Non-conservative quantifiers are unlearnable

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Big Picture: All natural language determiners have "conservative" meanings. If this typological universal reflects a deep fact about determiner semantics, non-conservative determiners should be impossible to learn. Novel quantifier learning experiments with adults bear out this prediction.

The cross-linguistic universal "conservativity"

Conservativity: The intuition

- The noun phrase that a **determiner** combines with "sets the stage"
- For sentences like ***every/some/no*** *frog is green*, only frogs (and their colors) matter
  - Compare: *only frogs are green*, where non-frogs (and their colors) matter too
    - *Only* – which isn't a determiner [1] – is non-conservative

Conservativity: A more formal definition

- A determiner **DET** is conservative iff duplicating its first/NP argument in its second/predicative argument is logically inert:

(1) [[**DET** NP] PRED] ↔ [[**DET** NP] [be NP that PRED]]

(2) ***every*** *frog is green* ↔ ***every*** *frog is a frog that is green*

(3) *only frogs are green* ↮ *only frogs are frogs that are green*

Since the former can be false while the latter is true, *only* is non-conservative

All natural language determiners are conservative [e.g., 2-4]

- Languages have conservative determiners like ***every***, but no language has non-conservative determiners like ***equi***

(4) ***equi*** *frogs are green*

≈ *the frogs are equinumerous with the green things* (true; 3=3)

↮ *the frogs are equinumerous with the frogs that are green* (false; 3≠2)

- This typological generalization has been argued to reflect a fundamental property of the language faculty [e.g., 5-9]
  - Suggests a connection to learnability: it should be impossible to pair non-conservative meanings with **determiners**

Prior work pursuing a conservativity-learnability link

Hunter & Lidz (2013): Picky Puppet Task [10]

- Taught 5-year-olds a novel quantifier that was either conservative, as in (5), or non-conservative, as in (6)

(5) ***gleeb*** *girls are on the beach*

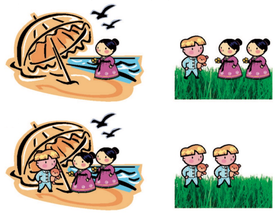
≈ *not all girls are on the beach* (true; 2 girls on grass)

↮ *not all girls are girls that are on the beach* (true; 2 girls on grass)

(6) ***gleeb*** *girls are on the beach*

≈ *not only girls are on the beach* (true; 1 boy on beach)

↮ *not only girls are girls that are on the beach* (false; contradiction)



- Tested on unseen scenes; asked to sort them according to whether the picky puppet liked the scene or not

5-year-olds showed a learnability advantage for the conservative vs. the non-conservative quantifier
On average, children were 82% correct vs. 62% correct; 5/10 vs. 1/10 participants perfectly sorted novel scenes

Spenader & de Villiers (2019): Attempted Replication [11]

- Failed to find a learnability advantage for the conservative *gleeb*, both in children and in adults

5-year-olds showed no significant effects of learning in either the conservative or non-conservative condition
On average, children were 60% correct vs. 68% correct when confronted with novel scenes
Adults showed the opposite effect: 56% correct vs. 69% correct; 1/9 vs. 4/9 perfect sorters

References: **[1]** Herburger (2000) What counts **[2]** Barwise & Cooper (1981) Generalized quantifiers and natural language **[3]** Higginbotham & May (1981) Questions, quantifiers and crossing **[4]** Keenan & Stavi (1986) A semantic characterization of natural language determiners **[5]** Romoli (2015) A structural account of conservativity **[6]** Pietroski (2004) Events and semantic architecture **[7]** Pietroski (2018) Conjoining meanings **[8]** Piattelli-Palmarini (2008) Events and conservativity **[9]** Knowlton et al. (2021) Determiners are 'conservative' because their meanings are not relations **[10]** Hunter & Lidz (2013) Conservativity and learnability of determiners **[11]** Spenader & de Villiers (2019) Are conservative quantifiers easier to learn?

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Current experiments

Differences between Hunter & Lidz's task and current experiments:

- Avoiding the partitive *(gleeb girls are on the beach)* vs. embracing it *(gleeb of the circles are blue)*
- Picky puppet task (figure out which scenes the puppet likes) vs. explicit word-learning task (figure out what *gleeb* means)
- Using negations of existing words (*not all* vs. *not only*) vs. a new pair of conservative and non-conservative meanings:

