24.949
Language Acquisition

Class 9
Quantifiers

Determiner quantifiers

(1) Jill smiled.

(2) a. Every girl smiled.
b. Some girl smiled.
c. No girl smiled.
d. Exactly one girl smiled.
e. Both girls smiled.
f. At most one of the 10 girls smiled.
g. Fewer than 5 girls smiled.
h. Most girls smiled.
i. All but 5 girls smiled.
j. More than 5 but less than 10 girls smiled.
k. More girls than boys smiled.

Determiner quantifiers v. referential terms

- Subset to superset inferences

(1) Jack is a student from France.
Therefore, Jack is from France.

(2) Everybody is a student from France.
Therefore, everybody is from France.

(3) Nobody is a student from France.
Therefore, nobody is from France.

Determiner quantifiers v. referential terms

- Law of contradiction

(1) Jack is under 30 and Jack is over 40.

(2) Somebody is under 30 and somebody is over 40.

(3) Exactly 5 students are under 30 and exactly 5 students are over 40

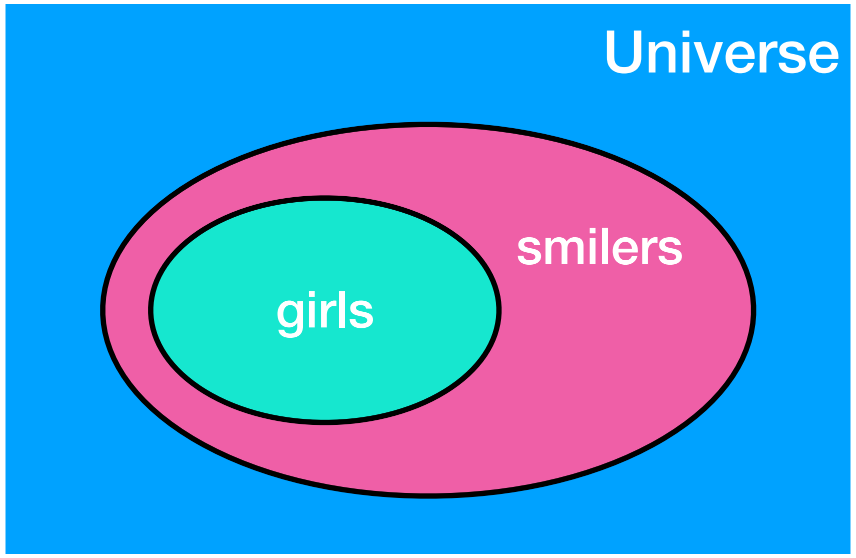
Determiner quantifiers v. referential terms

- Ambiguities

(1) a. Jack admires Jill.
b. Everyone admires someone.

Quantifiers don’t refer!

- Quantifiers do not refer to individuals (or groups)
- They are second-order predicates that relates two predicates:
  - the first picked out by the common noun argument
  - the second supplied by the rest of the sentence, e.g.:
    - [[every girl smiled]] = T iff
    - [[**every**]]([[girl]])([[smiled]]) = T iff
    - {x: x is a girl} ⊆ {y: y smiled}



Acquisition tasks

- Determiner quantifiers differ in meaning from referential expressions but the two kinds of DPs have largely overlapping syntactic distributions
    - the learner has to identify the Qs in your language and learn their meanings
- The linear position of a determiner quantifier is not necessarily a reliable indicator of their structural position, at least in some languages
    - the learner has to figure out whether they are in a “scope rigid” language, the mechanism of QR, and constraints on it

NB: Other quantificational expressions

- adverbial quantifiers (always, sometimes)
- modals (must, can)
- typically not examined in acquisition (in the case of adverbial qs), or treated as unrelated to quantification (modals, conditionals)
- Today we will focus on quantificational noun phrases, a bit too much perhaps on universal quantifiers

Meanings of quantifiers

Constraints on lexicalization

The missing O corner (Horn 1972)

- Looking at the Aristotelian square of opposition, Horn (1972) points out systematic asymmetries in how the different corners are lexicalized

A affirmative universal	every	no/none	?E negative universal
I affirmative particular	some	*nevery	*O negative particular

Constraints on lexicaliztation

- von Fintel and Matthewson (2008):
  - survey of 33 languages, all of which had at least universal and existential quantifiers (that is, A- and I -corners)
  - The E corner has questionable status:
    - there are E-corner lexicalization gaps
    - E-corner words often appear to be morphologically complex
    - E-corner words often show split scope patterns, leading to analyses in which the E element is decomposed into negation and an I -corner element.
  - No language has lexicalized the O corner

Katsos et al. 2016

- Large-scale typological study on the acquisition of quantifiers
  - 31 languages
  - 768 children (M=5.5yo)
  - 5 "quantifiers":

    i) all

    ii) some

    iii) none

    iv) some…not

    v) most

Katsos et al. 2016

- TVJT:
    - “In each trial, the cavegirl produces a single utterance of the type, “[Quantifier] (of the) [objects] are (not) in the boxes.” Children are then asked to evaluate whether what the cavegirl said was right or wrong and if they say wrong, justify why.”
- 2 (sometimes 3) items per quantifier, 1T, 1F

Katsos et al. 2016

- Hypothesized constraints and predicted acquisition trajectories:

