Preferences for shorter dependencies in miniature language learning are modulated by the statistics of learners' L1
Yiyun Zhao (University of Arizona), Charles Torres (University of California, Irvine), Masha Fedzechkina (University of Arizona)

Human languages differ greatly in how they order words in sentences. These superficially different orders, however, result in short grammatical dependencies [1, 2]. Recent work using artificial languages provided a causal link between this bias in language learners and patterns in linguistic diversity: Adult native (L1) speakers of English confronted with a novel language that had unnecessarily long grammatical dependencies systematically restructured the language to reduce dependency lengths [3]. This work leaves open an important question: Are these preferences based on general cognitive principles or are they also influenced by the principles that are themselves learned from the statistics of the learners' L1? We tease apart these possibilities by comparing the strength of learners' preferences for shorter dependencies in a miniature language across L1 speakers of English and Mandarin. These L1s were chosen because they exhibit dependency length minimization (DLM) to different degrees ([1], Fig. 1).

Prediction: If learners whose L1 allows longer dependencies, exhibit DLM to a lesser degree in a structurally different miniature language, this behavior would suggest that learners' performance is subject to an abstract principle-based L1 transfer. If, however, the degree of DLM in a miniature language is the same across learners' L1s, it would argue that this bias is rooted in pre-L1 general cognitive biases ('UG' in the broad sense).

Method: 40 L1 speakers of English and Mandarin learned a novel miniature language consisting of simple transitive sentences over two 1-hour online sessions on consecutive days. Participants were exposed to a verb-final (50/50% SOV/OSV order) language (different from their verb-initial L1s) with obligatory case-marking on objects (never on subjects). Participants first learned novel nouns (*pilika*=CHEF) and then heard sentences using these nouns along with novel verbs. During training, participants heard utterances in a novel language paired with videos of actors performing simple two-participant actions ('chef kicks referee'), where both the subject and object were either long (i.e., modified by a postpositional phrase) or short (no modification). Balanced word order (SOV/OSV 50/50%) was maintained in all sentence types. Each session ended in a sentence production test: learners described previously unseen videos in the novel language, in which constituent length was manipulated by requiring PP-modification of either the subject, object, or neither of the constituents. Thus, the language allowed flexibility in constituent ordering, which had implications for DLM – ordering constituents long-before-short resulted in shorter dependencies in the verb-final miniature language.

Results: To assess whether learners exploited constituent order flexibility in the input to reduce dependency lengths, we analyzed average dependency lengths in the languages produced by individual participants in the final session of the experiment. Wilcoxon signed-rank test revealed that both English (V=0, p<0.001) and Mandarin (V=24.5, p=0.025) learners produced shorter dependencies compared to the input, suggesting an influence of the abstract DLM principle. However, Mandarin learners, whose L1 has on average longer dependencies than English, produced miniature languages with overall longer dependencies compared to English learners (W=124, p=0.03, Fig. 2), suggesting a clear influence of L1 statistics.

Conclusion: Learners' DLM preferences in the miniature language are influenced both by abstract pre-L1 and L1-driven biases. We find that both Mandarin and English learners follow the abstract DLM principle. This preference is, however, stronger in English speakers, reflecting the differences in the input statistics across the two L1s. Our work adds to the growing body of literature exploring L1 influences on miniature language learning [5, 6]. We show how by teasing apart pre-L1 processing biases and L1-driven cognitive biases, we can begin to better understand how these influences are captured in the miniature language learning paradigm.

References

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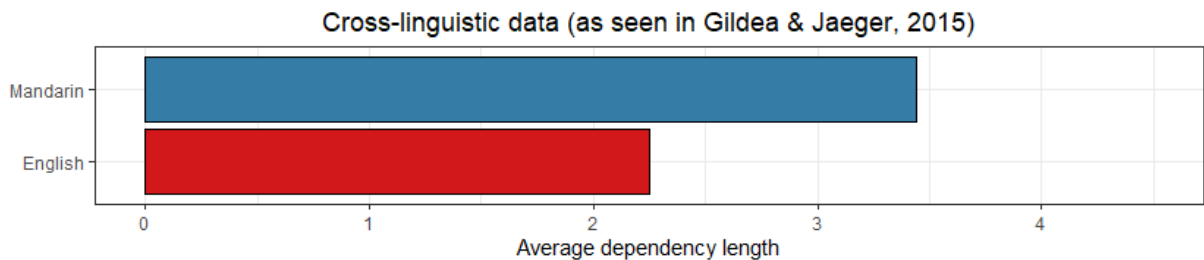
Figures:

Figure 1: Average dependency length in English and Mandarin (adapted from Gildea & Jaeger, 2015).
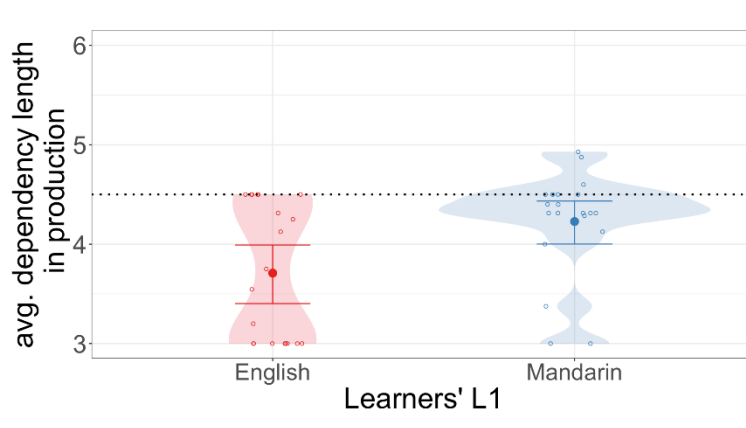

Figure 2: Average dependency length in learners' productions by L1 background. The dashed line represents average dependency length in the input miniature language. The dots represent individual learners' means. The error bars indicate 95% confidence intervals.