Hannah **Little**, hannah[at]ai.vub.ac.be
Bart **de Boer**, bart[at]ai.vub.ac.be
Vrije Universiteit Brussel, Belgium

Did the pressure for discrimination trigger the emergence of combinatorial structure?

Language has combinatorial structure, where meaningless building blocks combine to make meaningful elements. Hockett (1960) hypothesised that combinatorial structure came as the result of pressures for discrimination. Once the limit on the number of distinct signals that can be discriminated is reached, then recombination of those signals needs to happen. In this contribution, we aim to experimentally test whether, as a meaning set expands, signals will be reanalysed from holistic and possibly iconic wholes, to display combinatorial structure.

We carried out an experiment where participants created continuous signals using an infrared controller, Leap Motion, which manipulates the pitch of signals (see Little, Eryılmaz and de Boer, 2015, for details). The meaning space started as a set of 5 shapes that expanded by 5 with each of the 3 phases in the experiment. The meaning space had no internal structure, i.e. no two meanings had any shared features (shape, colour or texture). In each phase, participants created a signal for each meaning. They then heard their signals back and had to select the meaning from an array. Success in recognising their own signals did not significantly correlate with the size of meaning space. However, we found that signals for meanings introduced later were significantly less predictable, given the rest of the signal repertoire, than those in earlier phases ($X^2(1) = 4$, $p < 0.05$), indicating that pressures for discrimination had some effect on how systematic the signal repertoire was as a whole.

We also did a post hoc playback experiment to see if iconicity reduced as the signal space expanded, possibly indicating adoption of combinatorial structure. 185 naive participants on the Internet listened to 1 of 24 sets of signals; each produced by one of the original participants, and were asked to match signals with their meanings. If naive listeners can pair signals with their intended meanings, then those signals can be said to be iconic. There was no interaction between how early in the experiment participants produced signals, and how iconic those signals proved to be in the playback experiment. Also, iconicity was not a predictor for how well participants recognised their own signals.

We didn't find much evidence for the emergence of combinatorial structure in our experiment, possibly because humans can differentiate between a lot of holistic meanings. However, qualitative analysis and post-experimental questionnaires shed light on why we were unable to find supporting evidence for Hockett's hypothesis.

References

Hockett, C. F. (1960). The origin of speech. *Scientific American,* 203, 88–111.

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