

## Introduction/Background

What is the status of scalar inferences in child grammar?

- English *even* provides a window through which to investigate this question, due to its sensitivity to polarity
- English *even* is a scalar, additive particle, which triggers a least-likely presupposition in positive sentences, and a most-likely presupposition in negative sentences (K&P 1979)

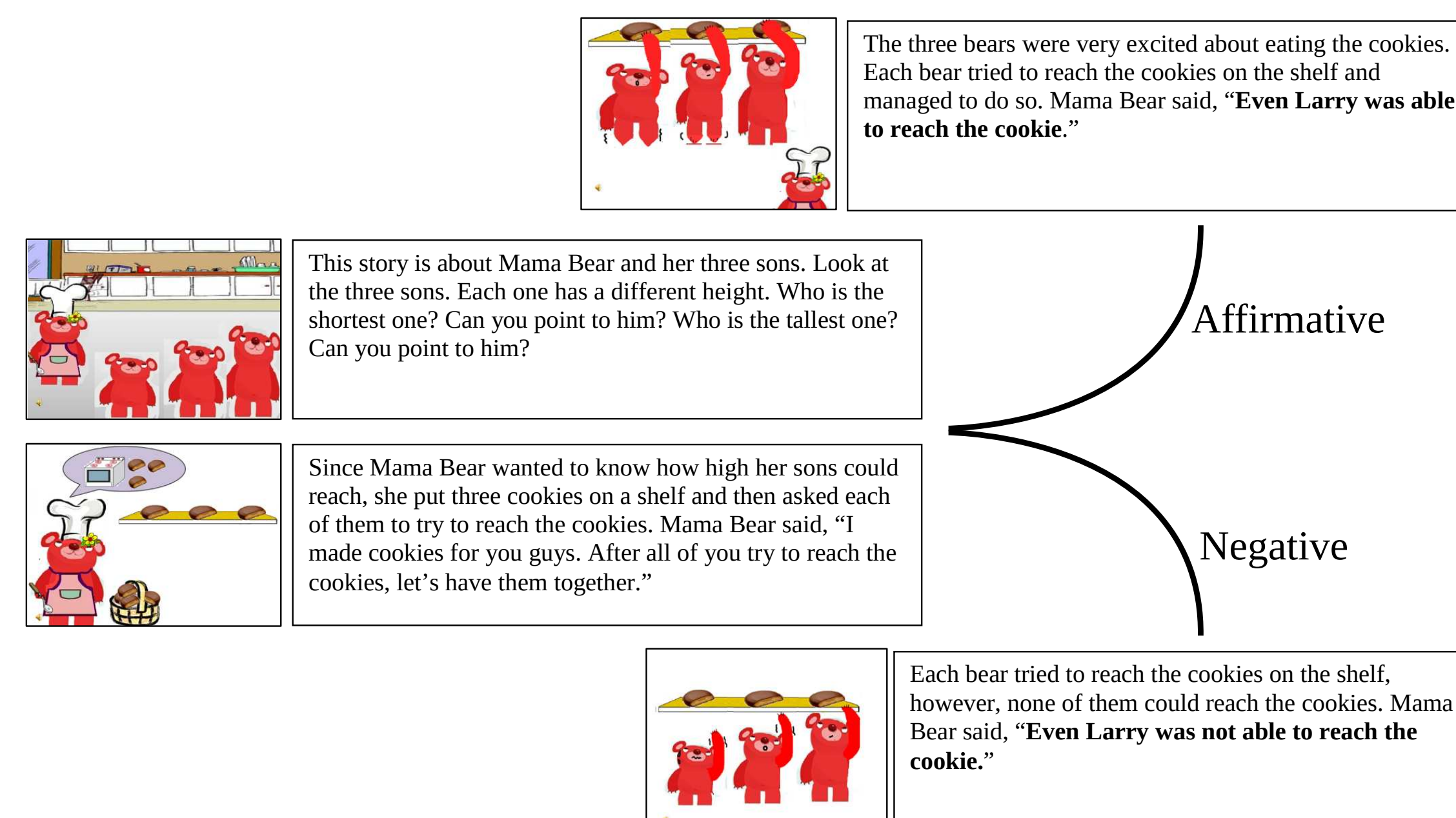
- Even JOHN came to the party.
  - John was the least-likely to come to the party.
  - There were other people that came to the party.
- Even JOHN didn't come to the party.
  - John was the most-likely to come to the party.
  - Nobody else (out of a salient set) came to the party.

