U-shaped development in children's discourse bootstrapping

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Children are able to learn a remarkable number of word meanings in a strikingly short amount of time. To do this, they can attend to ostensive signals [1], to statistical co-occurrences [2], and to syntactic environments [3]. But much of the time, when children hear a new word, the most informative cues to its meaning are neither social, statistical, nor syntactic, but come from the surrounding linguistic discourse. Here, we investigate how children's developing ability to process that discourse affects their word learning. To foreshadow, we find a striking pattern whereby children's improving skills at linguistic prediction actually cause a developmental disadvantage at word learning, resulting in U-shaped development.

Children can process sentences predictively by at least age two [4], and the accuracy of these predictions develop in the pre-school years [5]. Strong predictive parsing skills could facilitate language learning, by freeing up cognitive resources [6], but could also be a double-edged sword: When their predictions are strong, children may have difficulty revising when input is unexpected [cf., kindergarten path effects, 7], which could potentially impair learning (cf., [8]).

We tested how prediction skills interact with so-called "discourse bootstrapping", the finding that even 2-year-olds can use discourse context to guess word meanings [9]; for instance, on hearing *I'm thirsty! Look, there's a PLIFF, show me the PLIFF,* they guess that *PLIFF* refers to a drink not a foodstuff. We extended this paradigm to examine how children use different connectives for discourse bootstrapping, focusing on the contrast between *so* and *but.*

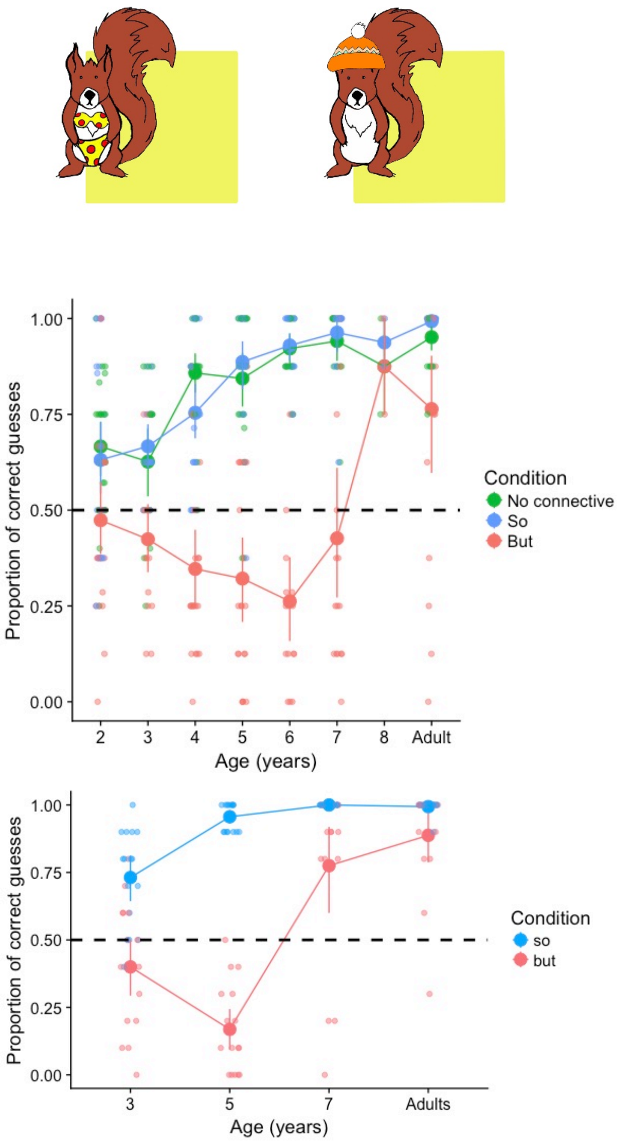
Children (n=118) aged from 2 to 8, plus 18 adults, heard three types of sentence (8 items per condition, Latin Squared), all containing novel words:
1a. Katy wore a ***dax*** on a cold day.
1b. Katy was cold, **so** she wore a ***dax***.
1c. Katy was cold, **but** she wore a ***dax.***
and then guessed which of two images depicted that word [Figure 1A]. 1a is a control condition with no connective, thus *dax* means "hat". The critical comparison is between 1b and 1c. The inferential connective *so* implies that the meaning of the second clause follows from the first clause, so *dax* clearly means "hat", while the connective *but* implies that the meaning of the second clause contrasts with the first clause, and so listeners must revise their expectations about the likely meaning of that second clause [*dax* means "bikini"].

There is good evidence that even two-year-olds understand the contrastive meaning of *but* (e.g.,[9]). But here, where the first clause set up a strong expectation about the meaning of the second clause, we found that after age 2, as their prediction skills improved, children actually got worse at interpreting sentences containing *but.* Figure 1B shows that accuracy on control sentences (like 1a) and *so*-sentences (like 1b) improved monotonically from childhood through adulthood. But accuracy on *but*-sentences showed a striking U-shaped pattern, which was significant under a stringent "two lines" test [10].

Experiment 2 replicated this task (n=16/age), but without the control condition (equating the number of inferential *so* and contrastive *but* items), and with an improved set of items (since even adults performed somewhat poorly in Experiment 1). And still, with these changes, we observed U-shaped development: Children's performance in the *so*-condition improved monotonically, while their performance in the *but*-condition declined and then improved (again significant under a "two lines" test).

This new case study illustrates how the tasks of learning language and processing language can interact. It confirms prediction's importance for child language processing, but shows its negative implications. And it raises how children might learn to override their predictions in the case of unexpected input, which in progress studies are addressing.

Figure 1. A. Pictures from an example trial. See text for associated sentences.
B. Results from Experiment 1. Error bars are bootstrapped 95% Confidence Intervals.
C. Results from Experiment 2.



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