# Iconicity and structure in the emergence of combinatoriality

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One design feature of human language is its combinatorial structure, allowing it to form an unbounded set of meaningful utterances from a small set of discrete building blocks. Recent laboratory experiments using iterated learning have suggested how such combinatorial building blocks could have evolved culturally from initially unstructured, continuous signals (e.g., Verhoef, Kirby, de Boer 2014; del Giudice, 2012). However, because the building blocks of a combinatorial system lack independent meaning and are representationally constrained in ways that continuously varying signals are not, combinatorial structure appears to be in conflict with iconicity. Consistent with this account, Verhoef, Kirby, and de Boer (2016) found that the onset of combinatorial structure in an iterated learning experiment was delayed when signal/referent mappings were scrambled between generations relative to a condition where mappings were kept intact. Because this study could only demonstrate the effects of iconicity on combinatorial structure indirectly, however, here we focus on a more abstracted yet tractable form of iconicity that has recently been described by Lewis and Frank (2016). The authors show that longer words are systematically associated with conceptually more complex meanings. To investigated the emergence of this form of iconicity and combinatoriality we conducted an iterated learning experiment where participants produced auditory signals using a virtual slide whistle instrument (Figure 1). Besides replicating the emergence of combinatorial structure (Figure 2A), our results shows that this more abstracted form of iconicity indeed emerges, does so immediately after the first generation, but is gradually lost over successive generations (Figure 2B). This is despite the existence of strong iconicity biases, as revealed in a guessing game, in which participants reliably picked complexity-matching referents for each signal. We discuss implications of our findings for different hypotheses about the interaction of biases for iconicity and structure.
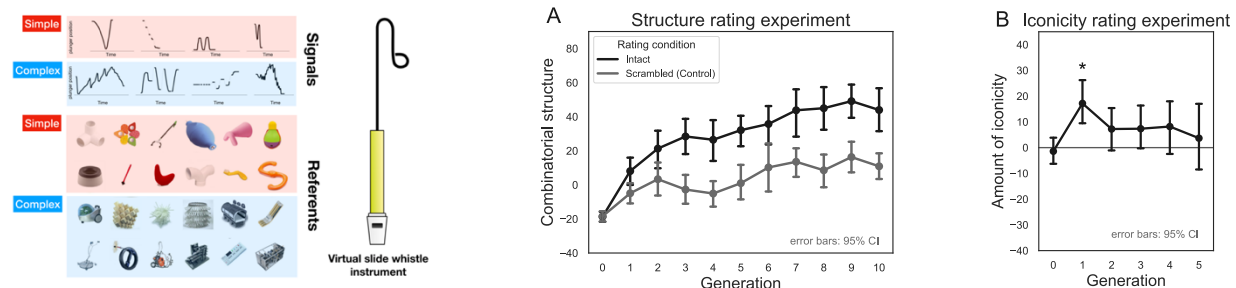
Left: Materials. **A**. Emergence of combinatoriality. **B**. Emergence of iconicity.

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Verhoef, T., Kirby, S., & de Boer, B. (2016). Iconicity and the Emergence of Combinatorial Structure in Language. Cognitive Science, 40(8), 1969–1994.