Can children track the different likelihood inferences triggered by *even* across different environments?

- We find that yes, children ages 4-6 understand *even* (contra previous findings), but they learn *even* more quickly in negative environments than positive ones.

## Previous Work: Kim 2011

- Kim 2011 tested acquisition of *even* and *only* following Filik et al. (2009), who found that adults process *even* more slowly than *only*
- Kim's hypothesis: young children struggle with *only*, so they should learn *even* later
- She concludes that this hypothesis is correct based on her results



The three bears were very excited about eating the cookies. Each bear tried to reach the cookies on the shelf and managed to do so. Mama Bear said, "Even Larry was able to reach the cookie."

This story is about Mama Bear and her three sons. Look at the three sons. Each one has a different height. Who is the shortest one? Can you point to him? Who is the tallest one? Can you point to him?

Since Mama Bear wanted to know how high her sons could reach, she put three cookies on a shelf and then asked each of them to try to reach the cookies. Mama Bear said, "I made cookies for you guys. After all of you try to reach the cookies, let's have them together."

Each bear tried to reach the cookies on the shelf, however, none of them could reach the cookies. Mama Bear said, "Even Larry was not able to reach the cookie."

Affirmative

Negative

Figure: An example test item from Kim's experiment, which was a forced choice task.

Response Pattern	Target characters for both pos/neg	Opposite characters for both pos/neg	Always leftmost or rightmost character
Rate of responses	33.3% (30/90)	38.9% (35/90)	27.8% (25/90) (22.2% for rightmost, 5.6% for leftmost)

Table: Kim's results show three response patterns: 1) completely adult-like, 2) always choose the opposite character, 3) always choose the leftmost or rightmost character. This distribution shows adult-like responses are roughly chance. Note: none of the children chose the middle character.

