# THE ROLE OF ICONICITY IN THE EVOLUTION OF LINGUISTIC STRUCTURE

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Linguistic structure is a complex adaptive system subject to multiple constraints, from cognitive biases to social factors (Beckner et al., 2009). Meaning structure is one such constraint: the structure of linguistic forms mirrors, to some extent, the structure of meanings (Perniss et al., 2010). An experimental tool to reveal the effect of biases on linguistic structure is Iterated Learning (Kirby et al., 2008). In this paradigm, artificial languages are transmitted along chains of learners (like in the Chinese whispers game). In Kirby et al. (2008), initially random languages gradually became structured: meaning categories were systematically represented by regularities in the corresponding linguistic forms. Thus, items within a category (e.g. all red objects) had similar linguistic labels (e.g. all start with "po"), while items in different categories (e.g. red versus black objects) had distinct labels.

We adapted Kirby et al.'s paradigm to explore whether *physical properties* of meaning categories could also come to be mirrored by properties of the linguistic forms, in this case *iconically*. For this purpose we included in our meaning structure the spiky-round distinction, known to have iconically motivated representations (see Cuskley, 2012 for discussion). We hypothesized that the linguistic labels for spiky objects would not only become distinct from those for round objects, but they would additionally be perceived by independent raters as more *appropriate* for spiky objects (and the opposite for round objects and their labels), thus providing evidence for the emergence of iconicity. Further, we investigated this under two transmission conditions -- learning only versus learning plus communicative usage-- to see whether communicative usage would enhance or mask the effects of an iconicity bias.

We used artificial languages that designated twelve objects (6 rounded, 6 spiky; 3 red, 3 green and 3 blue; 6 with and 6 without a black border). The labels

were neutral in terms of spikiness/roundedness, as measured with an ancillary norming study. And the initial languages showed no significant systematicity. As far as transmission is concerned, the *learning* condition was modeled on Kirby et al. (2008): one participant was trained and then tested on a language and her output was the training language for the next participant. The *communication* condition followed Tamariz et al. (2012): two participants sitting at separate computers were trained on a language, and then used it to play a communicative game. The labels produced by one of the players constituted the training language for the next pair. We ran four chains of six generations in each condition. We measured the systematicity (Mantel test, as in Kirby et al. 2008) and the iconicity (with a Likert-scale norming study: people rated how good each label was for a spiky/rounded object).

We found that overall systematic structure increased over generations, as in previous studies. Crucially, the emergent mappings between labels and shape were iconic, with labels for spiky objects being rated as more "spiky" by independent raters than labels for round objects. And these effects were significantly stronger in the communication than the learning condition.

Understanding why language is the way it is involves understanding the action of all the constraints that act upon it. The present results suggest that our participants shared a bias for iconicity (in our case, to iconically associate spikiness and roundedness with certain letters), which had a measurable effect on language structure; additionally, we found that the emergent iconic mappings can not only be learned and reproduced, but also maintained and enhanced over communicative interactions.

## References


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