Durham University
Department of Psychology

Prof. Marko Nardini - Psychology, Durham University

Webpage (lab and publications info):
https://markonardini.webspace.durham.ac.uk/

Learning new senses

Background

Can we go beyond our biology and extend our perceptual abilities? In recent work here at Durham we have shown that after only a few hours of training with a new auditory or vibro-tactile cue to distance, people start to incorporate this into their natural distance perception[1–3]. There are further opportunities to investigate these kinds of abilities, including:

• To what extent do such abilities use the same neural and cognitive mechanisms as standard, familiar senses?

• How do basic abilities to judge distance extend to more complex tasks such as navigation?

• How can we optimize use of new signals to help supplement failing vision?

Aims and Methods

Participants learn to use a new signal (for example, an auditory pitch mapped to distance) to make perceptual judgments. Our most recently developed training is interactive, using a device participants can wear to explore how the new signal works.

To study neural and cognitive mechanisms underlying a new signal, we look for signatures of how it is processed in brain responses (e.g. via fMRI) and in specific tasks that make alternative predictions about underlying mechanisms. For example, a participant who truly combines (averages) the new signal with existing (e.g. visual) abilities will show a different pattern of responses to one who switches between using one sense and other but does not combine them[4].

Extensions to navigation and action tasks use the Department's immersive VR and motion capture lab[5].

Testing applications to vision impairment involves work with patients, as well as simulating low vision in control participants.

Relevance

The work will advance our understanding of the organisation, development, and plasticity of sensory systems. It has direct applications to extending the human sensory repertoire using technology – to help individuals with sensory impairment, and also to extend the scope of healthy human perception.

Training

The project will provide training in perceptual (multisensory) psychophysics, programming and advanced data analysis (e.g. in Matlab). Depending on the focus, it can also provide training in neuroimaging, VR, motion capture, and work with patients.

Suitable for

PhD and MSc by Research students.

References

1. Negen J, Wen L, Thaler L, et al (2018). Bayes-Like Integration of a New Sensory Skill with Vision. *Sci Rep*; 8: 16880.

2. Negen J, Bird L-A, Slater H, et al (2023). Multisensory perception and decision-making with a new sensory skill. *J Exp Psychol Hum Percept Perform*; 49: 600–622.

3. Negen J, Slater H, Nardini M (2023). Sensory augmentation for a rapid motor task in a multisensory environment. *Restor Neurol Neurosci* 1–8.

4. Rohde M, van Dam LCJ, Ernst M (2016). Statistically Optimal Multisensory Cue Integration: A Practical Tutorial. *Multisens Res* 29: 279–317.

5. Negen J, Heywood-Everett E, Roome HE, et al (2018). Development of allocentric spatial recall from new viewpoints in virtual reality. *Dev Sci* 21: e12496.