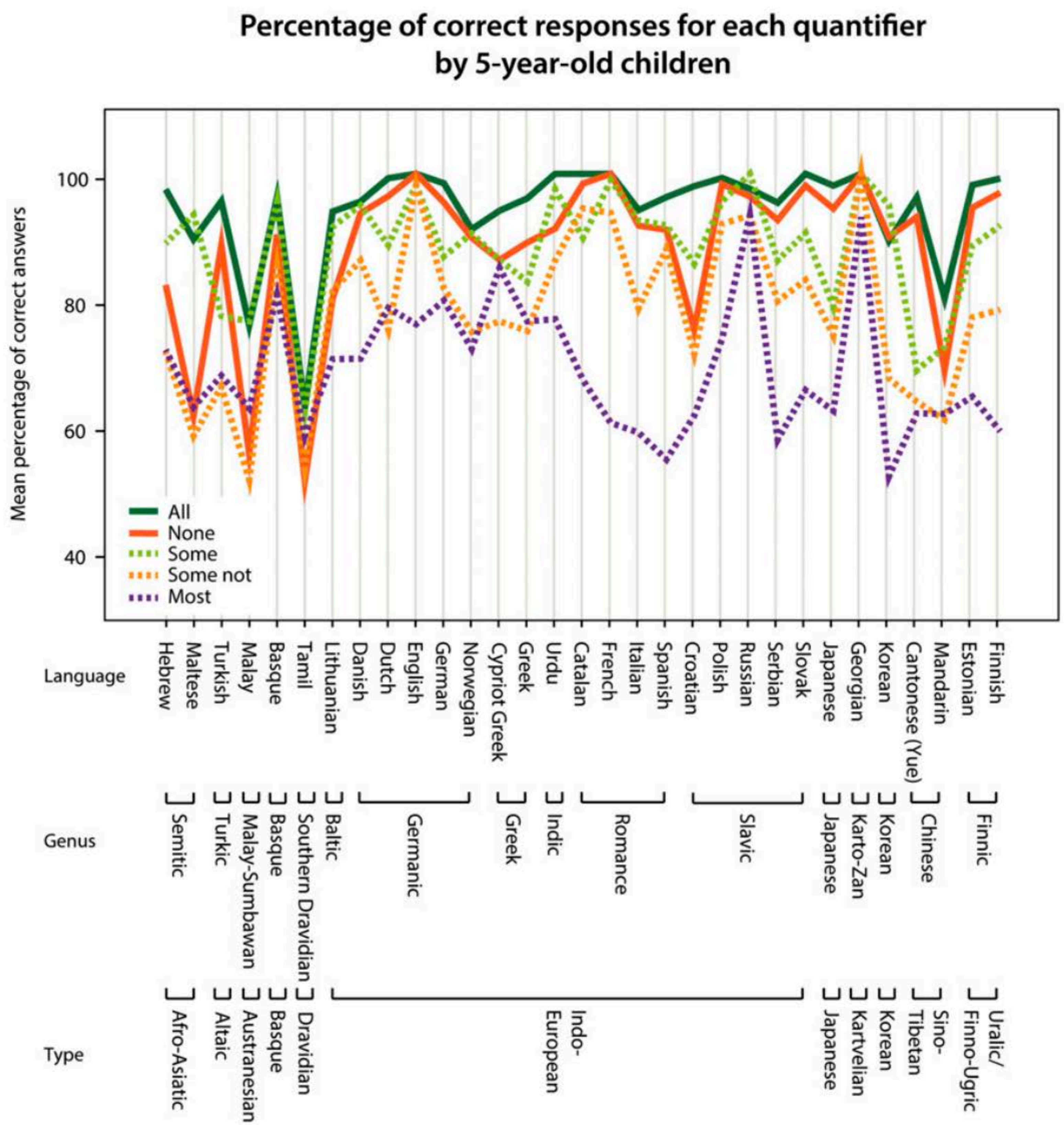
  I. Constraint 1: Monotonicity

  II. Constraint 2: Totality

  III. Constraint 3:

  IV. (Constraint 4: Informativity)

Katsos et al. 2016



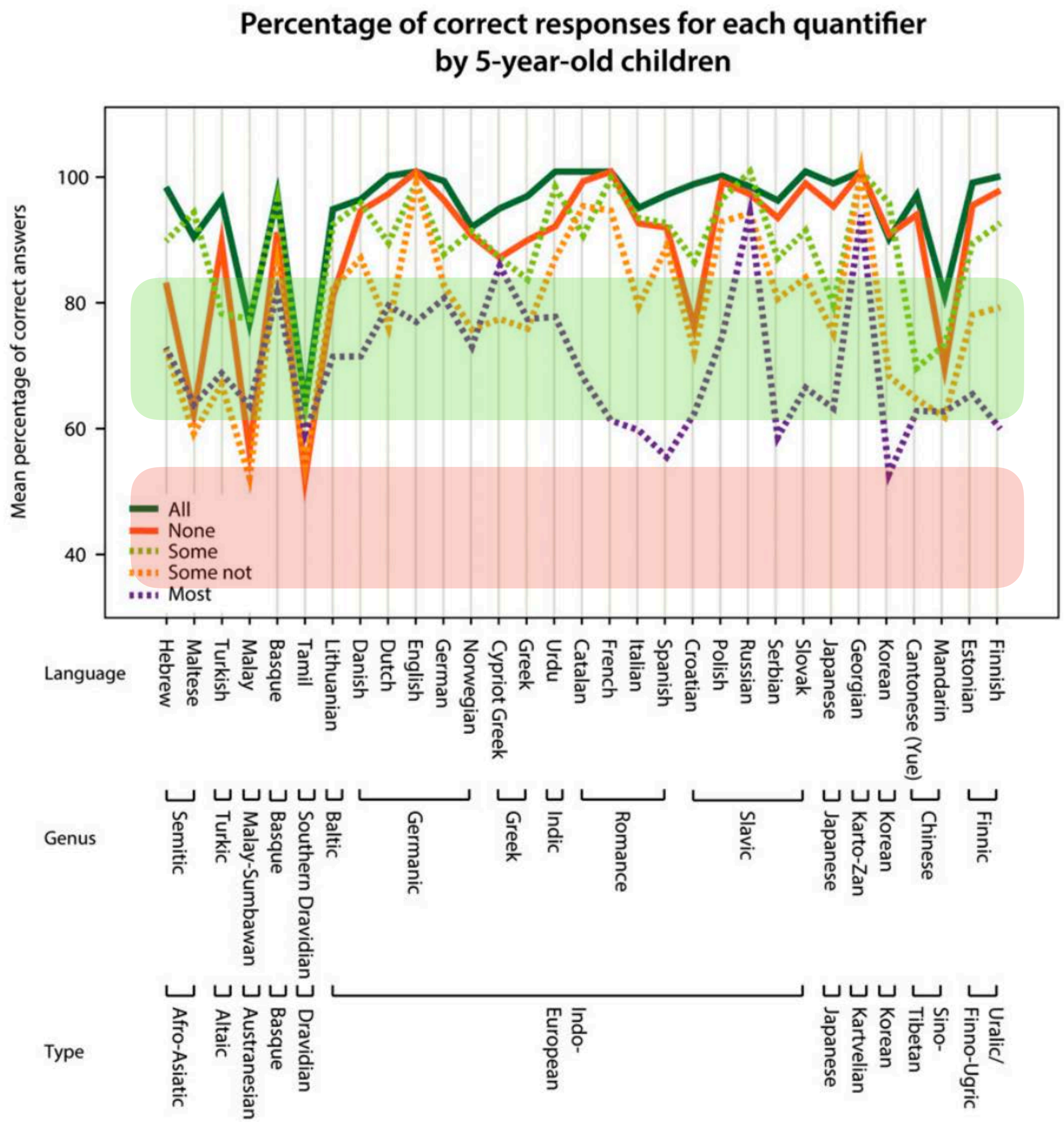
Katsos et al. 2016

All		None		Some		Most		Some…not	
T	F	T	F	T	F	T	F	T	F
97.7	88.8	84.4	88.0	80.8	92.9	72.9	60.8	69.4	82.6
93.25		86.2		86.85		66.85		76	

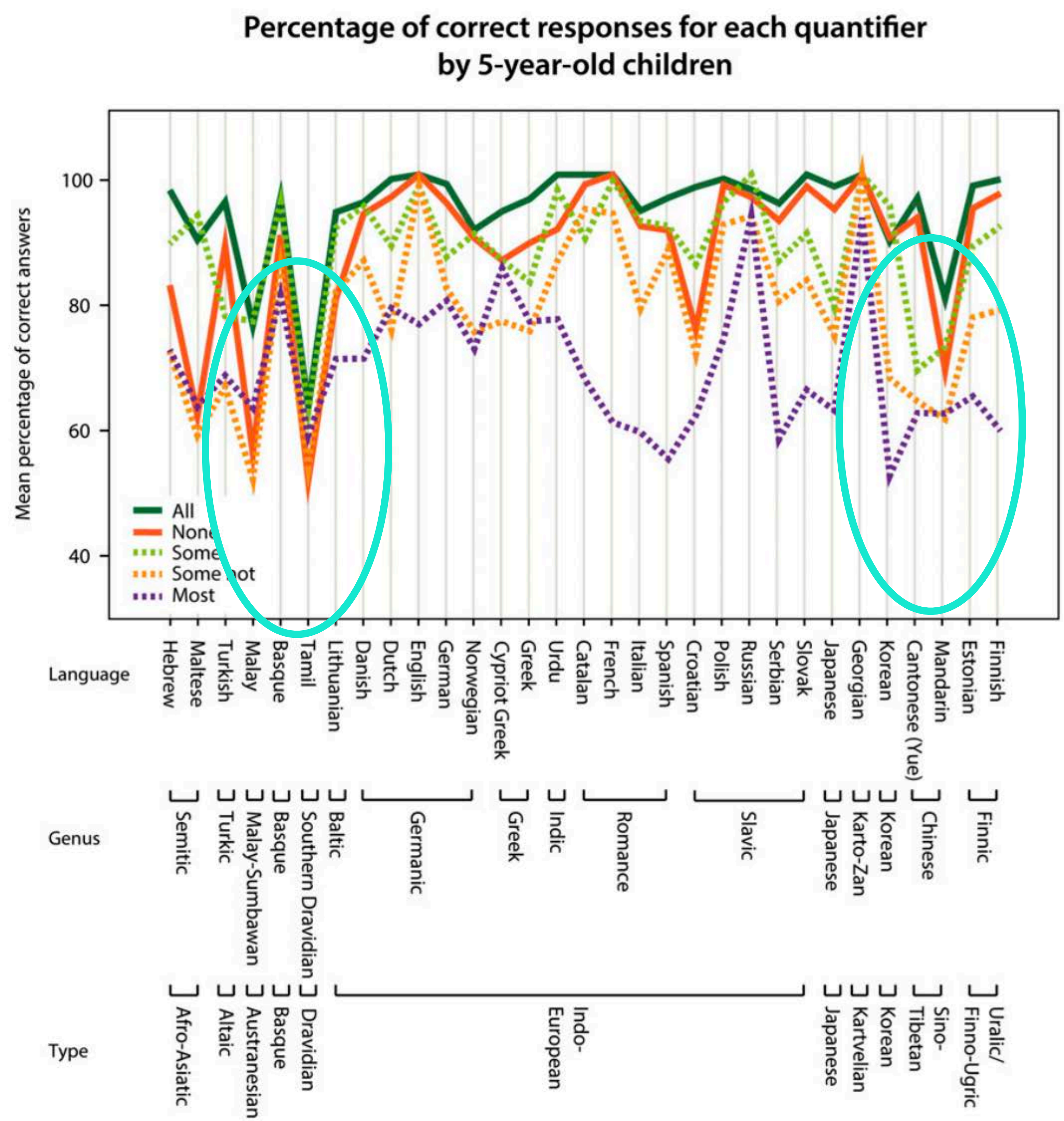
Effects of:

- **Truth: T > F, except for *some* & *some…not***
- **Quantifier: *all > none/some > most***

Katsos et al. 2016



Katsos et al. 2016



Constraining quantifier meanings

- Let Q be the set of possible determiner quantifier meanings and assume a universe of discourse U that contains all individuals under consideration, then
  - the number of possible subsets over U is $|\{X: X \subseteq U\}| = 2^{|U|}$
  - the number of possible ordered pairs of subsets of U is $|\{X: X \subseteq U\}|$^2 $= 2^{|U|} * 2^{|U|}$
  - the number of possible sets of such pairs, i.e. $|Q| = 2^{4^{|U|}}$
- Let $|U| = 2$, then there are $2^{16} = 65536$ different possible quantifier meanings

Constraining quantifier meanings

Conservativity:

- A relation Q is conservative iff for any A, B, $Q(A)(B) = Q(A \cap B)(B)$
  - Every girl smiled = Every girl is a girl who smiled

  Conservativity Universal (Barwise&Cooper 1981, etc.)
  All quantifiers in natural language are conservative

- $|Q\_CONS| = 2^{3^{|U|}}$

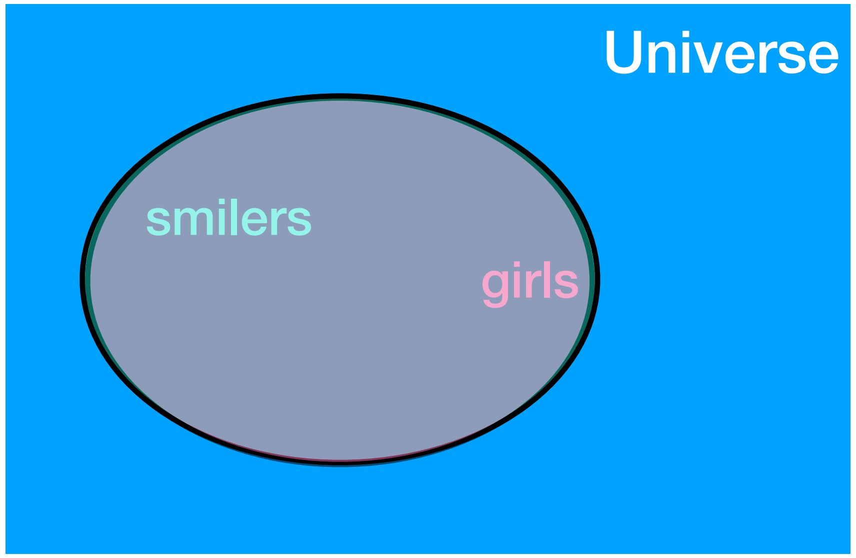
- Let $|U| = 2$, then there are now 512 different possible conservative quantifier meanings

