Štúdium neurálnych procesov v mozgu pri spracovaní sluchovej informácie

Norbert Kopčo

Pavol Jozef Šafárik University in Košice **Faculty of Science** Institute of Informatics **Perception and Cognition Lab http://pcl.upjs.sk**



What we do?

Computational & Cognitive Neuroscience Research:

- Behavioral experiments,
- brain activity
 measurements, and
- computational modeling

of **perceptual** and **cognitive** processes, mainly related to **spatial hearing**.



https://www.youtube.com/watch?v=DdvN4WqJh6g







Spatial Hearing?

Sound Localization:

- Left / right, top / down, near / far

Sound Separation:

- Cocktail Party Effect

Auditory Scene Analysis:

- How many sounds,
- Enhance **foreground**, suppress **background**





1. Behavioral experiments on **spatial auditory perception**:

- Sound localization,
- Speech perception,
- Audio-visual interactions,
- Attention,
- Plasticity,
- Training,
- Learning,
- and data analysis.





1. Behavioral experiments in real or in **virtual environments**.





1. Behavioral data analysis & interpretation: iso-contours representing equal perceptual weights for two localization cues ITD & ILD





- 2. Neuroimaging:
- EEG / Electroencephalogram
- 64 channels
- 4096 samples/sec







Kopco and Sebena (2018, 2020)

- 2. Neuroimaging:
- fMRI / functional Magnetic Resonance Imaging







Kopco, Norbert, Doreswamy, K. K., Huang, S., Rossi, S., & Ahveninen, J. (2020). Cortical auditory distance representation based on direct-to-reverberant energy ratio. *NeuroImage*, *208*, 116436.



3. Modeling – ventriloquism effect and aftereffect



Hládek, Ľ., Seitz, & Kopčo, N. "Modeling the Integration of Audio-Visual Distance Information", presented at ARO 2016



Applications

Hearing prosthetics Auditory Displays, e.g., for the blind Virtual reality Telecommunications





Applications

Computer Games Phone/Tablet Brain-Training Games Human-Computer Interaction **Brain-Computer Interaction**





Workshop

The 4th Workshop on Cognitive neuroscience of auditory and cross-modal perception

3 – 5 June 2019 Košice, Slovakia

About:

- > Topics: neural processes of auditory, visual and cross-modal perception, as well as other interdisciplinary topics in computational and cognitive neuroscience.
- » Main focus: adaptation, learning and training in spatial perception and cognition.
- » Target audience: early-stage and advanced students and young researchers.

Format:

 5 sessions involving invited and contributed talks and posters

Venue:

 Lecture hall 2.17T, Faculty of Science / Technicom building, P. J. Šafárik University, Jesenná 5, 04001, Košice, Slovakia.



Viac info: http://pcl.upjs.sk



Our team:

Gabriela Andrejková, René Šebeňa, Eleni Vlahou, Peter Lokša, Keerthi Doreswamy, Ondrej Spišák, Stanka Linková UPJŠ Collaborators:

Gin Best, Barbara Shinn-Cunningham Hearing Research Ctr., Boston Univ. Volker Hohmann Univ of Oldenburg Bernhard Laback Austrian Acad Sci Jyrki Ahveninen, MGH / Harvard Med. School, Petr Maršálek Charles Univ. Erick Gallun Portland VA, Aaron Seitz University of California, Riverside

