

Project title: Enhancing speech comprehension with speech-shaped stimulation

Project leader: Dr. Lars Riecke

Function: Assistant professor

Collaborators:

Proposal (250 words):

Speech comprehension in noisy environments is facilitated by watching the speaker's lip movements. These visual movements provide relevant predictive information regarding the rhythm of the speech. Whether speech comprehension is also facilitated by this predictive information when it is provided via other, non-visual modalities is still unclear.

The proposed research will investigate this question using the following experimental approach: the predictive speech information will be carried by a speech-envelope-shaped signal that will be transmitted to the brain (i) directly via transcranial electric stimulation at the scalp or (ii) indirectly via tactile stimulation at a peripheral body part. Participants will receive the speech-shaped stimulation while undergoing electroencephalography and listening to a degraded auditory version of the speech signal. The presence of the predictive information and its timing will be varied. Participant's speech-envelope-following neural activity and speech-recognition performance will be assessed and correlated to the presence and timing of the predictive information. Both measures are predicted to reveal enhancement within a narrow timing range, in line with lip-reading findings.

These expected findings will contribute (i) novel insights into how the human brain integrates predictive information for speech comprehension and (ii) novel approaches to assist normal or impaired speech comprehension.

Requirements candidate: Highly motivated student with excellent English communication skills (verbal and writing) and proactive and resolute attitude.

Keywords:

Top 5 selected publications:

1. Riecke, L., Peters, J.C., Valente, G., Kemper, V.G., Formisano, E., Sorger, B. (2017). Frequency-selective attention in auditory scenes recruits frequency representations throughout human superior temporal cortex. *Cerebral Cortex*, 27, 3002-3014. [IF: 7.9]
2. Riecke, L., Sack, A.T., Schroeder, C.E.S. (2015). Endogenous delta/theta sound-brain phase entrainment accelerates the buildup of auditory streaming. *Current Biology*, 25, 3196-201. [IF: 9.7]
3. Riecke, L., Vanbussel, M., Hausfeld, L., Baskent, D., Formisano, E., Esposito, F. (2012). Hearing an illusory vowel in noise: Suppression of auditory cortical activity. *The Journal of Neuroscience*, 32, 8024-34. [IF: 6.8]
4. Riecke, L., Walter, A., Sorger, B., Formisano, E. (2011). Tracking vocal pitch through noise: Neural correlates in non-primary auditory cortex. *The Journal of Neuroscience*, 31, 1479-88. [IF: 6.8]
5. Riecke, L., Esposito, F., Bonte, M., Formisano, E. (2009). Hearing illusory sounds in noise: The timing of sensory-perceptual transformations in auditory cortex. *Neuron*, 64, 550-61. [IF: 16.2]