

# **Five aspects of compositionality and a universal principle**

**Steven Phillips**

National Institute of Advanced Industrial Science and Technology, Tsukuba, Ibaraki, Japan

## **Abstract**

Compositionality supposedly explains structure-sensitive features of cognition, such as productivity and systematicity. However, the nature of compositionality is still controversial: e.g., symbolic versus subsymbolic. Category theory—a formal theory of structure—provides an explanation for systematicity in terms of universal morphisms: the optimal factorization of cognitive components (Phillips & Wilson, 2010). We survey five aspects of compositionality as they relate to formal properties of universal morphisms. The emerging view is a unified (universal) principle for compositionality. This category theoretical view affords a novel perspective on the emergence of symbol systems, i.e. as the construction of universal morphisms, which is illustrated in regard to some empirical data.

Reference: Phillips & Wilson (2010). Categorical compositionality: A category theory explanation for the systematicity of human cognition. *PLoS Computational Biology*, 6(7), e1000858. doi:10.1371/journal.pcbi.1000858