

## Predictions all the way up: predictive coding from neural microcircuits to language change

Ina Bornkessel-Schlesewsky and Matthias Schlesewsky

*Cognitive Neuroscience Laboratory, School of Psychology, Social Work and Social Policy, University of South Australia*

Predictive processing has been hailed a possible unifying theory of brain function [1]. From this perspective, the brain actively draws inferences about the causes of its sensory input (i.e. it actively interprets sensory signals). It also tests hypotheses about its current internal model of the world by matching model predictions against actual sensory input, with a mismatch ("prediction error") leading to model adaptation. This framework has a plausible neurobiological implementation down to the level of microcircuits [2] and it has been fruitfully applied to model a range of cognitive phenomena [3,4] including language processing [5,6]. In this presentation, we will argue that predictive coding can also provide a unifying – and neurobiologically plausible – perspective on the processing of typologically diverse languages, as well as having the potential to shed light on aspects of language change. Our account will focus specifically on the mechanisms of model adaptation in the face of a prediction error. We will discuss cross-linguistic differences in language processing and argue that these depend – at least in part – on the features leading to model adaptation. In the second part of the talk, we will provide an initial account of how a predictive coding perspective could be extended to account for mechanisms of language change.

### References

- 1 Friston, K. (2010) The free-energy principle: A unified brain theory? *Nature Reviews Neuroscience* 11, 127–138
- 2 Bastos, A.M. *et al.* (2012) Canonical Microcircuits for Predictive Coding. *Neuron* 76, 695–711
- 3 Friston, K. *et al.* (2012) Perceptions as Hypotheses: Saccades as Experiments. *Frontiers in Psychology* 3, 151
- 4 Garrido, M.I. *et al.* (2009) The mismatch negativity: A review of underlying mechanisms. *Clinical Neurophysiology* 120, 453–463
- 5 Pickering, M.J. and Garrod, S. (2013) An integrated theory of language production and comprehension. *Behavioral and Brain Sciences* 36, 329–47
- 6 Bornkessel-Schlesewsky, I. *et al.* (2015) Neurobiological roots of language in primate audition: Common computational properties. *Trends in Cognitive Sciences* 19, 142–150