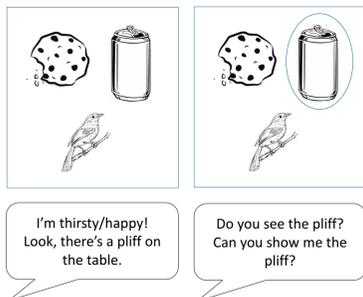


U-shaped Development in Children's Discourse Bootstrapping

Hugh Rabagliati, Nora Wolf, Barbora Skarabela, Hannah Rohde
University of Edinburgh

We learn a remarkable number of words during childhood, using ostensive cues, statistical co-occurrences, or syntactic contexts. But much of the time, the most informative cues to meaning come from discourse.



Sullivan & Barner (2016, *Dev Sci.*): 2-year-olds learn words via "discourse bootstrapping", i.e., inferring meanings from discourse cues.

Our question: **How does discourse bootstrapping interact with children's developing prediction skills?**

The speed and accuracy of linguistic prediction dramatically increases from age 2 (Borovsky et al, 2012, *JECP*; Mani & Huettig, 2012, *JEP:HPP*).

This could improve discourse bootstrapping (e.g., by easing processing, Rabagliati et al., 2016, *LCN*).

However, when older children's predictions are wrong, they have trouble **revising expectations** (Trueswell et al. 1999, *Cogn.*).

This could specifically **impede** learning from discourse connectives like *but*, which imply **contrast** with prior meaning, i.e., a **violation of discourse expectations**.

Experiment 1 – Learning from different connectives

Even two-year-olds *use* contrastive connectives appropriately.

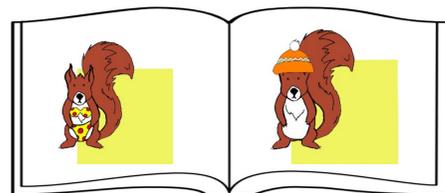
[after singing happy birthday]

Mother. Hooray!
Fraser (2;04): But I wanna say that!
Lieven et al (2009, Cog. Ling)

[Ross wants to sit down]

Mother. I don't mind.
Ross (2;07): But daddy might.
MacWhinney (1991, CHILDES)

But does learning to predict affect how children learn from contrastive, expectation-violating connectives?

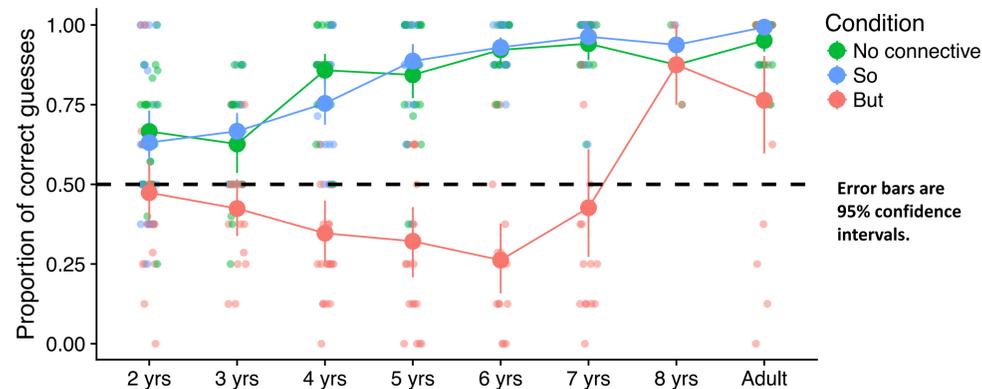


Katy was cold **SO/BUT** she wore a **dax**.
Can you point to the **dax**?

Causal	No Connective	Katy wore a dax on a cold day
Causal	So	Katy was cold SO she wore a dax
Contrast	But	Katy was cold BUT she wore a dax

Sample. N=118 children from 2 to 8 years + 18 adults.

Items. 24 per participant, rotated across three within-subject conditions, and counter-balanced for meaning, side, order, etc.



Monotonic increase for causal (No connective, So) conditions.

U-shaped development for contrastive But. Statistically significant under a stringent "two lines" test (Simonsohn, 2017, *SSRN*).

- As children's prediction skills improve, their ability to learn from contrastive, expectation-violating *But* declines, only improving from 6yrs.

Potential concerns about design:

- Only 1/3 of items contrastive, biasing towards non-contrastive responses?
- Even adults are unsure about contrastive *But* items!

