The emergence of non-absolute synonymy: An iterated-learning experiment

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Synonymy is common, but absolute synonymy—where synonyms can be substituted for one another in any context with no change to truth value, communicative impact, or connotational meaning—has long been recognized to be extremely rare (Cruse, 1986). Why should this be?

One possibility is that this pattern is driven by a cognitive bias against treating words as perfectly synonymous. For example, following the mutual-exclusivity bias, learners assume a single object has a single label (Markman & Wachtel, 1988; Lewis, Cristiano, Lake, Kwan, & Frank, 2020). Alternatively, a lack of absolute synonymy could be driven by accidental differences in the distribution of competing items. Potential synonyms—particularly those arising through borrowing—are rarely entirely equivalent in their sociocultural distributions (cf. Andersen, Furiassi, Mišić Ilić, et al., 2017), which could to lead to them acquiring connotational differences. Over time, these differences could become amplified and lexicalized during learning, pushing synonyms apart.

Altenhof and Roberts (2023) investigated this by exposing participants to two "new slang" verbs in English—*snater* and *fincur*—informing them that the two words had the same meaning, which participants had to guess. The words were presented embedded in English sentences, whose valence was manipulated to imply a negative, positive, or neutral meaning. Next, participants were asked to insert the words into unseen sentences that also differed in terms of valence. A distractor noun (*murp*) was included in both exposure and generalization to reduce demand characteristics. The distribution of words across the different valenced contexts during exposure was manipulated. Participants in all conditions treated the words as if they differed in meaning, even when the words had been presented in the same distribution of sentences in exposure. Participants also did not seem to track quantitative distributions in exposure, though qualitative differences (where words were presented in very reliably different contexts) influenced differentiation. Altenhof and Roberts (2023) took these results as potential evidence for a cognitive bias but also noted substantial variation in participants' statistical learning patterns, leading to complex output distributions. What would happen as a result of

exposure to these output distributions? Would distributions stabilize over generations (Smith & Wonnacott, 2010) and, if so, would that involve a stable pattern of non-absolute synonymy?

We investigated this by performing an iterated-learning study (Kirby, Griffiths, & Smith, 2014) with 75 participants arranged into 15 diffusion chains of five generations. The first generation of each chain received the same input language: 12 sentences for the distractor noun and 12 for each novel verb (half positive and half negative). To measure the differentiation of each verb during generalization, for each participant, we calculated a differentiation score by dividing the frequency of each verb in its dominant context by its frequency in all contexts and taking the product of the resulting scores. In line with Altenhof and Roberts (2023), we found that differentiation scores increased in the first generation, suggesting that participants were not treating the verbs as synonymous (Fig. 1). However, unlike some previous work on iterated learning (Smith & Wonnacott, 2010; Smith et al., 2017), we did not find increasing stability and reduction of unpredictable variation over generations. In fact, a one-way ANOVA revealed no significant effect of generation on differentiation score, $F(4, 70) = 0.977, p = 0.426$. Participants also exhibited interesting and substantial heterogeneity in their statistical learning patterns.

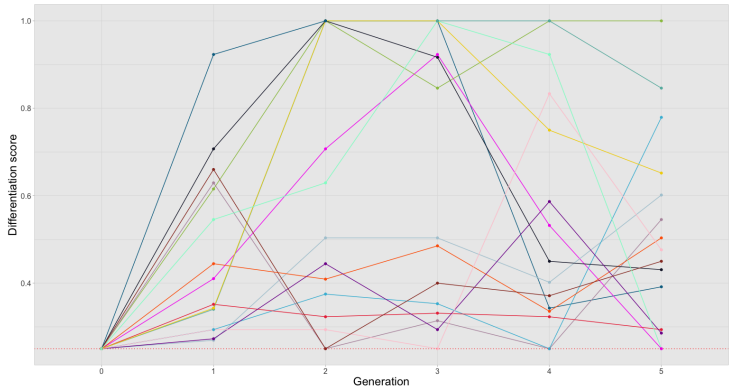

Figure 1. Differentiation scores over all generations.

We discuss these results and their implications alongside ongoing work to replicate the study with modifications designed to control for the role of participant attention and syntactic context. Finally, we discuss the implications of this work for understanding individual differences in statistical learning, an important question for better understanding the cultural evolution of language across generations (Kidd & Arciuli, 2016; Navarro, Perfors, Kary, Brown, & Donkin, 2018).

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