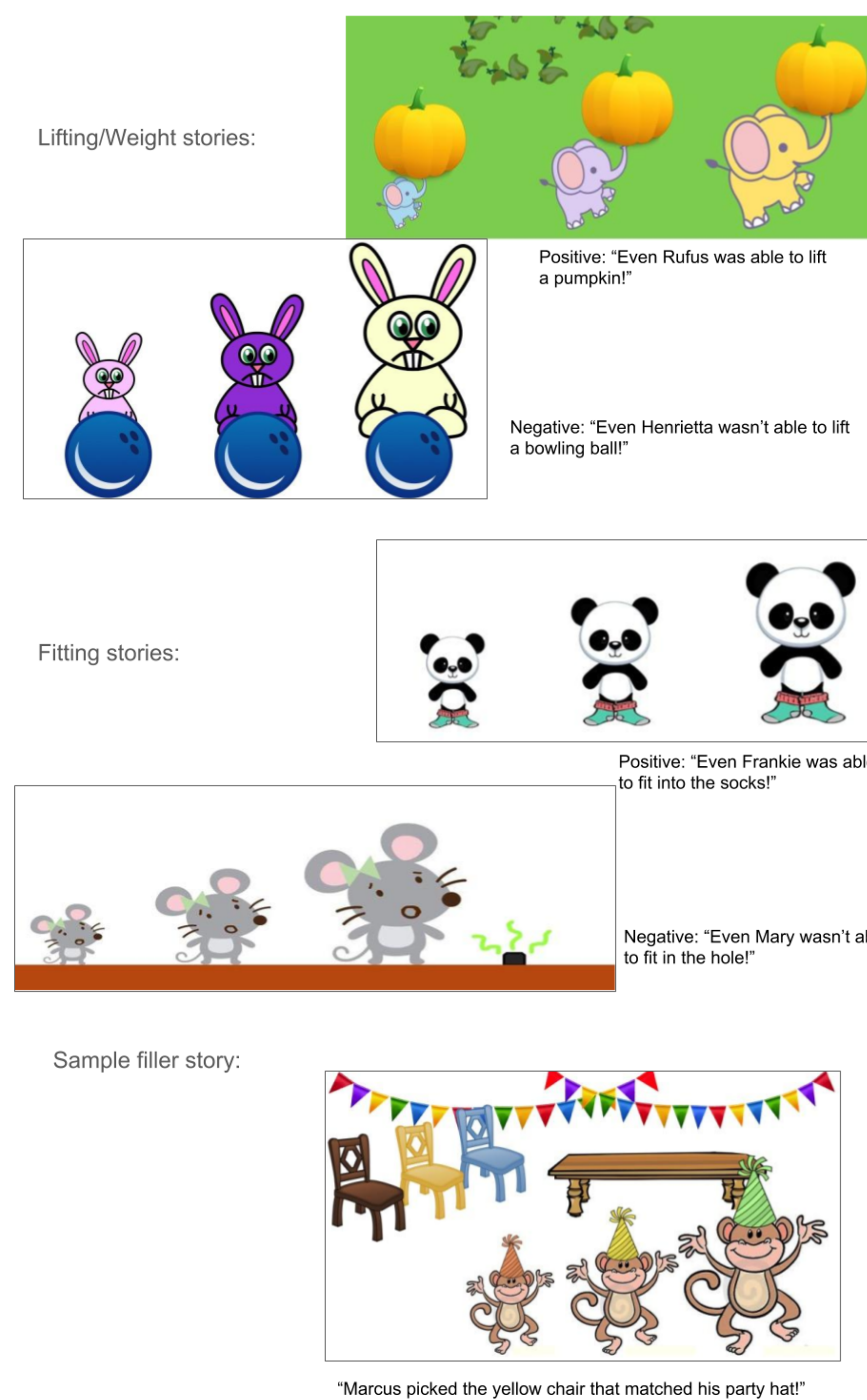
- Branan's (2015) observation: **The fact that none of the children chose the middle character could be a feature of the developing grammar.**

Our questions:

- What is the developmental trajectory for *even*?
  - Kim only tested 4-5 year olds.
- What reasoning do children use when evaluating *even*?
  - Kim did not systematically record children's justifications.
- Why don't any children choose the middle character?
  - Was the experiment biased against the middle character or are we missing something?
- What if we change the scale types?
  - In Kim's study, the least-likely character was always leftmost and vice versa.

## Methods

- 88 children, ages 3-6
- similar setup as Kim's but with 4 different scales (8 total target stories): reaching stories, lifting stories, fitting stories, and filling stories
  - reaching and lifting stories: the largest character is most likely to succeed
  - fitting and filling stories: the smallest character is most likely to succeed
- 4 filler stories that favor middle characters
- blocked design in two orders: negative first and positive first
- after the experimenter reads each story, a puppet asks children to help them identify the named character (i.e. the associate of *even*) and to justify their answers
- data collected at Boston-area daycares, preschools, and the Museum of Science



Lifting/Weight stories:

Positive: "Even Rufus was able to lift a pumpkin!"

Negative: "Even Henrietta wasn't able to lift a bowling ball!"

Fitting stories:

Positive: "Even Frankie was able to fit into the socks!"

