A feedback-facilitated iterated learning experiment

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Many languages like Korean, Russian, and Turkish use flexible word orders to express the same meanings, often with different pragmatic emphasis. Yet, iterated learning experiments suggest that cultural transmission eliminates alternate patterns. How do flexible word orders persist across generations of learners?

Languages in iterated learning experiments tend to degenerate without pressures like horizontal transmission (Carr et al., 2017; Theisen-White et al., 2011) or filtering (Kirby et al., 2008). Feedback might have a similar influence. It improves learning in artificial languages (Jeuniaux et al., 2009; Monaghan et al., 2021) and the L2 (Carroll & Swain, 1993; Ellis et al., 2006). Like horizontal transmission, feedback models the sociolinguistic factors that predominately explain trade-offs between linguistic variables, such as word order acting as a cue for grammatical role in languages without case marking (Levshina, 2021). Therefore we consider that feedback may help maintain multiple alternate non-native word orders in a culturally transmitted artificial language.

Materials. Participants learned 24 sentences comprising a verb, subject, and case-marked object, corresponding each to one of 24 scenes. The initial language contained 12 VOS and 12 VSO sentences. All sentences used the same verb (*poox*) and object case marker (*-ma*). The language's eight nouns were English words, divided into sets for Exposure (*goat, cat, fox, horse*) and Generalization (*dog, sheep, pig, cow*).

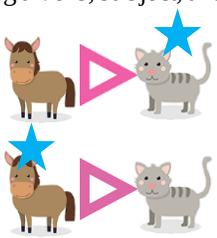

Fig 1. In the initial language: *Poox cat-ma horse* (top), *Poox horse cat-ma* (bottom)

Sentences described "who does what to whom" scenes picturing a subject animal and a red arrow (*poox*) pointing to an object animal. Because VSO and VOS sentences involve different pragmatic emphasis, a blue star marked the referent that is foregrounded by being mentioned first (Fig 1).

Method. The experiment had three parts: Noun, Exposure, and Generalization. In each part, participants completed two types of trials: Comprehension and Production. Comprehension trials presented text for two seconds then a two alternative forced choice (2AFC) between images. Production

trials presented images for two seconds then a three alternative forced choice (3AFC) between texts. The initial Noun part consisted of eight trials of both types and introduced participants to the experiment using familiar English nouns.

Next, the Exposure part contained six blocks of 24 trials of each type covering all 24 scene-sentence pairs. To correctly answer a 2AFC trial required learning the object case marker as one answer choice was the correct scene and the foil reversed that scene's subject and object. A 3AFC trial required understanding of the blue star to pick the correct word order among VSO, VOS, and SVO options. In the first generation, SVO was never a correct answer choice and participants were never taught an SVO sentence mapping. Participants received feedback in all but the final block of 3AFC trials. The scene-sentence mappings participants made here became the input for the next generation. Feedback consisted of a thumbs up upon answering a question correctly (positive) or a thumbs down upon answering a question incorrectly (negative), followed by the correct scene-sentence pair. No feedback participants saw their selected scene-sentence pair after every response to ensure equal language exposure. The six generations of a transmission chain all received the same type of feedback.

The Generalization part tested participants on novel stimuli mapped to the original language of 12 VSO and 12 VOS sentences. Feedback was not given.

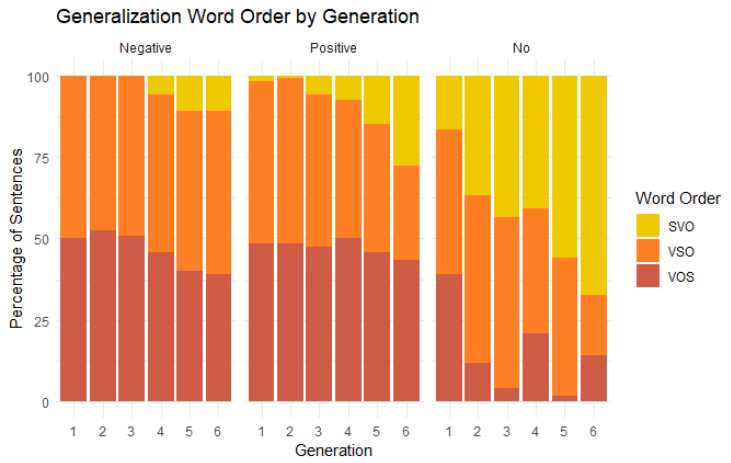

Fig 2. Participants maintained the original word orders best when feedback was given.

Results. Our preregistered sample of 90 native English speakers (60 female, 22 male, 8 non-binary; mean age = 19.8), all Cornell University undergraduates, completed the experiment for course credit. The convergence to SVO in the no feedback condition shown in Figure 2 is consistent with our predictions. Negative feedback best retained the original word order, subverting our expectations about positive feedback (cf. Frinsel et al., 2024). These findings provide new insight into the possible impact of generational transmission and feedback on stability of flexible word order in the cultural evolution of language.

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