Experiment 2 – Enhanced Replication

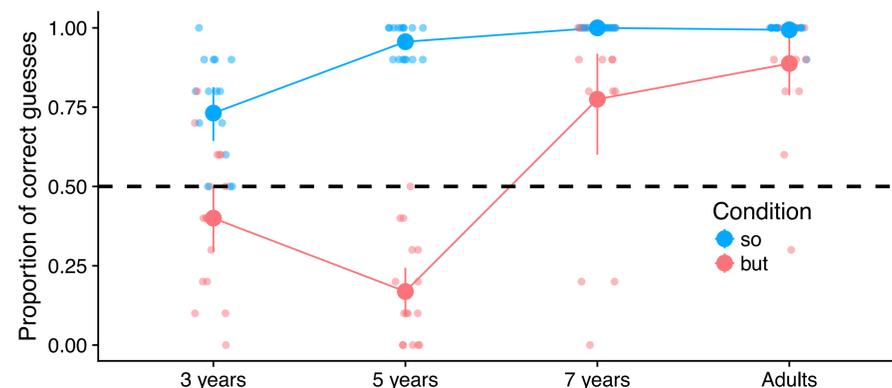
Improvements: Equal number of inferential *So* and contrastive *But* items (*No Connective* items dropped).

Revised set of items, for which adult intuitions should be more robust.



The day was cold **SO/BUT** Katy put on a **pagle**. Can you point to the **pagle**?

Sample. N=16 per age group.
Items. 20 per participant.

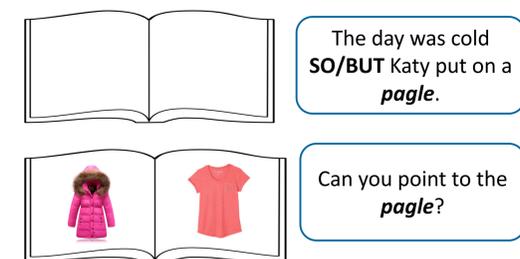


Replicates the results of Experiment 1: U-shaped development when using contrastive, expectation-violating But to learn words.

Experiment 3 – Linguistic or Motor prediction?

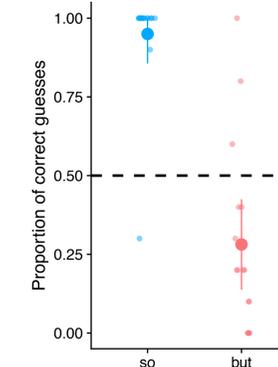
Counter-explanation 1:

Perhaps 5-year-olds predictively prepare their response early, and cannot inhibit that motor action after they hear *but*?



Sample. N=16 5-year-olds.

Items. As in Exp. 2.

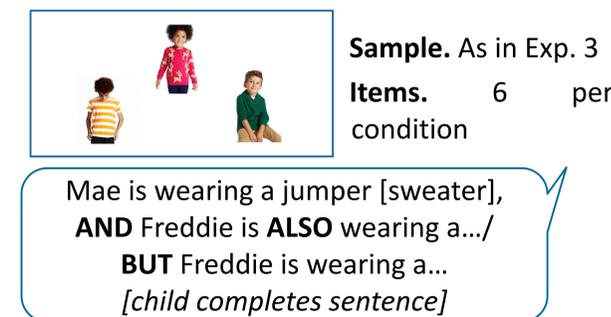


Even when actions cannot be planned in advance, five-year-olds still misinterpret contrastive, expectation-violating But.

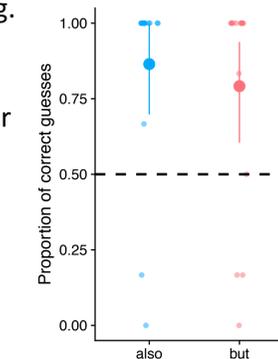
Experiment 4 – But do they really understand But?

Counter-explanation 2:

Perhaps 5-year-olds do not understand contrastive component of *but*? Test comprehension without prediction/learning.



Sample. As in Exp. 3
Items. 6 per condition



Outside predictive contexts, 5-year-olds can understand contrastive component of But.

Conclusions

Evidence that children's developing ability to process via prediction plays an important role in language learning, and **can even impede learning** (c.f., Huang & Arnold, 2016, *Cognition*).

Open questions:

- How do children learn to recover if expectations are violated?
- When the bottom-up signal is stronger, are expectations easier to revise?