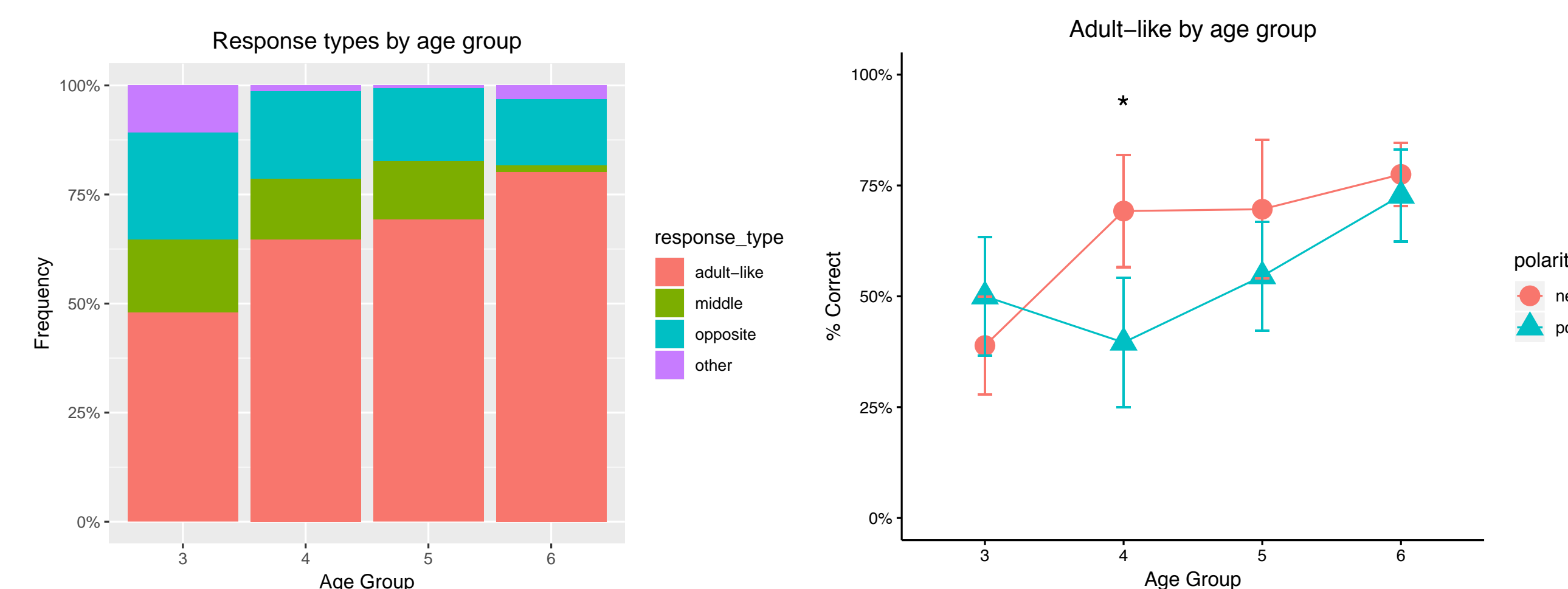
Negative: "Even Mary wasn't able to fit in the hole!"

Sample filler story:

"Marcus picked the yellow chair that matched his party hat!"