Not of equal stature

- Thus, the first argument of determiner quantifier is "special"
    - It restricts the quantifier, supplies the domain, sets the scene
    - To evaluate the quantificational statement, we only have to look at members of the set picked out by the first argument

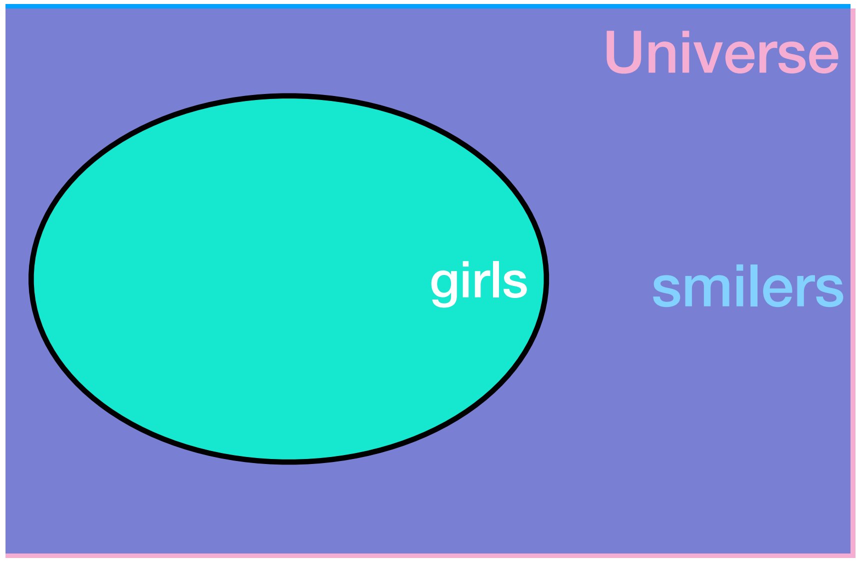
Made up non-conservative quantifiers

- **Equi** girls smiled ≈ the girls are the smilers



Made up non-conservative quantifiers

- **Allnon** girls smiled ≈ the non-girls are smilers



Constraints on quantifier meanings and learnability

A good question and a bad study…

- Hunter & Lidz (2013):
    - Are non-conservative quantifiers harder to learn?
    - If yes, might be indication that such Qs are never even part of the hypothesis space

Hunter & Lidz 2013

- Two novel quantifiers
  - Gleeb_1: conservative, *nevery* meaning

    (1) ‘Gleeb_1 girls are on the beach’ is true iff
    GIRL $\not\subseteq$ BEACH-GOERS

  - Gleeb_2: non-conservative, *nonly* meaning

    (2) ‘Gleeb_2 girls are on the beach’ is true iff
    BEACH-GOERS $\not\subseteq$ GIRLS

Hunter & Lidz 2013

- Participants:
  - 20 children, aged 4;5 to 5;6 (M=5;0), randomly assigned to conservative or non-conservative conditions (10 per group)

Hunter & Lidz 2013

- “Picky Puppet Task”
    - “One experimenter controls a ‘picky puppet’, who likes some cards but not others. The second experimenter places the cards that the puppet likes in one pile, and the cards that the puppet does not like in a second pile. The child’s task is to make a generalization about what kinds of cards the puppet likes, and subsequently ‘help’ the second experimenter by placing cards into the appropriate piles.”
    - “Liking criteria”: puppet likes it when e.g. ‘gleeb X are Y’

Hunter & Lidz 2013

Figure 1:
Gleeb=*Not all*: True
Gleeb=*Not only*: False

Figure 2:
Gleeb=*Not all*: False
Gleeb=*Not only*: True

Hunter & Lidz 2013

Card	beach		grass		'gleeb girls are on the beach'	'gleeb′ girls are on the beach'
	boys	girls	boys	girls		
Train 1	2	0	1	2	true	true
Train 2	0	2	3	0	false	false
Train 3	0	1	2	3	true	false
Train 4	2	3	0	0	false	true
Train 5	2	1	1	2	true	true
Test 1	3	0	0	2	true	true
Test 2	0	3	3	0	false	false
Test 3	2	3	0	2	true	true
Test 4	1	2	2	0	false	true
Test 5	1	2	0	2	true	true

Table 1 The distribution of girls and boys on each card in the experiment

Hunter & Lidz 2013

Condition	Conservative	Non-conservative
Cards correctly sorted (out of 5)	mean 4.1 (above chance, $p<0.0001$)	mean 3.1 (not above chance, $p>0.2488$)
Subjects with "perfect" accuracy	50%	10%

Table 2 Summary of results

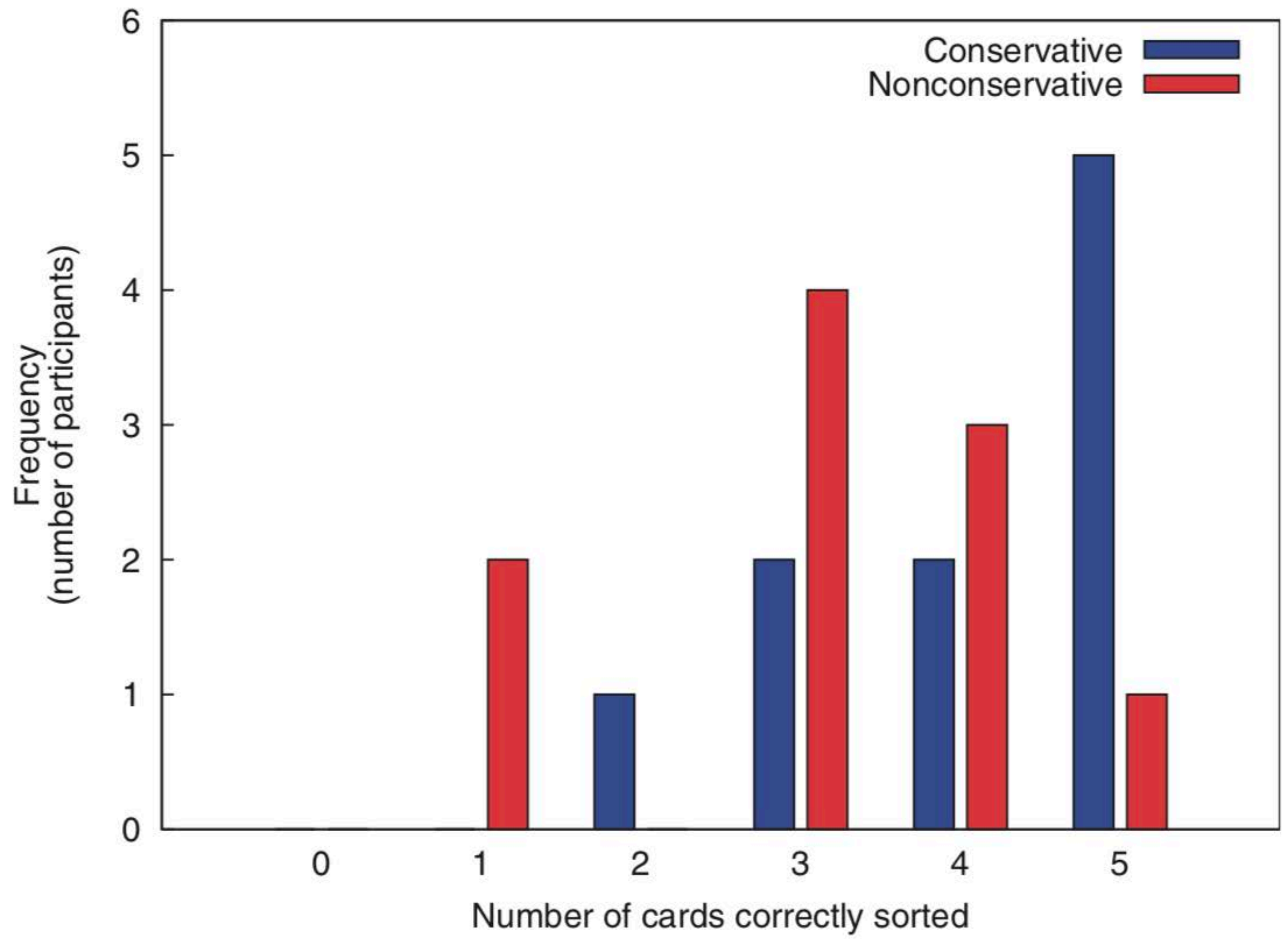


Figure 2 Distribution of participants in each condition according to how many cards were correctly sorted.

Failures to replicate

Spenader & de Villiers 2019

- Experiment 1:
  - Adults (N=18; 9 per group)
  - Same materials as H&L13
  - 56% success on conservative; 69% non-conservative, not statistically different
  - NB: post-hoc review of justifications indicated that some adults succeeded by treating “gleeb2 girls” as “non-girls" s.t. if boys were on the beach, they say yes.

