Is there transfer of verb-bias learning from comprehension to production?

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To what extent do comprehension and production use the same linguistic representations? Studies of the cross-modality transfer of new learning suggest that the answer varies by level of linguistic structure. Syntactic priming transfers robustly from listening to speaking, implying shared representations of abstract syntax [1]. Newly-learned phonotactic constraints, in contrast, do not transfer from comprehension to production unless the task recruits the production system; this suggests separate representations of phonotactics across modalities [2]. Does verb-bias learning, like syntactic priming, transfer directly from comprehension to production? Verb bias refers to each verb's probabilistic tendency to appear in particular syntactic structures. For instance, *hand* and *send* occur in both double-object (DO: He handed/sent her the book) and prepositional dative (PD: He handed/sent the book to her) sentences, but *hand* is used more often in the double-object form than is *send*. Verb-bias knowledge guides production and comprehension [3,4] and adapts to new experience within each modality [5,6]. In two experiments, English-speaking participants alternately produced and listened to sentences with dative verbs in a verb-bias learning task. We asked whether new verb-bias patterns created within the listening trials interfered with the learning of verb-bias patterns created within the production trials.

Experiment 1: In *Production* trials (based on [5]), participants (N=97) completed sentence stems to describe pictures (Fig-1a). Training stems included a post-verbal NP, inducing speakers to produce one verb only in DO datives (DO-trained: Boots handed Mickey__), and another only in PD datives (PD-trained: Boots brought the present__). Test stems ended at the verb (Piglet handed__), allowing participants to use either structure. In *Comprehension* trials, participants heard spoken sentences, scripted to create verb-bias patterns that either *Matched* or *Mismatched* the verb-bias patterns induced in production trials. Match vs. Mismatch condition varied between subjects. After each trial, participants judged whether the item (spoken sentence or picture) had been presented before. Structural choices in test trials showed learning of the verb-bias patterns induced in the production trials: Speakers produced more DO sentences for their DO-trained than their PD-trained verb (Fig-2a). However, the training effect did not differ across Match and Mismatch conditions, suggesting no transfer of verb-bias learning from comprehension to production. In contrast, we found reliable abstract syntactic priming from comprehension to production in the test trials (Fig-2c).

In **Experiment 2** (N=101) we aimed to enhance cross-modality transfer of verb-bias learning by invoking production processes in comprehension trials [2] and by doubling the number of comprehension trials. Production trials were as in Experiment 1. In the comprehension trials, participants saw a picture and a sentence stem ending at the verb, then heard a spoken sentence (Fig-1c). After each trial, they judged whether the spoken sentence matched the picture. This new comprehension task gave participants an opportunity for predictive processing, which may involve the production system [7]. Here we saw cross-modality transfer in verb-bias learning: Participants in the Match condition showed robust learning of the verb biases induced in production trials, whereas those in the Mismatch condition did not (Fig-2b). We again found syntactic priming from comprehension to production in the test trials (Fig-2c).

These results suggest that verb-bias learning can transfer across modalities, but only under some circumstances. In Experiment 1, speakers' structure choices reflected the verb-bias patterns in the sentences they had produced, regardless of whether they had heard matching or opposing verb-bias patterns in the interleaved comprehension trials. Experiment 2, in contrast, showed cross-modality transfer of verb bias, revealing a route by which speakers can learn verb biases by listening. Transfer may have been facilitated both by the doubling of listening trials, and by the recruitment of production-like processes for prediction during the comprehension trials [2,7]. Future studies will disentangle these two factors, to investigate how comprehension and production processes interact in verb-bias adaptation.

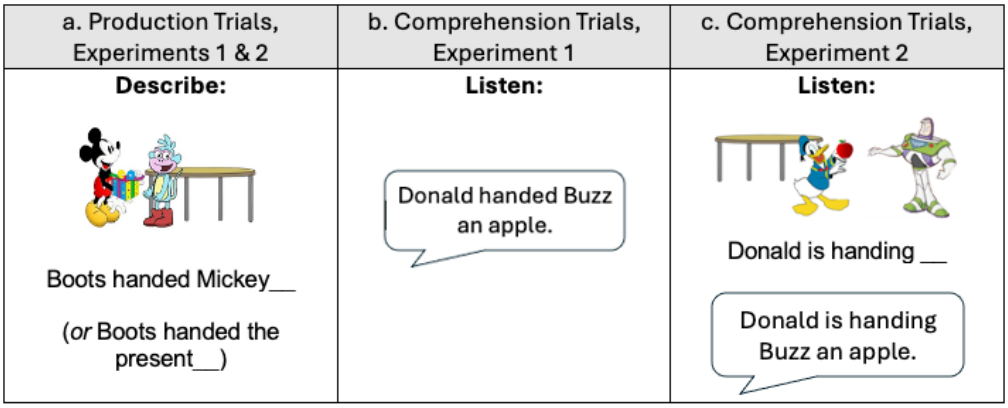

Figure 1. A: Sample Production trial, Experiments 1 & 2. **B**: Sample comprehension trial, Experiment 1. **C:** Sample comprehension trial, Experiment 2. *Note*: All sentence stems in Experiment 2 used present progressive form (e.g., 'is handing').

