

How Productivity and Compositionality May Emerge from a Neural Dynamics of Perceptual Grounding

Daniel Sabinasz

Ruhr-Universitt Bochum, Bochum, Germany

Mathis Richter

Ruhr-Universitt Bochum, Bochum, Germany

Jonas Lins

Ruhr-Universitt Bochum, Bochum, North Rhine-Westphalia, Germany

Gregor Schner

Ruhr-Universitt Bochum, Bochum, Germany

Abstract

The productivity and compositionality of language and thought have often been taken as evidence that higher cognition is a form of information processing on systems of symbols with combinatorial syntax and semantics. We present a non-symbolic neural dynamic architecture that can ground combinatorial concepts in perception, i.e., establish a link between a combinatorial concept and an object in the perceptual array. The components of a combinatorial concept tree are sequentially grounded from the leaves to the root, while the output of each grounding step is passed on to the next grounding step by means of a mental map. This way, compositionality is an emergent property of the neural dynamics and does not require any form of symbolic information processing. We discuss how this process account contrasts with other neural accounts of compositionality and conclude with implications for the modeling of higher cognition.