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Spontaneous Algorithms of Hierarchical Behavior Across Age and Species

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Abstract

Dendrophilia — a widespread proclivity toward hierarchical behavior — has long been argued to be central to human cognitive uniqueness. Alternative views emphasize the developmental and evolutionary continuity of complex hierarchical psychological processes with simpler sequencing mechanisms. We investigated the predispositions of human adults and 3-to-6-year-old children to spontaneously generate hierarchical patterns in an open-ended sequence generation task. We also compared the human ability to learn hierarchical patterns with that of rhesus macaques and carrion crows. Our Bayesian mixture model quantified the extent to which distinct mechanisms — associative chaining, linear iteration, queues, and stacks — were implicated in hierarchical behavior. Our results suggest that hierarchical behavior is possible across species. It emerges early in cognitive development and may be scaffolded by simpler cognitive processes that eventually increase in representational and computational complexity. Thus, our findings contradict the dendrophilia hypothesis and point to shared psychological processes underpinning hierarchical behavior.