Failures to replicate

Spenader & de Villiers 2019

- 20 children (10 per group) trained on exactly the same materials as HL13, + 6 extra items

- 60% success for conservative; 68% for non-conservative gleeb
  - 3.0 cons vs. 3.4 ncons for the first 5 items
  - 6.0 cons vs. 7.2 ncons for the total 11 items

Failures to replicate

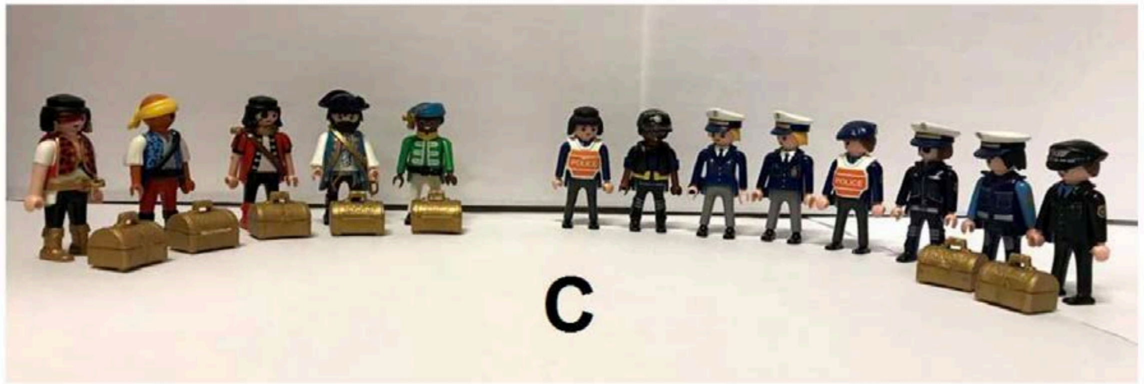
Spenader & de Villiers 2019

- conceptual replication using an situation verification + correction task

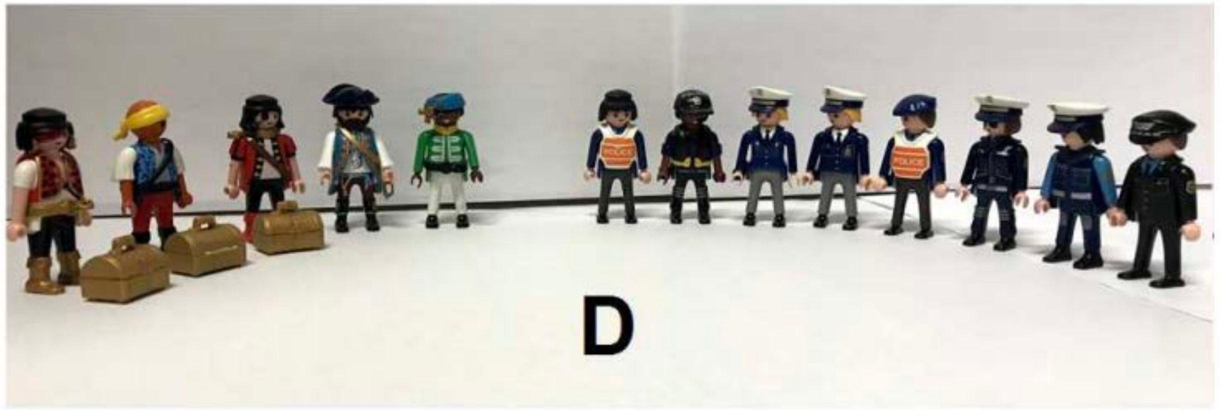
- 37 Dutch children; 18 & 19 per group

- Same conservative and non-conservative meanings, novel word used is *flep*

- 63% cons vs. 54% ncons (n.s)



Do *flep* of the pirates have treasure chests?
Flep1 = No, fix by removal from pirates



Do *flep* of the pirates have treasure chests?
Flep2 = No, fix by giving to police

Methodological morals

- More careful experimentation
    - counterbalance aspects of the task that might lead to artifactual results (e.g. presentation order)
    - statistical power
- More careful reviewing and citation practices
    - at some point in the review process, both (i) and (ii) above should have been raised as concerns

Non-conservativity in child quantifier meanings?

Is every rabbit riding an elephant?

Non-conservativity in child quantifier meanings?

Is every rabbit riding an elephant?

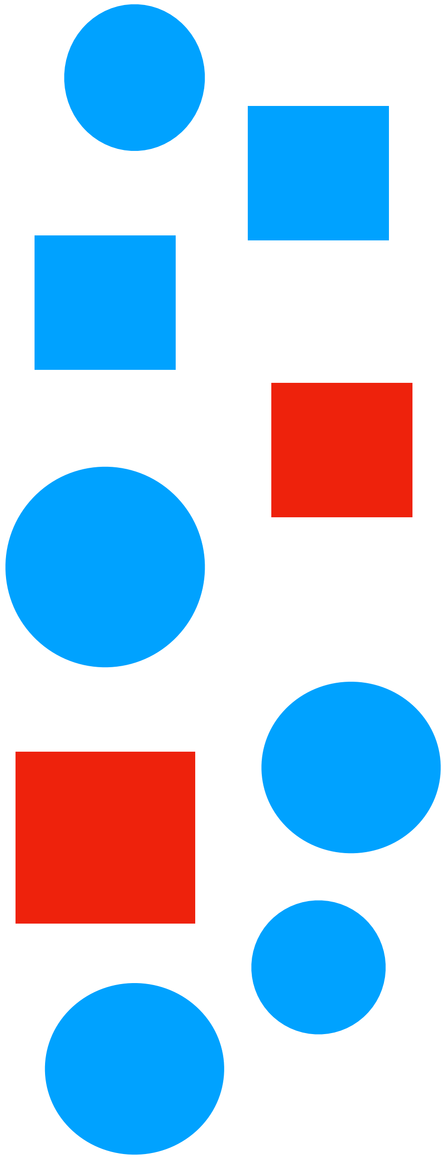
Adults: Yes

4-6-year-olds: No

Why? extra elephant

Inhelder & Piaget 1958, 1964

- Class inclusion task—an assessment of children's ability to classify objects on the basis of common features
- E.g. child might be shown a set of counters comprising five blue circles, two blue squares, and two red squares
- When asked “Are all the circles blue?” children say “no” and point to the blue squares as justification



Donaldson & Lloyd 1974

- Fourteen preschool children (3-to 5-year-olds)
- Array of 4 garages and a set of either 3 or 5 cars, with the cars arranged in partial one-to-one correspondence with the garages.
- When there were 4 garages and 3 cars, children tended to evaluate the statement "All the cars are in the garages" as wrong, often justifying their answer by noting the emptiness of the fourth garage.
- Similarly, where they saw 4 garages and 5 cars, they rejected "The garages have all got cars in them" justifying their answer by pointing to the ungaraged car.

One-to-one correspondence

- Inhelder & Piaget: “It looks as if the child’s thinking is conditioned by a need of symmetry: the extension of the predicate blue must be the same as that of the subject round… **[Our subjects] substitute equivalence (A = B) for class inclusion (A > B or B > A)**”

- But this is precisely the kind of quantifier meaning that natural language disallows!

Two error types

- Overexhaustive search
- Underexhaustive search

Is every circle above a star?

Overexhaustive vs. Underexhaustive Search

Table 1: % of children who make over- and under-exhaustive search errors

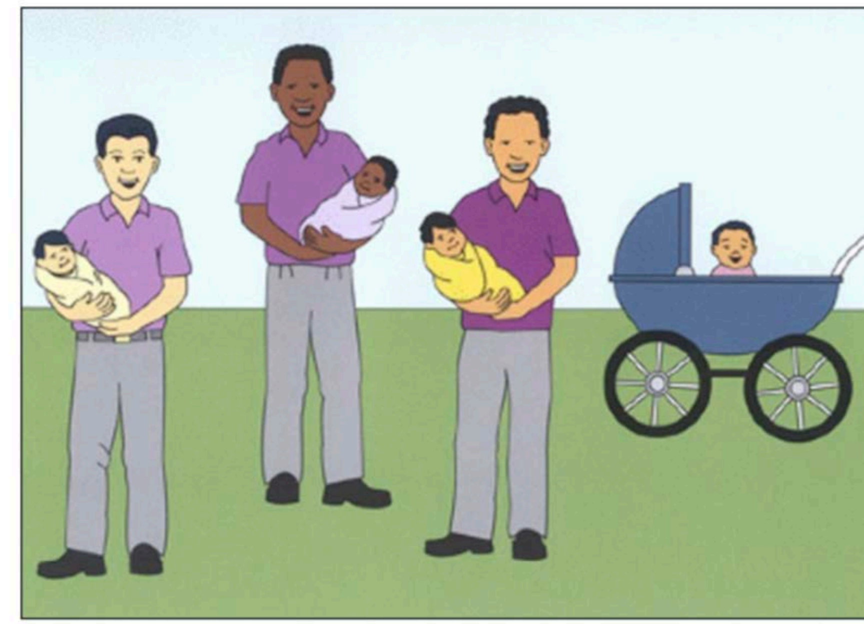
Language	Avg. Age	Over-exhaustive	Under-exhaustive	Other
English (6 studies)	4;7	80%	18%	2%
Japanese (2 studies)	5;1	62%	38%	0%
Dutch	6;6	57%	12%	31%
French	5;9	43%	44%	13%
Spanish	5;6	42%	43%	15%
Norwegian	6;2	40%	55%	5%

Meta-analysis from Philip 2011

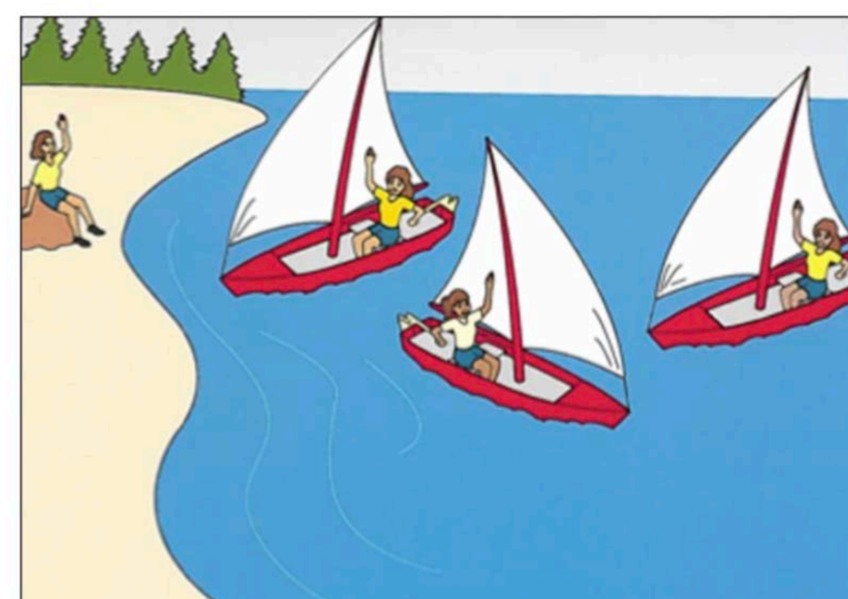
Relation between the errors

- Aravind et al. 2017
- Longitudinal study, 140 English-acquiring children tested 4 times
- Mean age, T1 = 4.22; Mean age, T4 = 6.73
- 2 questions each of (i) over-exhaustive vs. (ii) under-exhaustive scenarios

Is every man holding a baby?



