Human and Nonhuman Learning of Hierarchical Structures in a Lindenmayer Grammar

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Abstract

One proposed explanation for humans' unique cognitive capacity is our ability to extract hierarchical, recursive structures from ambiguous input. However, little work has successfully tested when humans represent hierarchical structures, and whether nonhuman animals do so. Using a serial reaction time task, we test if human adults, children, and rhesus macaques predict upcoming items in a Lindenmayer grammar containing self-similar recursive constituents. Recursively merging constituents makes the sequence more predictable. Constituents of different levels vary in predictive power, allowing measurement of depth of embedding in these representations. We test the human and nonhuman capacity to represent recursive structures, measured by reaction times, and its developmental and evolutionary origins. Preliminary results indicate human subjects recursively merge chunks to build multiple levels of embedded structures spontaneously. With similar training, macaques use simpler, linear strategies to predict items. Follow-up experiments will test whether macaques can learn to extract hierarchical structures for better prediction.

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