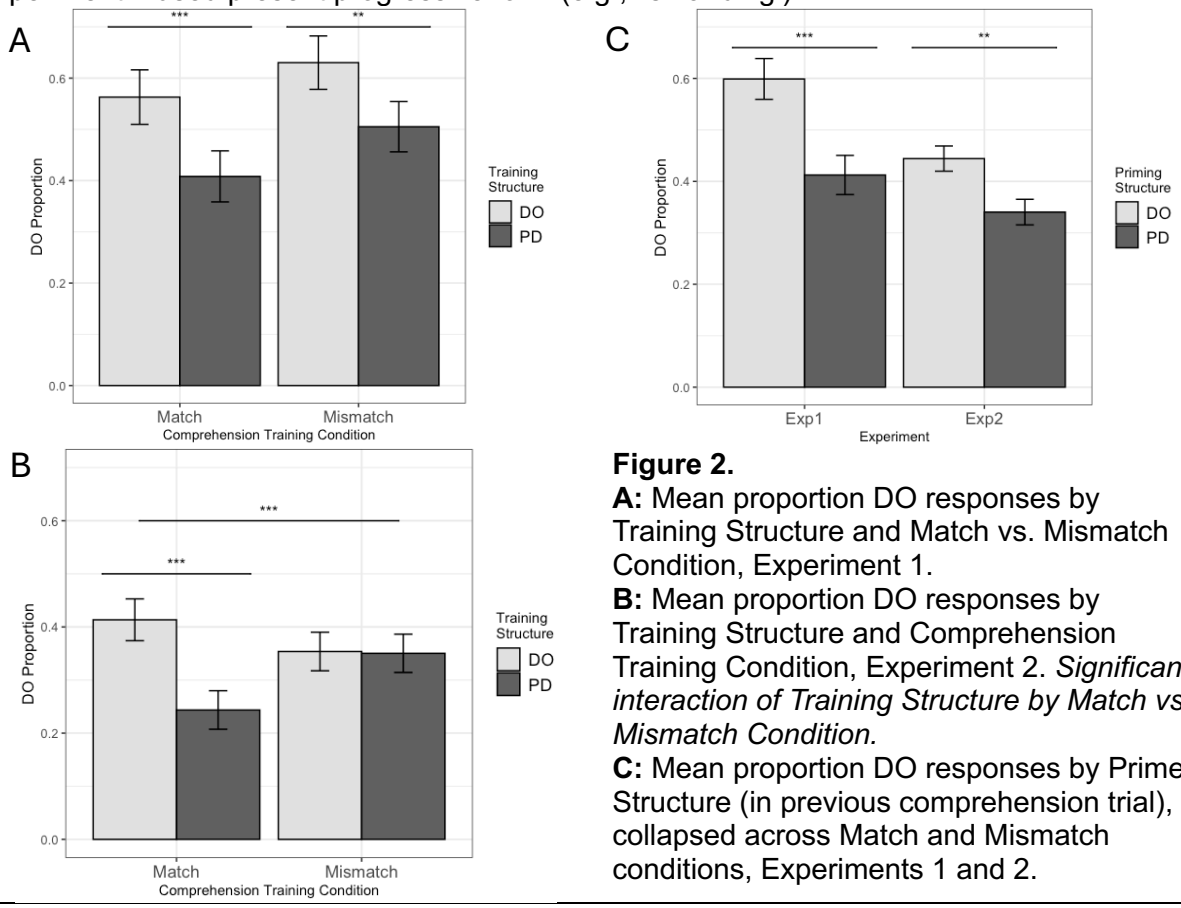

Figure 2.
A: Mean proportion DO responses by Training Structure and Match vs. Mismatch Condition, Experiment 1.
B: Mean proportion DO responses by Training Structure and Comprehension Training Condition, Experiment 2. *Significant interaction of Training Structure by Match vs. Mismatch Condition.*
C: Mean proportion DO responses by Prime Structure (in previous comprehension trial), collapsed across Match and Mismatch conditions, Experiments 1 and 2.

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