Is every woman sailing a boat?



Trajectory

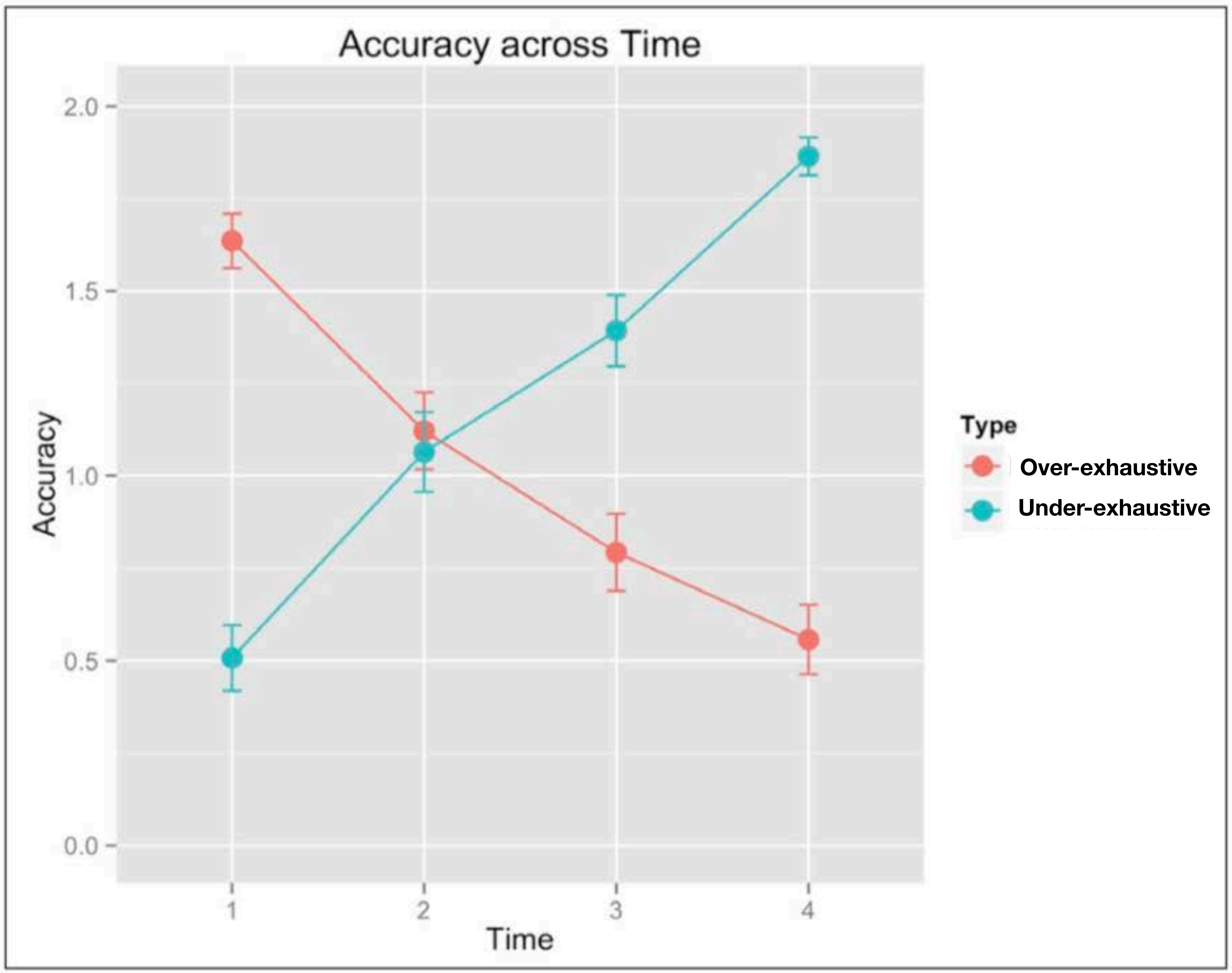


Figure 3: Mean accuracy for the two types across time.

So…

- Inverse relationship in development between Overexhaustive errors and Underexhaustive errors

- Not compatible with the idea that the error derives from an initial non-conservative “one-to-one” meaning for the quantifier

- The interesting case is the over-exhaustive errors: it seems *progressive* in nature

- What’s going on?

Event quantification

Philip 1995

- Basic idea: children misinterpret *every* as a sentence-level quantifier ranging over *events* rather than as ranging over individuals

Event quantification

- Event quantifiers in English:

(1) a. Sue **always** runs in the morning
b. Sue **usually** runs in the morning
c. Sue **mostly** runs in the morning
d. Sue **sometimes** runs in the morning

- "Unselective", unlike quantifiers over individuals like *every*

(2) Sue always runs *in the morning*
Every event in which Sue is a participant that is a running event is an event that takes place in the morning

(3) Sue always *runs* in the morning
Every event in which Sue is a participant that is in the morning is an event of running

Event quantification

- “Is every bunny riding an elephant?” is for the child similarly ambiguous:

  (1) Is it the case that…

  a) Every event in which the bunny is a participant is a riding event?

  or

  b) Every event in which an elephant is a participant is a riding event?

Evidence against

- Crucially, the event quantification account involves positing a non-adult semantic representation for universal quantifiers like *every* in early child language

- But there are reasons to suspect that children have the universal quantification early

  - Universal quantifiers first appear in child speech around age 2 (Brooks and Sekerina 2005/2006)

  - Earliest uses involve cases like *Milk all gone, Apple all gone,* but shortly thereafter, more sophisticated cases emerge:

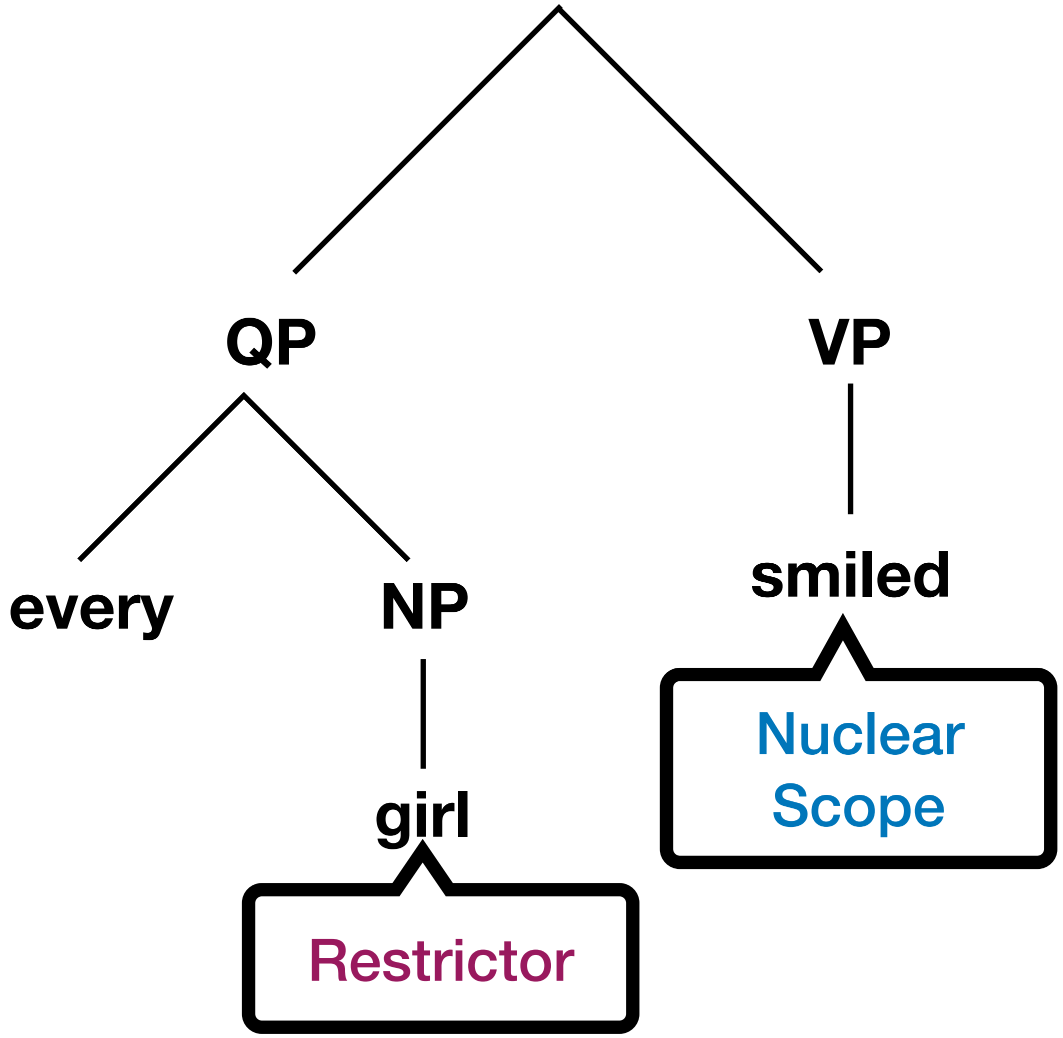
(1) a. These everybody else's (Joel, Manchester Corpus, 2yo)
b. I show you every sticker (Anne, Manchester Corpus, 2yo)

