

Using a children's gameshow to study iterated learning and the emergence of combinatoriality

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One of Hockett's (1960) design features of language, duality of patterning, says that the speech stream is composed of meaningful recombinable units (compositionality), which themselves are composed of meaningless recombinable units (combinatoriality). The iterated learning paradigm (Kirby & Hurford, 2002) has shown that these structural features of language can emerge from cultural evolutionary processes. In particular, Kirby, Cornish, and Smith (2008) demonstrated the emergence of compositional structure, and recent work by Verhoef (2012) suggests that iterated learning can also explain the emergence of combinatorial structure.

Copycats is a children's gameshow in which two teams compete in games based on Chinese Whispers. In one game, the team must pass along a pop song from one team member to another by imitating it using a simple musical instrument. This game is very similar to Verhoef's (2012) experimental setup and therefore provides a good opportunity to further study iterated learning, albeit without the benefits that experimental modification provides. This project looks at what happens to the songs as they are transmitted along a chain of human learners. It was hypothesized that (a) combinatorial structure would emerge from the process of cultural transmission, and that (b) the learnability of the songs would increase as a consequence of this emergent structure.

Data has been collected from 20 episodes of the show for a total of 40 diffusion chains. Following Verhoef (2012), learnability is measured by taking the Derivative Dynamic Time Warping (Keogh & Pazzani, 2001) distance between consecutive players' songs. Combinatoriality is measured by computing the Dynamic Time Warping (Sakoe & Chiba, 1978) distance between each pair of segments that a song is composed of and using agglomerative hierarchical clustering to group together segments that can be considered members of a single building block; the song's entropy (Shannon, 1948) is then calculated, giving an estimate of the level of combinatorial structure.

Early results suggest no significant increase in learnability and no significant increase in combinatoriality, which runs contrary to the hypotheses. However, a simple alternative metric for quantifying combinatoriality, which involves taking the average distance between the segments of a song, appears to indicate that the songs become increasingly repetitive, which may suggest the emergence of some form of combinatorial structure.

In this presentation, I discuss the various benefits and limitations of using this dataset. I also discuss the methods used to analyse the data, some early results, and how these results might be interpreted in terms of iterated learning and the cumulative cultural emergence of combinatoriality.