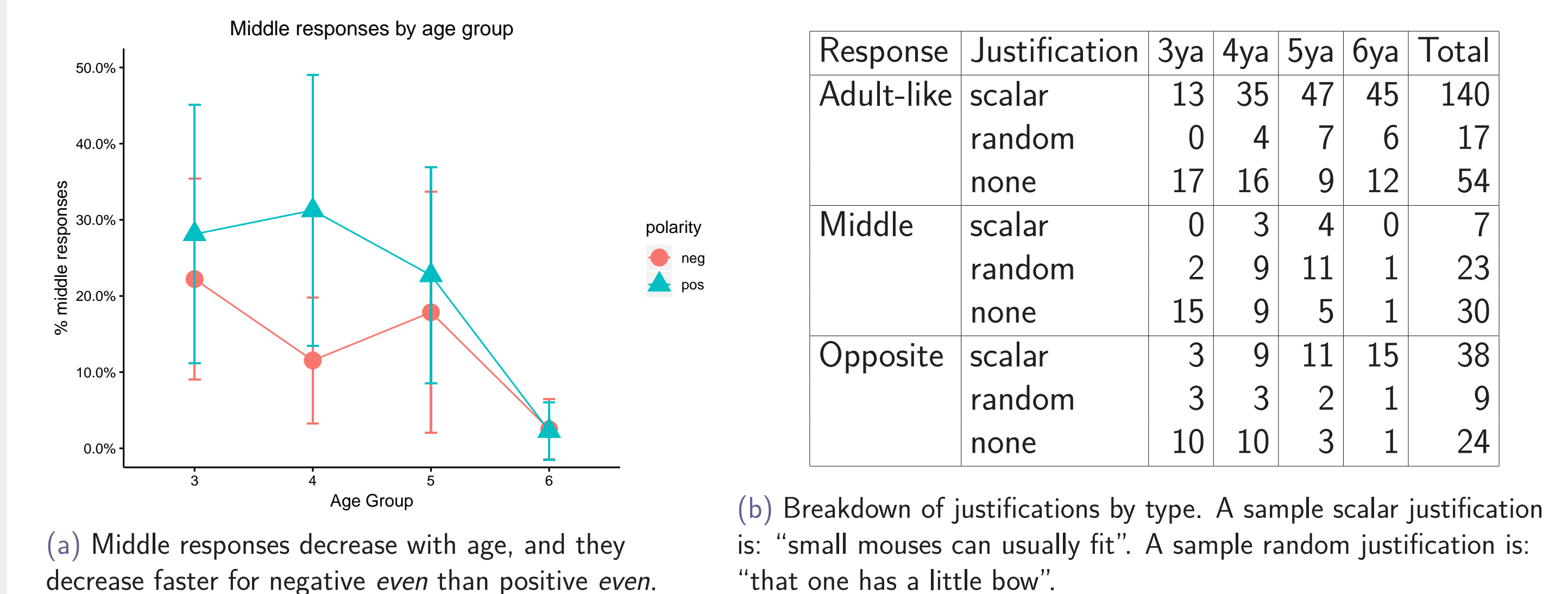
## Results

- We see a polarity effect! Negative *even* is learned faster than positive *even*.
- We get middle responses! Their justifications tell us that middle responses are an important measure of confusion.



(a) A stacked bar graph of all of our response types by age. (b) A plot of the rate of adult-like responses by age group, separated by polarity.

## Results cont.



Analysis:

- Used R for statistical analysis, lme4 package
  - Taking order into account: not enough statistical power for a fully specified linear mixed effect model → we instead analyzed data by blocks; positive *even* data was taken from pos-first group, and negative *even* data was taken from neg-first
- Significant effect of polarity on adult-like responses in 4 year olds ( $p=0.0365$ ) but not for any other age group