Evidence against

- And there is experimental evidence for early knowledge of core logical properties of *every* (at least as early as the EP error stage)

Entailments

- The two arguments of *every* show distinct logical properties
  - the **restrictor** set licenses inferences to *subsets* (⟹ downward entailing)
  - the **nuclear scope** licenses inferences to *supersets* (⟹ upward entailing)

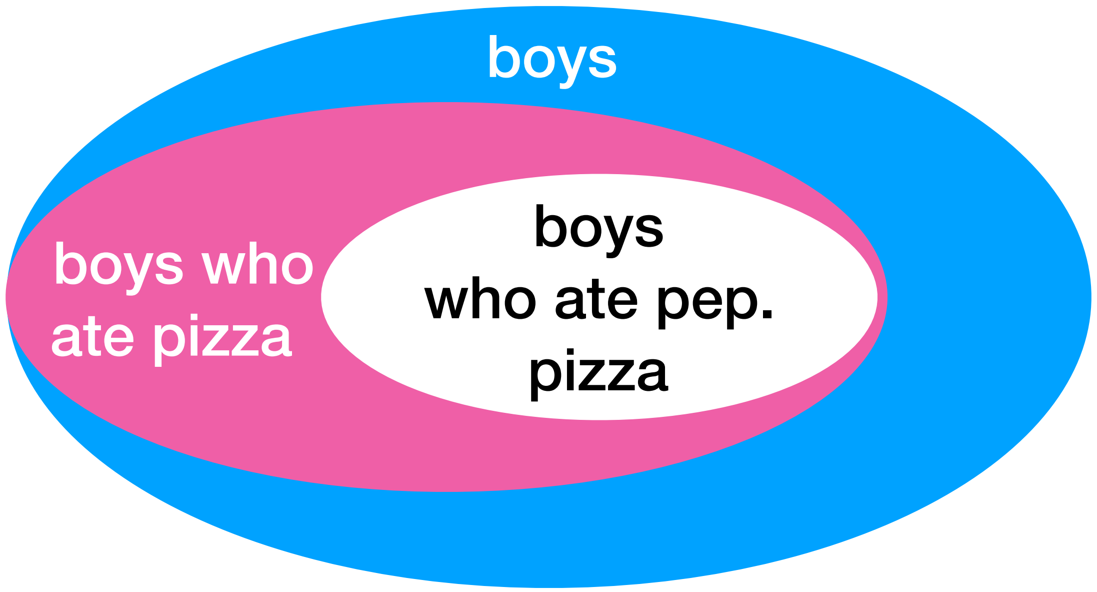


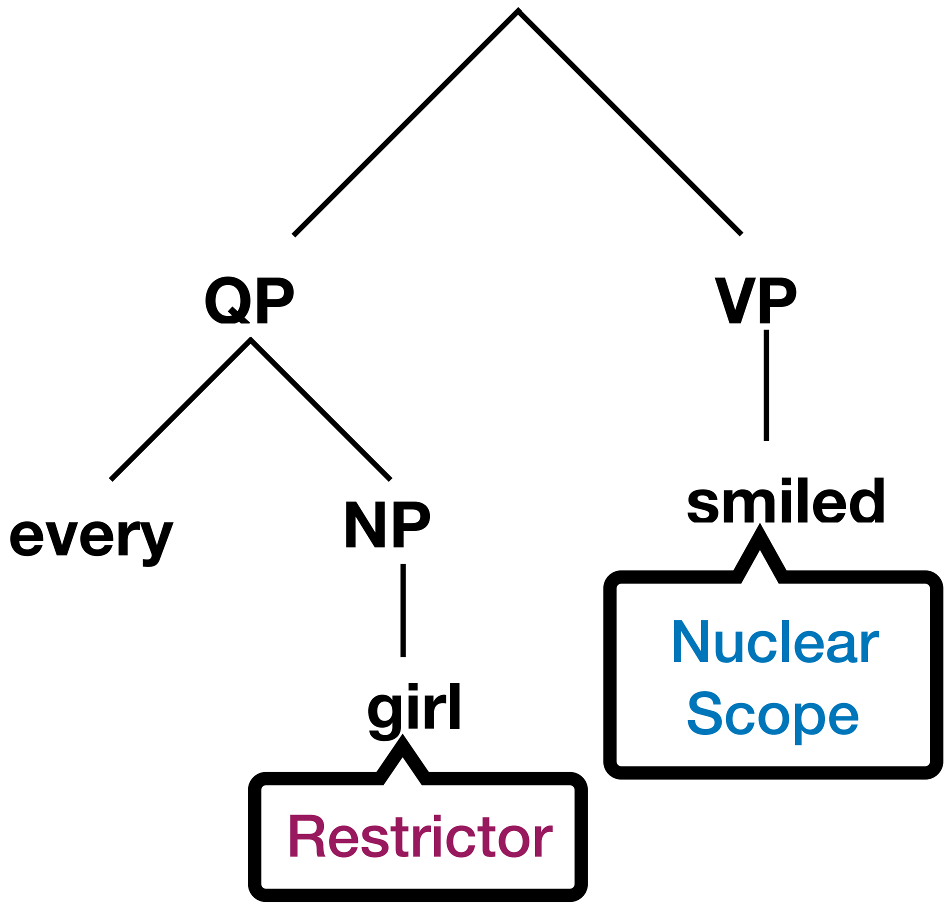
Entailments

(1) Every boy who ate pizza got sick

⟹ Every boy who ate pepperoni pizza got sick

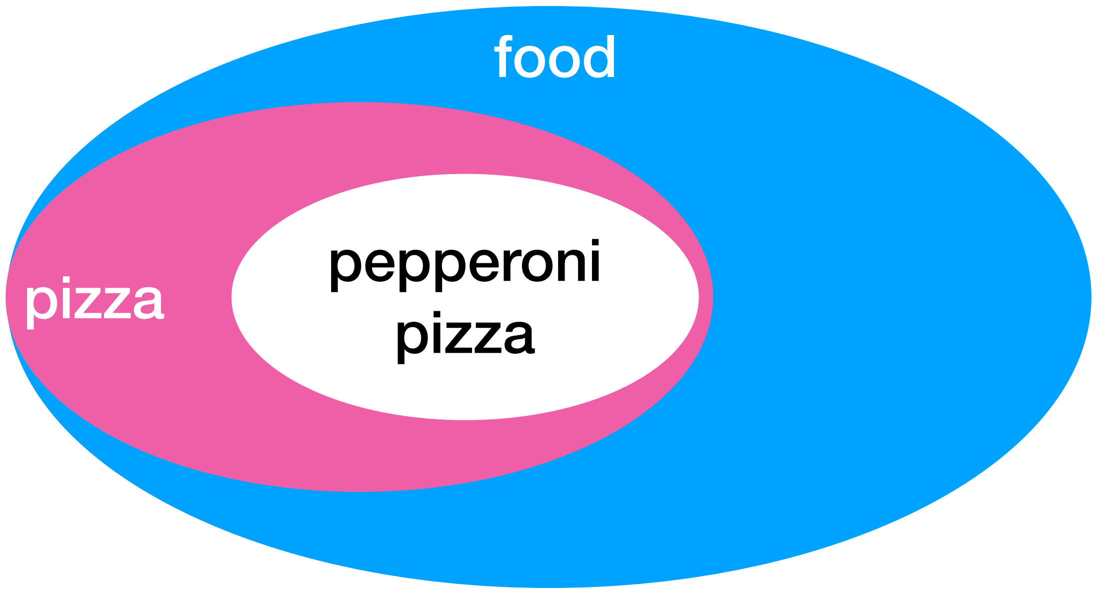
⇏ Every boy got sick

