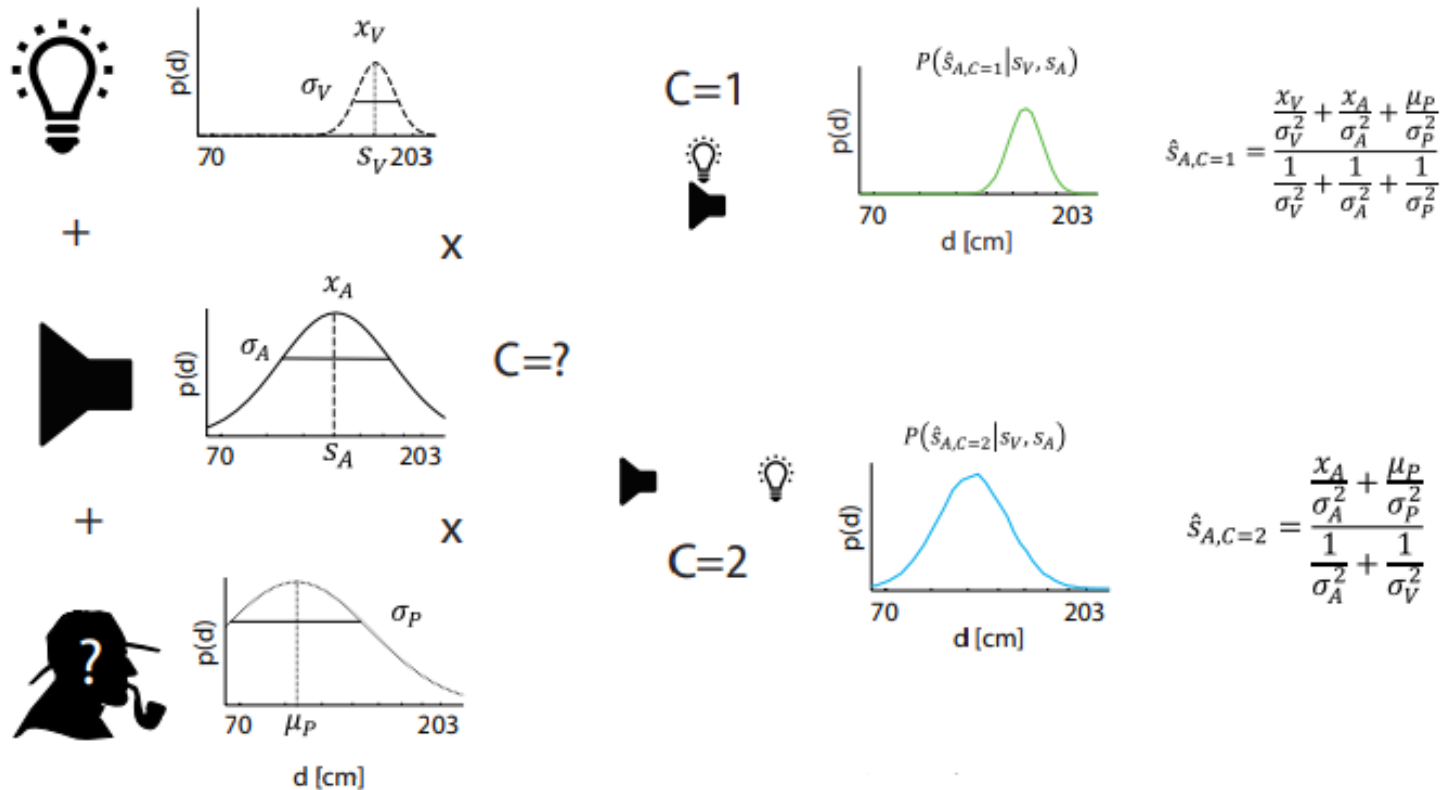
Method 3:

fMRI (functional Magnetic Resonance Imaging)



Method 4: Modelling

Model Structure



Topic 1:

Neural oscillations and spatial auditory attentional control

Supervisor: Y. Modaresnia

- EEG analysis (MATLAB / FieldTrip)
- Event-related potentials (ERP)
- Brain oscillations (alpha band)