(7) ***gleeb*** *of the circles are blue*

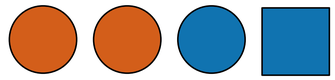
≈ *all but one of the circles are blue*

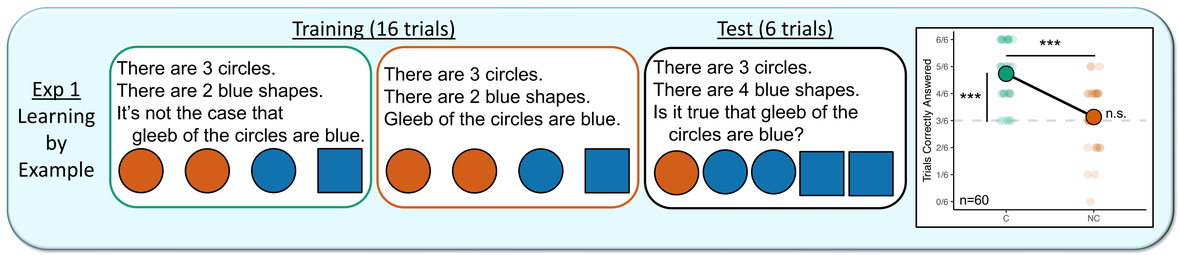
↔*all but one of the circles are circles that are blue*

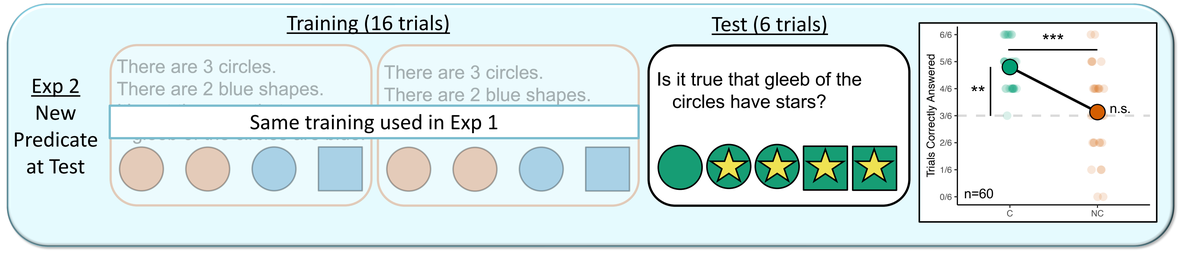
(8) ***gleeb*** *of the circles are blue*

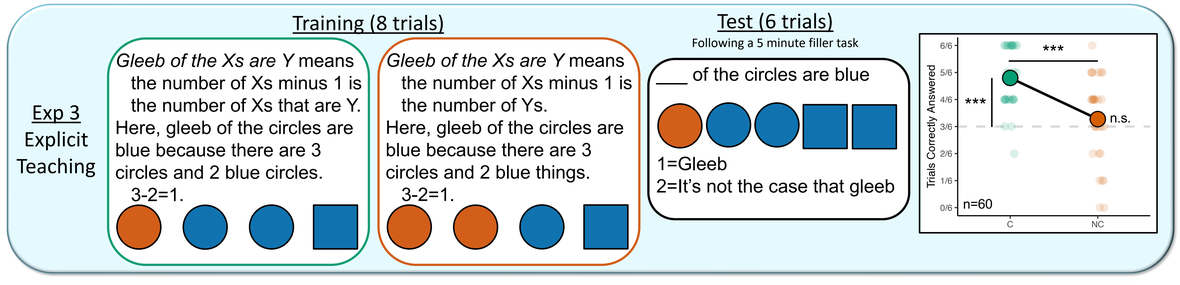
≈ *the circles outnumber by 1 the blue things* (true; 3 circles – 1 = 2 blue things)

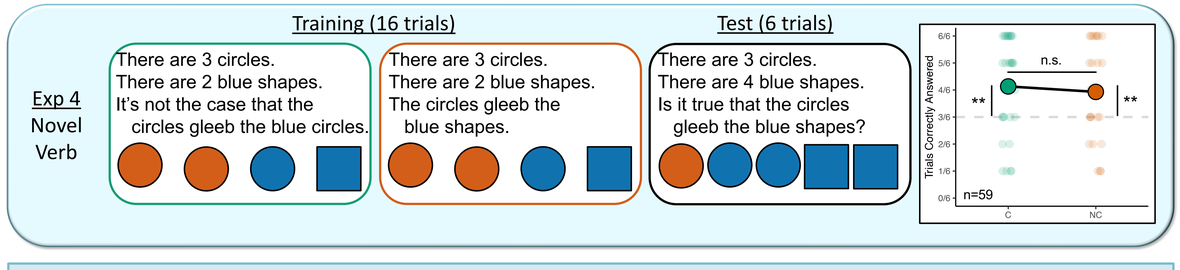
↮ *the circles outnumber by 1 the circles that are blue things* (false; 3 circles – 1 ≠ 1 blue circle)











Takeaway: Conservativity and learnability are connected, as predicted by views on which conservativity isn't a historical accident or general cognitive/communicative tendency, but a cornerstone of the semantics of determiners [e.g., 5-9]