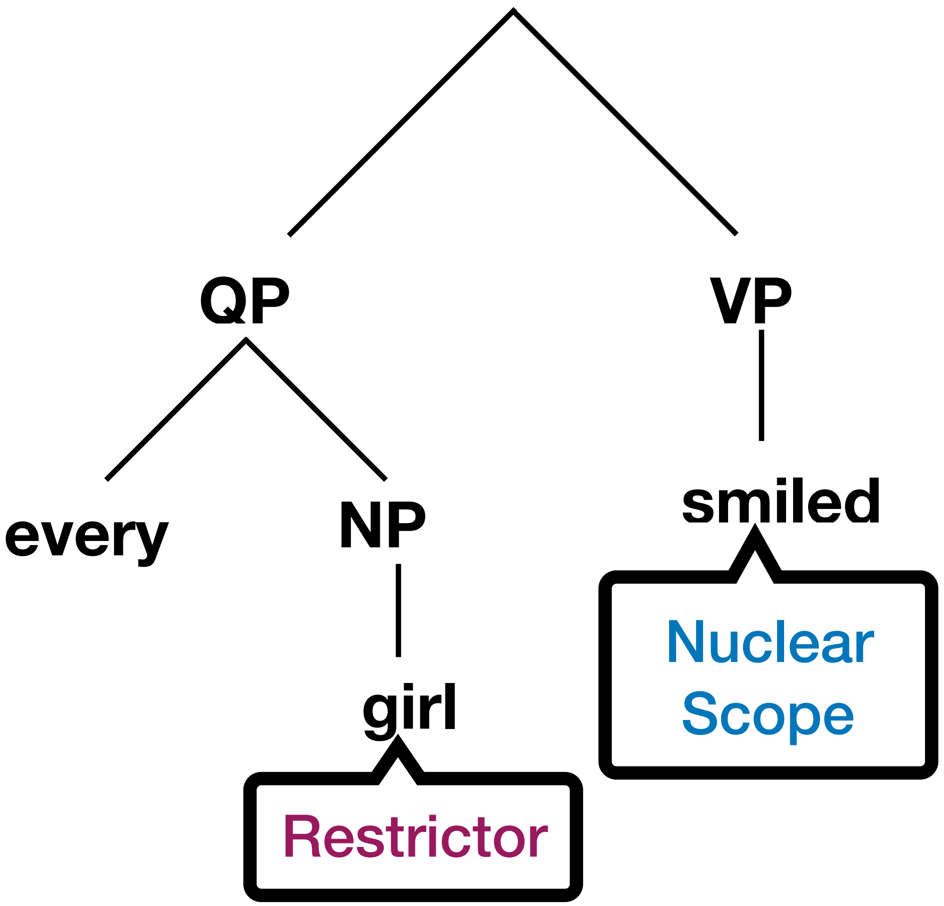




Entailments

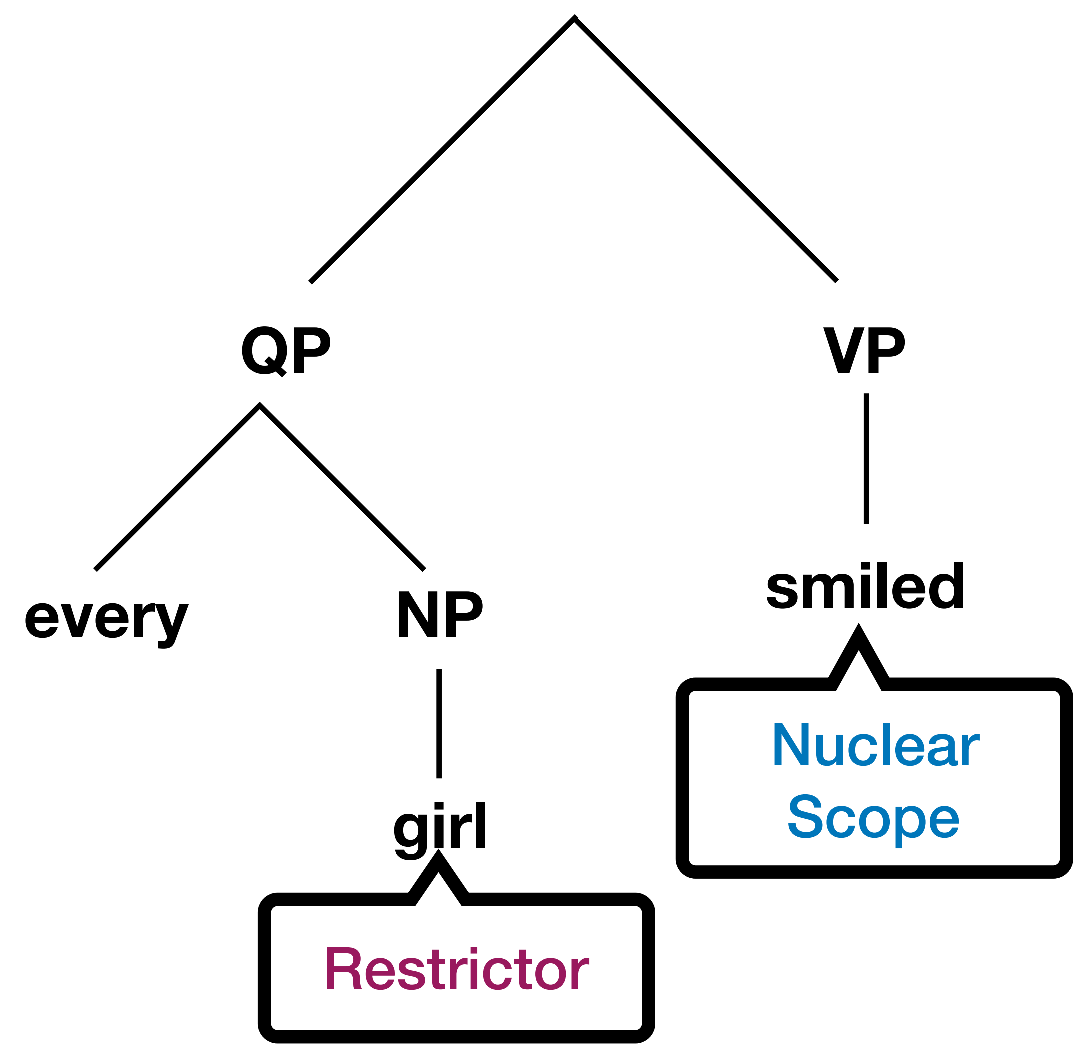
(2) Every boy ate pizza
⇏ Every boy ate pepperoni pizza
⟹ Every boy ate food





Entailments

- The two arguments of *every* show distinct logical properties
  - the restrictor set licenses “conjunctive” interpretations of disjunctions (*or*)
  - the nuclear scope licenses only “disjunctive” interpretations of disjunctions

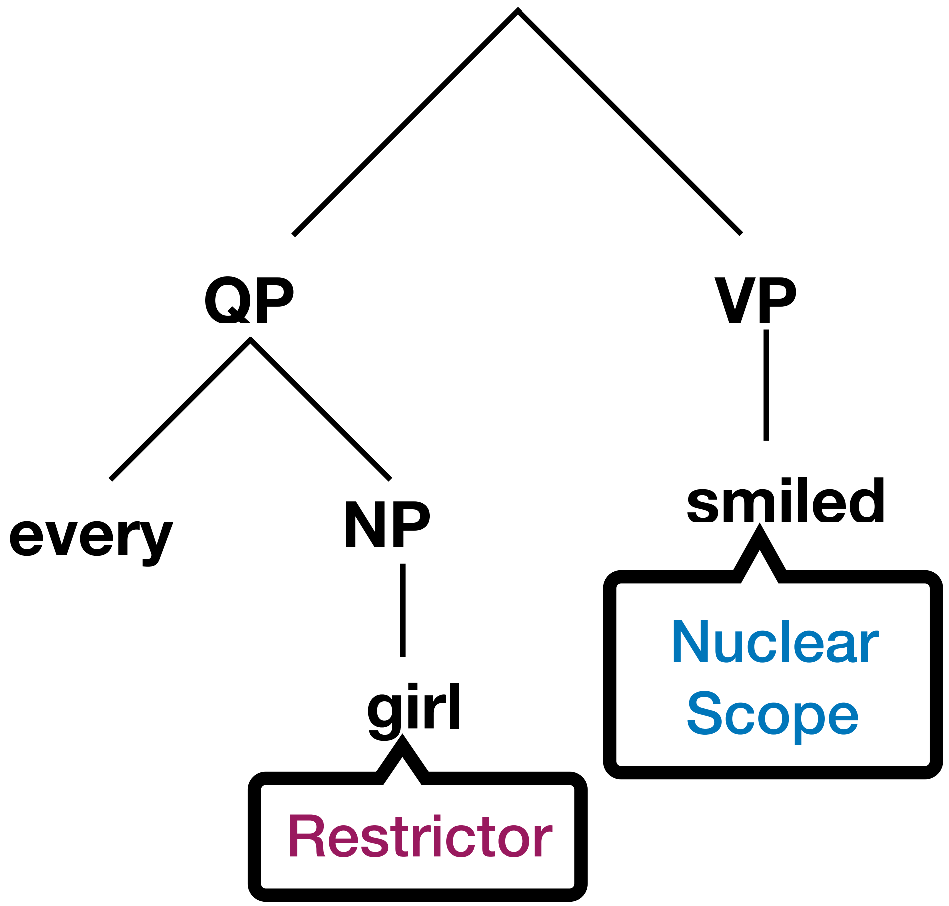


Entailments

(1) Every boy who ate cheese or pepperoni pizza got sick

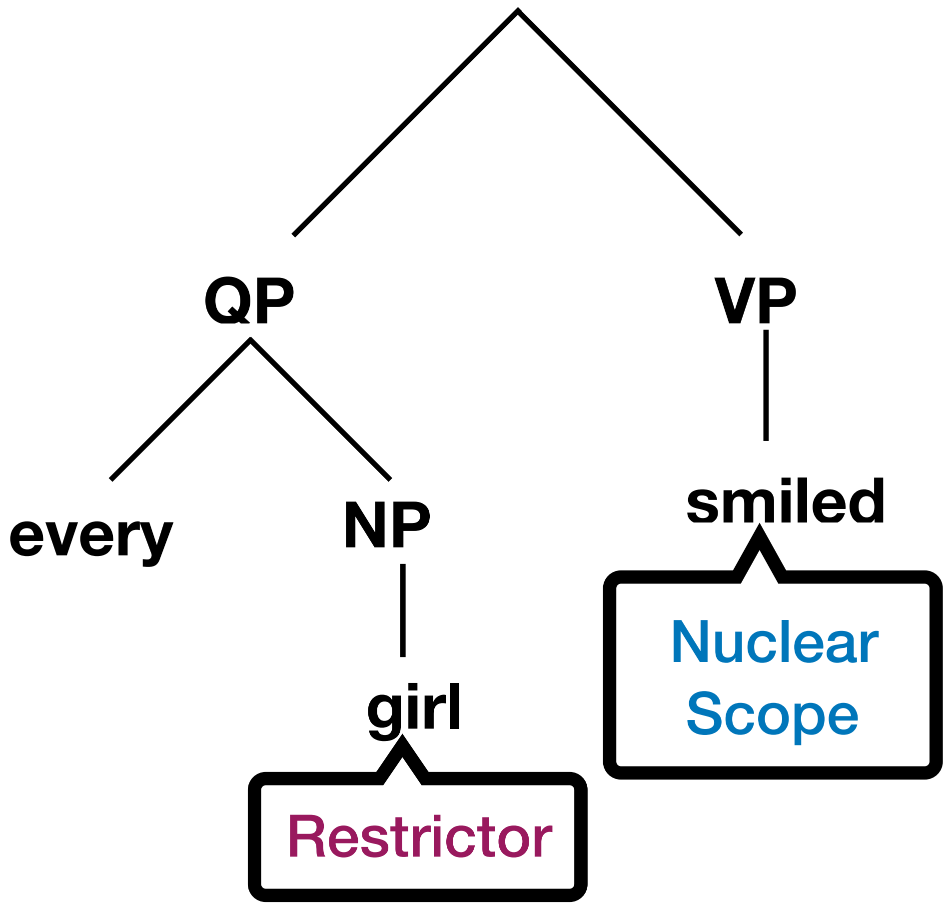
⟹ Every boy who ate cheese pizza got sick AND every boy who ate pepperoni pizza got sick