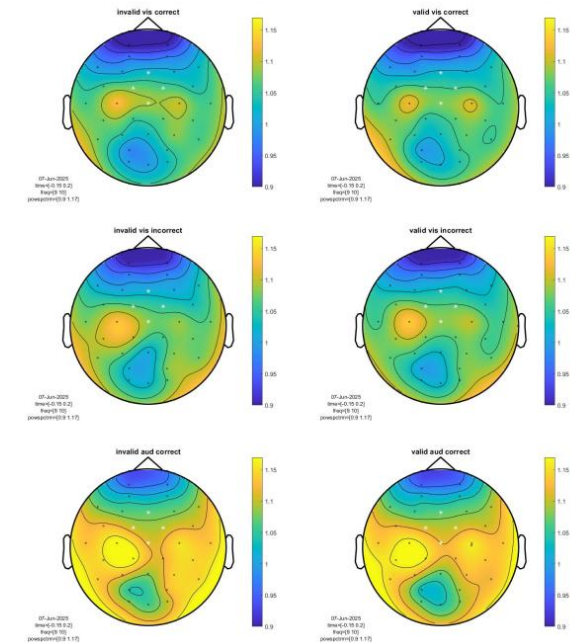
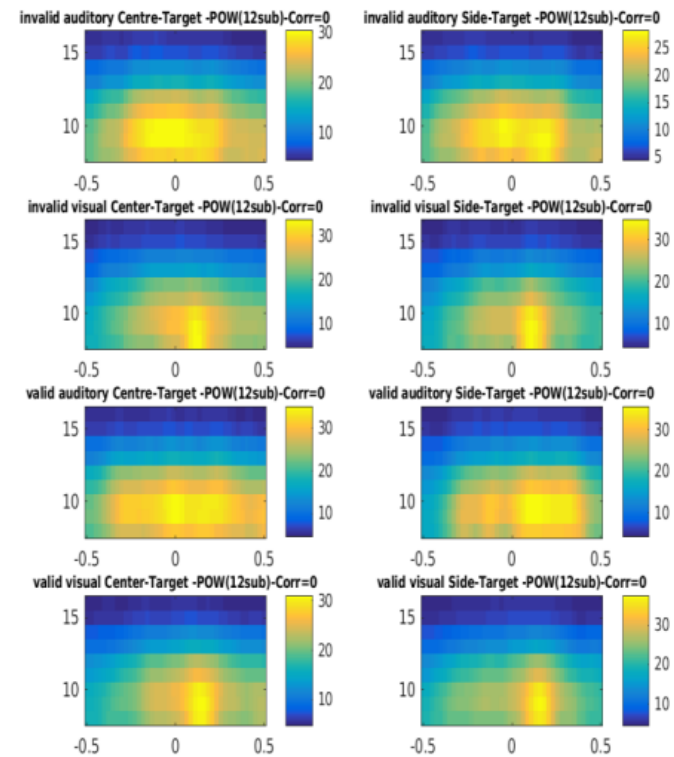
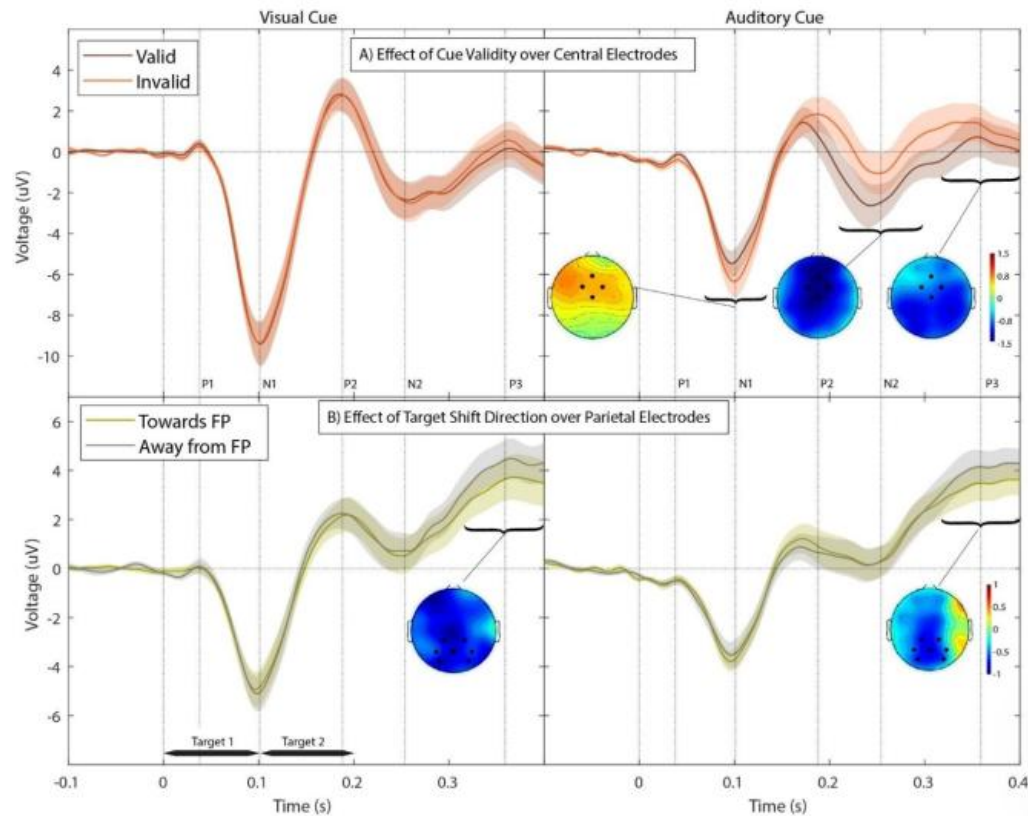
Student Tasks

