THE ARBITRARINESS OF THE SIGN REVISITED: THE ROLE OF PHONOLOGICAL SIMILARITY

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Recent research has suggested that the structure of the lexicon bears the hallmarks of an adaptation to support language learning (Monaghan et al., 2014). It has been suggested that systematically structured languages (i.e. where some feature of meanings is related to a feature of words) might aid in bootstrapping language acquisition- thus, explorations of how different types of systematic structure affect learnability might answer important questions and generate further testable predictions about the origins of language. In 2011, Monaghan, Christiansen, & Fitneva reported the results of a series of experiments and computational models of language learning that were designed to test the effect of systematicity on learning. In their study they used a feed-forward neural network model and an artificial language learning paradigm with human participants to explore the differences in learnability between languages where the relationships between forms and meanings were either systematic or arbitrary (i.e. where no feature of meaning is reliably associated with any feature of words).

In Monaghan et al.'s study, systematic associations between words and meanings are based on there being phonological similarities *within* a group of words (e.g the fricative phonemes /*f*/ and /*ʒ*/ being associated with similar meanings*)*, and also phonological dissimilarity *between* groups (e.g. the plosive phonemes /*g*/ and /*k*/ being associated with a second group of meanings) Here, we extend the findings of Monaghan et al. (2011) using a new experimental methodology and a number of computational simulations. In addition to systematic associations between words and meanings that are based on phonological similarity, we explore the learnability of systematic languages that are phonologically dispersed.

We replicated the model described by Monaghan et al. (2011), instantiating a version using a 2x2 design with systematicity (arbitrary vs. systematic) as one factor and phonology (clustered vs. dispersed) as a second factor. In the clustered condition of the simulation (which directly replicates Monaghan et al.), labels with similar phonemes (e.g. *f* and ʒ) were used to create one set of labels, with a set of dissimilar phonemes (e.g. *g* and *k*) used in a second set of labels. In the newly added dispersed conditions the coupling of phonemes based on their featural similarity was broken (pairing, for example, *f* and *g*).

Where Monaghan et al. (2011) contrasted fricative and plosive phonemes, our experiment used a set of phonemes that differed in plosivity (plosive vs. continuant consonants)as in Nielsen & Rendall, 2012. Additionally, our experiment moved from an alternative forced choice task to a signal detection protocol: after training, participants were presented with trials where they were shown a single image with a single label and tasked with responding whether the pairing was one that they had been trained on before. As with the model, the experiment was a 2 (systematic vs. arbitrary) x 2 (phonological vs. dispersed) design.

Our results suggest that human language learners learn systematic languages better than arbitrary ones, regardless of their degree of phonological dispersion. This stands in contrast to the results of the model, which overestimates the importance of phonological dispersion for learning- confusing similar phonemes at higher rates than do human participants. These results suggest that the types of systematic structures we might expect to see in real languages might not always be neatly phonologically clustered, but that systematic structure in its most general form is adaptive for the process of language learning.

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