

Predictive processing in context

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Abstract

The brain is thought to generate internal predictions, based on the memory of past stimulation, to optimise behaviour. Predictive processing has been repeatedly demonstrated in non-invasive studies on human volunteers and in animal models. However, it is unclear to what extent auditory predictions are modulated by other contextual factors such as attention and task demands, and whether predictions can be dissociated from related cognitive functions such as memory. In this talk I will present results of several studies combining neural recordings in humans and rodents with computational modelling to identify the brain mechanisms of sensory predictions and their interactions with other cognitive factors. First, in a series of studies in humans, analysis of behavioural and neural data shows that the effects of predictions are not automatic but are modulated by their contextual relevance. Second, computational modelling of the data suggests that these modulations can be linked to specific candidate mechanisms, including gain control in sensory regions. Finally, in a series of studies using direct recordings in anaesthetised rodents, neural representations related to stimulus memory and predictions can be decoded from auditory cortical activity, shedding light on the evolutionary conservation of predictive processing across species. Taken together, these studies demonstrate that sensory processing is a highly flexible process, integrating past experiences, current goals, and predictions of the future.

Biography

Ryszard Auksztulewicz is a cognitive computational neuroscientist specialising in the neural mechanisms of prediction, attention, and memory. His work combines empirical research methods from cognitive neuroscience (EEG, fMRI, MEG, ECoG, TMS) and systems neuroscience with computational modelling (generative models of neural and behavioural data) and multivariate techniques (decoding). Following a doctorate in Psychology at the Humboldt University of Berlin and postdoctoral work at University College London, Oxford University, and City University of Hong Kong, he currently holds a visiting professorship in the Department of Education and Psychology at the Free University Berlin, heading an independent research group funded by the German Research Foundation.

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