- Replicate previous EEG studies
- Analyze behavioral & EEG data
- Test alpha oscillations and attention
- Modify cueing experiment & collect data

Topic 1:

Neural oscillations and spatial auditory attentional control

Supervisor: Y. Modaresnia



Topic 2:

Reweighting of binaural sound localization cues in virtual environment

Supervisor: U. Singhal/ Y. Modaresnia

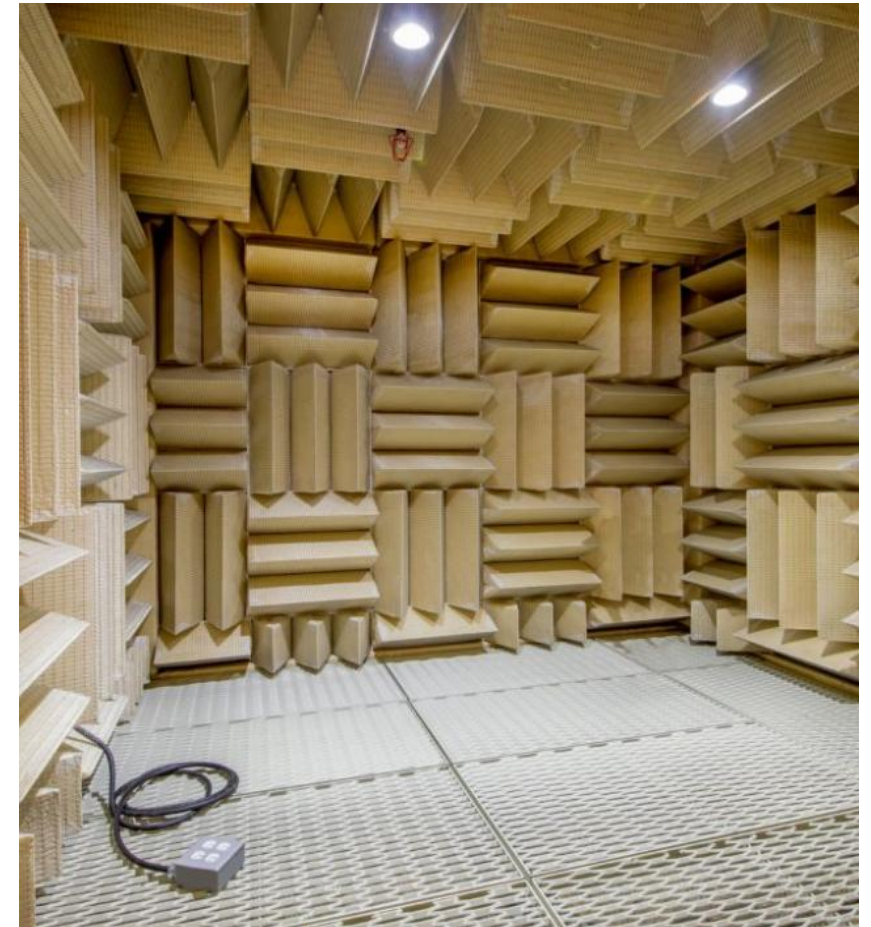
Student Tasks

- Design virtual listening experiment
- Compare anechoic vs reverberant environments
- Model cue weighting (linear regression)
- Compare with previous datasets
- Optional: EEG / brain stimulation

Topic 2:

Reweighting of binaural sound localization cues in virtual environment

