

Iterated learning optimizes for simplicity

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Language is shaped by the pressures of simplicity and informativeness: A language must be both simple (learnable) and informative (communicatively useful) if it is to be propagated (Kemp & Regier, 2012; Kirby, Tamariz, Cornish, & Smith, 2015). However, it can be difficult to tease these two pressures apart because the features that make a language learnable are often the same features that make a language informative. For example, Carstensen, Xu, Smith, and Regier (2015) conducted an iterated learning experiment in which participants learned labels for spatial relationships, and they found that over generations the languages tended to become more informative. But since this experiment included no communicative pressure, another explanation can be provided in terms of simplicity. In this talk I will present three experiments that aim to shed some light on this.

In Experiment 1, participants were asked to learn and recall a partition of a two-dimensional meaning space into four semantic categories; in the first condition, the partition only marked the angle dimension; in the second, the partition only marked the size dimension; and in the third, the partition marked both dimensions simultaneously (see top of Fig. 1). We found that partitions marking both dimensions were harder to learn than partitions marking only one dimension. One dimensional category systems are favoured by learning.

In Experiment 2, the test procedure was modified: Rather than produce labels for stimuli, participants were asked to select stimuli for labels. Together, these first two experiments provide data about the production and comprehension facets of communication, allowing us to simulate what would happen in a communicative scenario. We found that communicative accuracy was highest when participants used the partition that marked both dimensions. Two dimensional category systems are favoured by communication.

In Experiment 3, participants had to learn the partition inferred by the previous participant in an iterated learning chain (see bottom of Fig. 1). All chains fixated on highly simplified partitions that never marked both dimensions simultaneously.

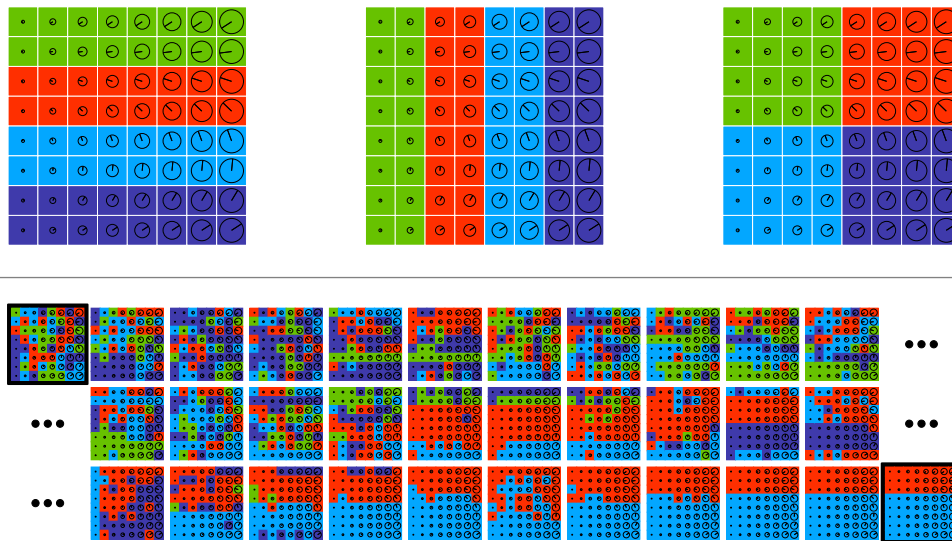


Figure 1: TOP The partitions learned by participants in Experiments 1 and 2: The meaning space is divided into four categories (indicated by colour) based on the angle dimension (left), the size dimension (middle), or both dimensions (right). BOTTOM An example chain from Experiment 3, which shows the randomly generated partition taught to the first participant (top left) through 30 generations of iterated learning to the partition that was eventually fixated on (bottom right).

Thus, while the languages usually became more informative over time, it is clear that the pressure that shaped them came only from learning. I will therefore argue that in these types of experiments it is important to consider the effects of both pressures, and that future work should look for test cases where the simplicity and informativeness pressures are not aligned.

References

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