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# Simplicity and Informativeness in the Evolution of Combinatorial Structure

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## Abstract

Cultural symbol systems, such as language, music, or pictorial diagrams, are crucial for the storage and transmission of knowledge, and ultimately underpin our capacity for culture. One important feature of these systems is their combinatorial structure: the reuse of building blocks to compose new concepts or ideas. Here, we conduct a study that combines iterated learning with a communication game to show that combinatorial structure is not inevitable, but rather arises as a trade-off between the simplicity of signals and the amount of information they convey. Our results provide additional insights into the role of communication in the emergence of signal structure, as a force that maintains complexity and creates alignment. These results validate a key theoretical prediction about how combinatorial structure arises in the interplay of learning and use, and shed light on how signaling systems such as language have become such powerful and flexible tools in human cognition.