Supervisor: U. Singhal/ Y. Modaresnia



Topic 3:

Rapid adaptation in audio-visual spatial perception

Supervisor: Dr. Loksa

Student Tasks

- Audio-visual spatial perception
- Multisensory plasticity
- Ventriloquism effect
- Eye movements & spatial adaptation
- Literature review on audio-visual plasticity
- Set up system for head, eye-gaze, and pointing tracking
- Study role of saccade adaptation in ventriloquism effect
- Analyze human and monkey experimental data
- Examine trial-to-trial adaptation and reference frames

Topic 4:

Plasticity in audio-visual spatial perception

Supervisor: Dr. Loksa

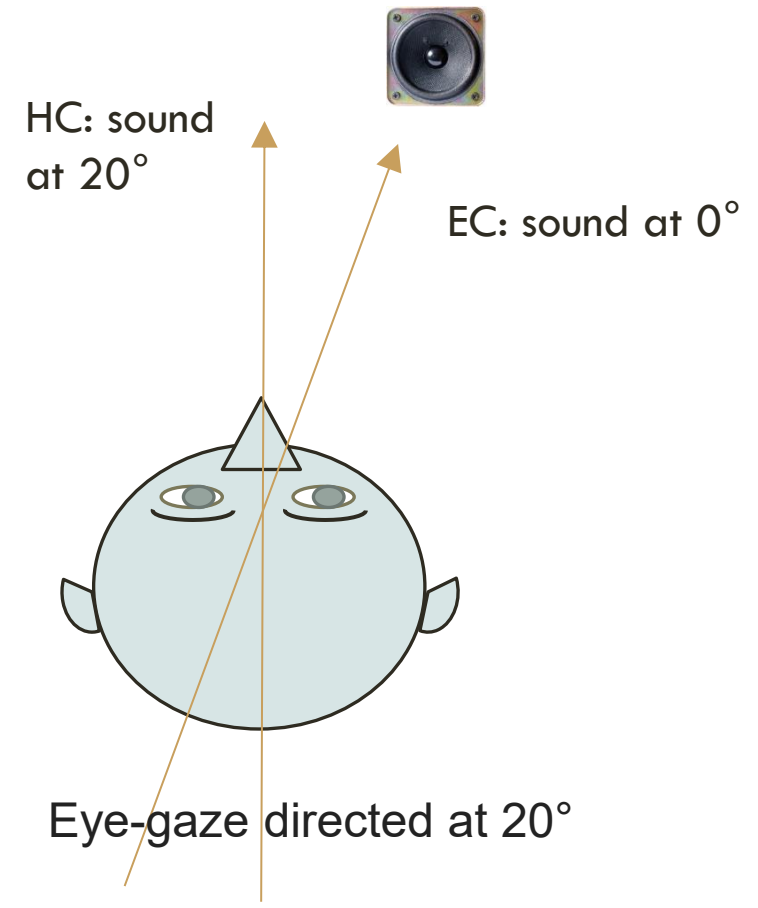
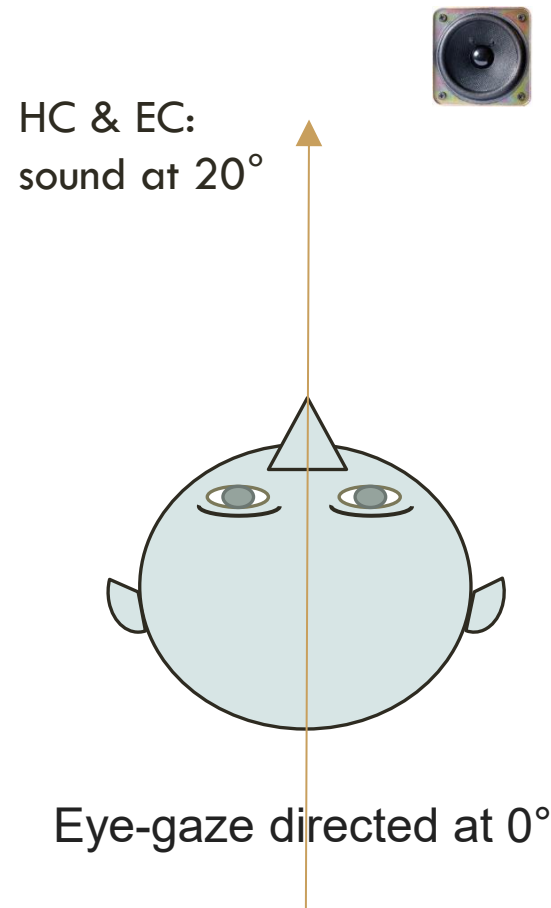
Student Tasks