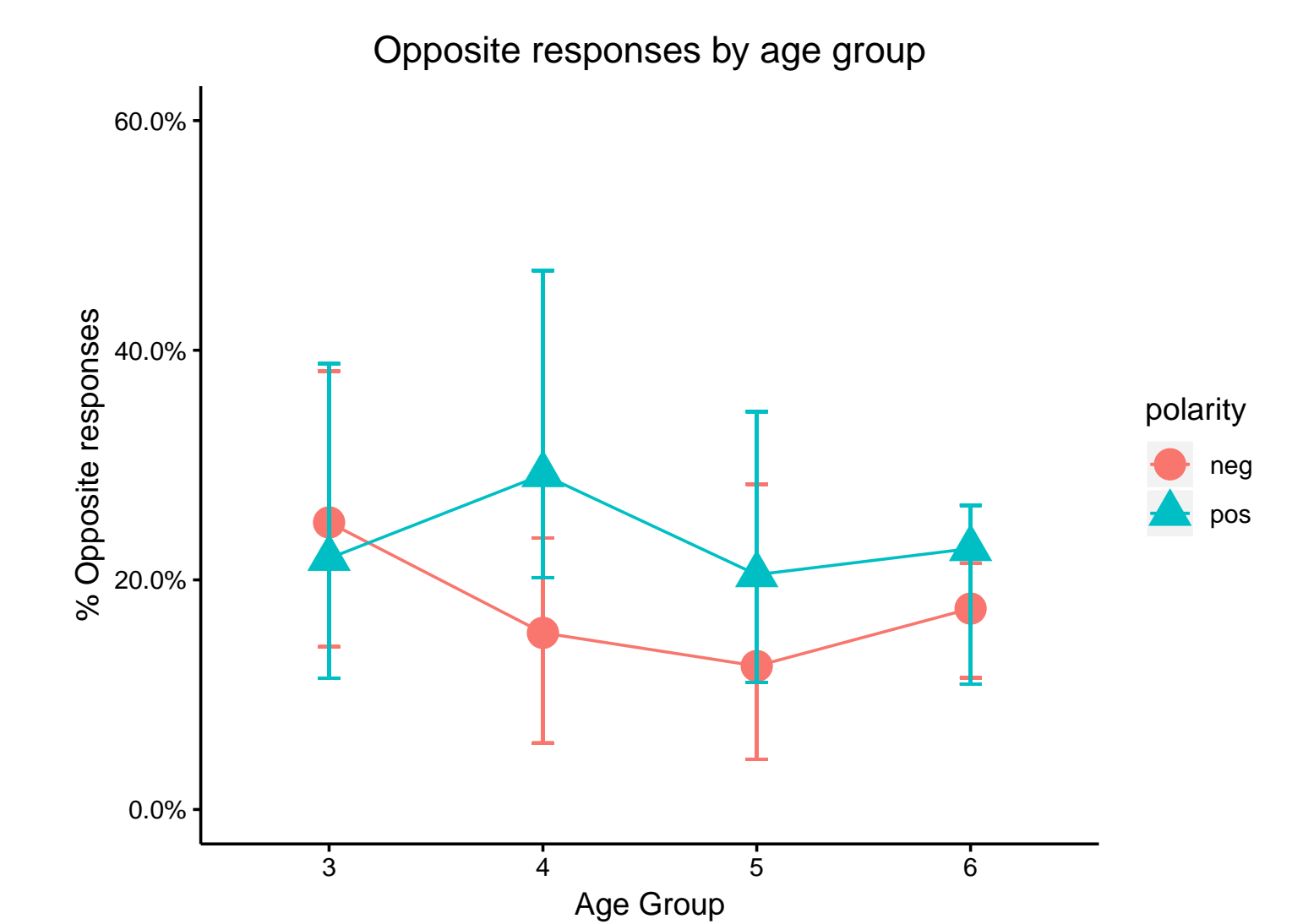
## Discussion

- Ambiguity theory of *even* (Rooth 1985): *even* is actually two lexical items, *even<sub>POS</sub>* and *even<sub>NPI</sub>*. Examples (1) and (2) contain separate lexical entries for *even*.
- Tieu (2010) shows an asymmetry in production between NPI and free-choice *any* that resembles our results → she argues that NPIs are learned earlier because their environmental cues are more obvious

→ *even<sub>NPI</sub>* is learned earlier than *even<sub>POS</sub>*

The polarity asymmetry begins at age 4, suggesting that 4 yr olds begin learning *even* as an NPI before learning the full adult meaning.

- A point of future interest... while middle responses disappear as children get older, opposite responses do not! Their justifications also suggest that they choose the opposite character because they interpret *even* with the inverse likelihood inference, rather than out of simple confusion.



**Conclusion:** we find that children do in fact associate *even* with scalar reasoning, showing close to adult-like competence on *even* in negative environments starting at age 4. As they approach 6 years old, they learn *even* in positive contexts as well, showing some competition from another possible meaning that has the inverse likelihood inferences compared to adult-like use.

What is children's hypothesis space for the meanings of scalar focus particles?

## References

- Branan, K. *Even paper*. Term paper for 24.965, MIT, 2015.
- Karttunen, Lauri and Peters, Stanley. "Conventional implicature". *Syntax and semantics, volume 11: Presupposition* 1979.
- Kim, Soyoung. *Focus particles at syntactic, semantic and pragmatic interfaces: the acquisition of only and even in English*. University of Hawaii, Manoa dissertation, 2011.
- Rooth, M. *Association with focus*. PhD thesis, University of Massachusetts Amherst, 1985.
- Tieu, Lyn. "The acquisition of NPI *any* in English: a case study". In *Online Supplement to the Proceedings of the 34th Boston University Conference on Language Development*, eds. Katie Franich, Lauren, Keil, Kate Iserman, and Jane Chandlee, 2013.