- Review research on audio-visual spatial plasticity
- Set up system for head, eye-gaze, and pointing tracking
- Design experiment based on Kopco & Loksa (2019)
- Analyze data to test saccade contribution to adaptation
- Examine reference frame of the ventriloquism aftereffect

Topic 4:

Plasticity in audio-visual spatial perception

Supervisor: Dr. Loksa



Topic 5:

A Robot Arm System for Auditory Distance Localization Studies

Supervisor: M. Fedorenko

Student Tasks

- Auditory distance perception
- Experimental systems in neuroscience
- Robotic control and automation
- Behavioral data collection
- Learn experimental methods in neurocognitive research
- Install and configure the robotic arm system
- Develop scripts for automated data collection
- Process and validate experimental data
- Prepare data for further analysis

Topic 6:

Auditory distance perception in fixed and varying simulated acoustic environments

Supervisor: M. Fedorenko

- Collect new data and analyse them together with available data to find
- Whether listeners can maintain multiple models of auditory environments in their brains in parallel
- Whether learning distance perception in different rooms is affected by consistency of room simulation

Topic 7:

Neural encoding of auditory distance information in the human brain

Consultant: Dr. Doreswamy

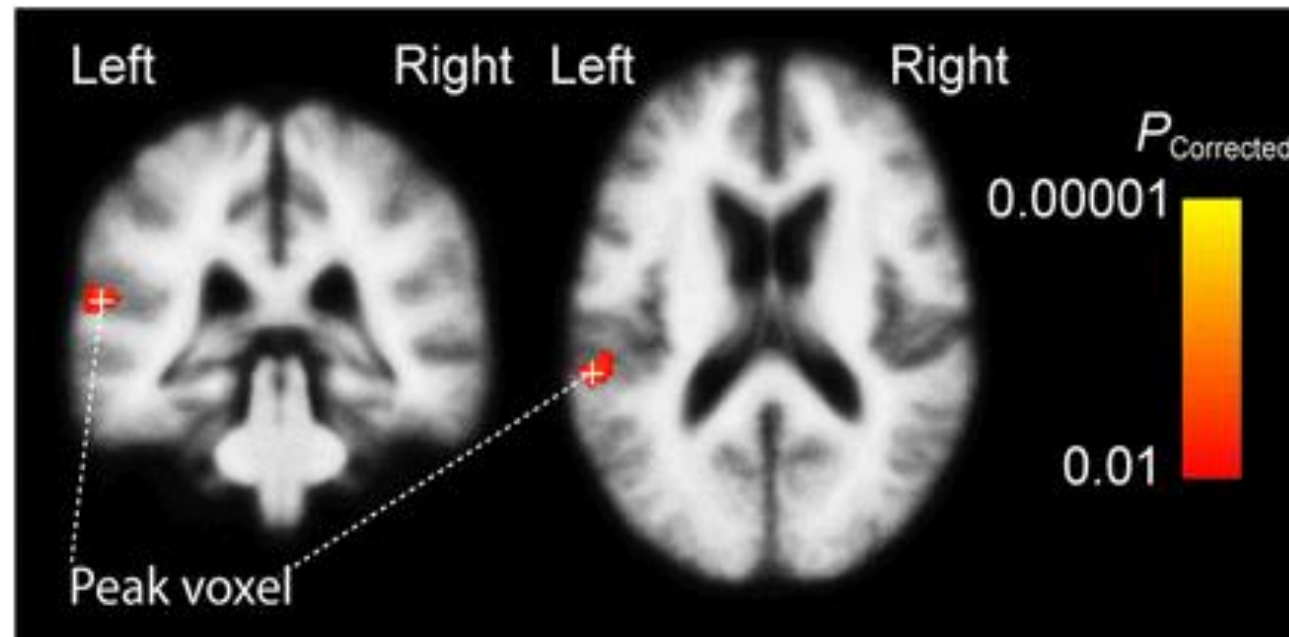
Student Tasks

- Determining the distance of objects is of key value in many everyday situations.
- Neuronal mechanisms of auditory distance perception are poorly understood.
- To study and understand how we perceive distance using auditory signals.
- We combine behavioral experiments, fMRI measurements, and computational analyses to identify the neural representation of distance.

Topic 7:

Neural encoding of auditory distance information in the human brain

Consultant: Dr. Doreswamy

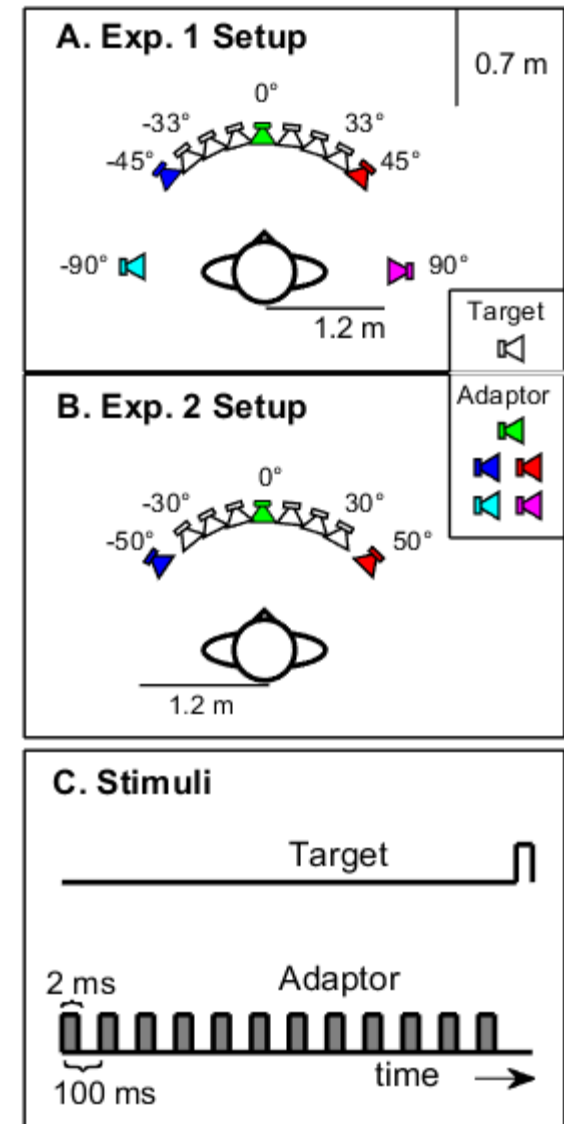


Topic 8:

Contextual plasticity and scaling in virtual environment

Supervisor: Dr. Andrejkova

- To process an overview of the current research related to contextual plasticity
- Modify the experimental setup in the virtual environment for the test of the dependence of responses on the range of stimuli





THANK YOU FOR YOUR
ATTENTION

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