$\not\Rightarrow$ Every boy who ate cheese pizza got sick OR every boy who ate pepperoni pizza got sick



Entailments

(2) Every boy ate pepperoni or cheese pizza
$\not\Rightarrow$ Every boy ate pepperoni pizza AND cheese pizza
$\Longrightarrow$ Every boy ate pepperoni pizza OR cheese pizza



Gualmini et al. 2003

- Do children in the over-exhaustive-search-error making stage know these logical properties of *every*?
- 20 4-and-5-year-olds (M=5;1) in a TVJT

Gualmini et al. 2003

This is a story about five trolls who go to the fast food owned by Genie. The Trolls order food. One troll gets a big hot-dog, two trolls order onion rings and two trolls order French fries. Genie serves all the food and asks the trolls whether they need anything else. The Troll who ordered the hot-dog says he does not need anything else. The two trolls who ordered French fries ask for mustard, and Genie gives a big bottle of mustard to each of them, The two trolls who ordered onion rings also ask for mustard. Genie says: “I am sorry, but I do not have any more regular mustard”.

Puppet: Every troll who ordered French fries or onion rings got some mustard. (False)

- Children correctly rejected the target sentences 95% of the time (on 76 out of 80 trials)

Upshot

- Children seem to know core semantic properties of *every,* making less plausible the idea that they start out with a non-adult ‘event-quantifier’ meaning

- But if they do have the right meaning representation, what’s going awry?

Pragmatic problems

- In these "extra object” scenarios, children have difficulties identifying which objects in the context should be taken as relevant/irrelevant

Drozd and van Loosbroek 2006, Philip 2011, Smits 2011, a.o

Domain restriction

(1) Every student is happy.

Domain restriction

You should really come to MIT Linguistics.

(1) Every student is happy.

Domain restriction

You should really come to MIT Linguistics.

(1) Every student is happy.
= every student *in MIT Linguistics* is happy

Domain restriction

- When we use quantificational expressions like *every* or *most,* we are rarely quantifying over every single member of the restrictor set

- The domain under consideration seems to be much narrower

Domain restriction

- How do we do this?
  - Enrich the structure
  - Every C_i NP VP, where *C* is a predicate-denoting pronoun that picks up its meaning from the context.
  - Thus:

(1) [Every C_i student] is happy. [i —> {x: x is in course 24}]

Domain restriction

- Like pronouns, these C-variables require a contextually salient antecedent

- Consequently, interpreting (1) out of the blue is hard. Surely not every student in the world?

(1) [Every C_i student] is happy.

Extra object scenarios

- In scenarios that elicit over exhaustive search errors, adults restrict their domain based on the scene/image

(1)[Every C_i rabbit] is riding an elephant.

[i —> {x: x is in the picture}]

Is every rabbit riding an elephant?

Extra object scenarios

- Children, on the other hand, might restrict the domain differently

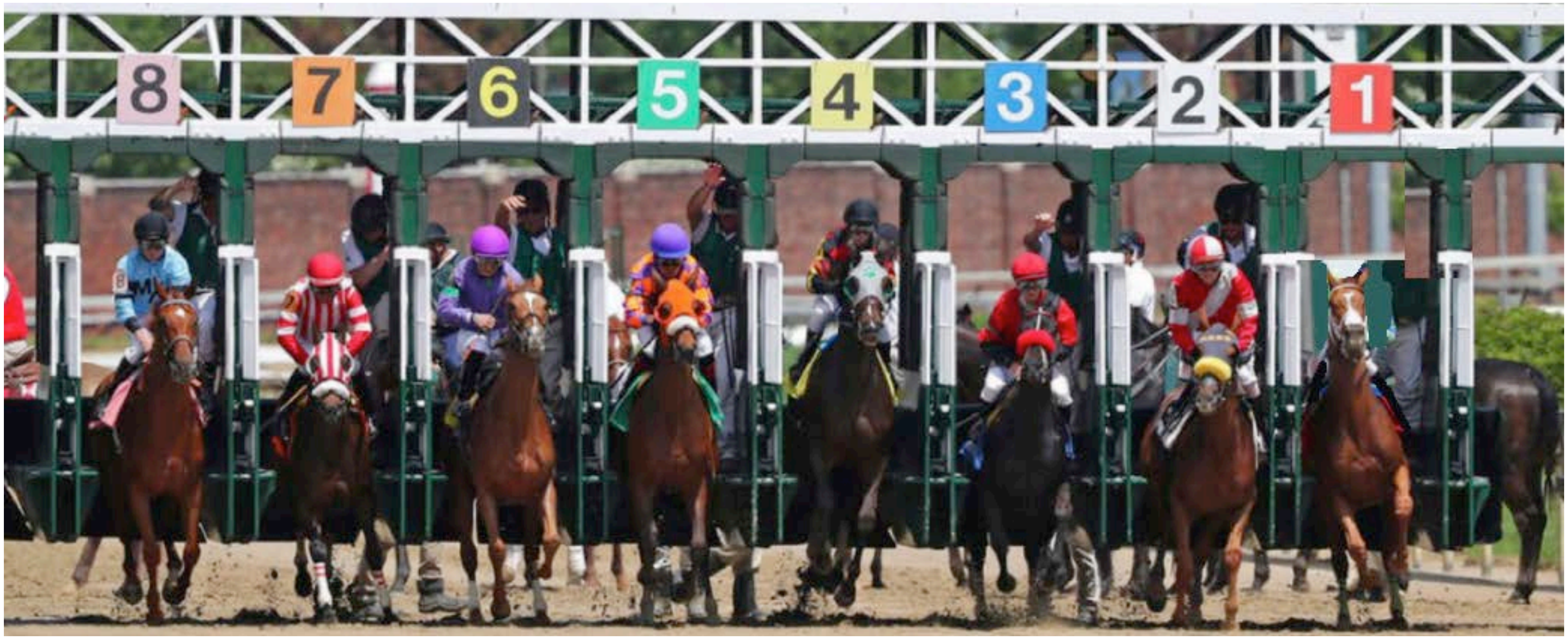
- For instance, they might imagine a relevant bunny that's supposed to be riding the elephant

(1)[Every C_i rabbit] is riding an elephant.

[i —> {x: x is supposed to be on an elephant}]

Is every rabbit riding an elephant?

Extra object scenarios

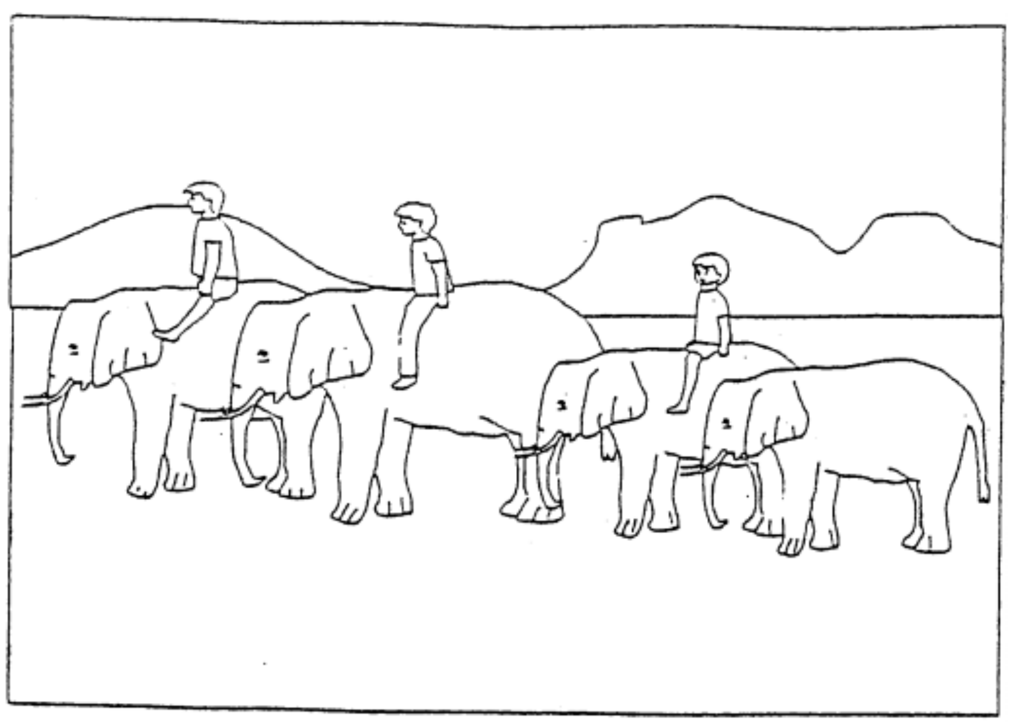


Is every jockey on a horse?

Drozd and van Loosbroek 2006

Experiment 1

- 52 4-5-y.o in a Y/N question task
- the quantifier *iedere* ‘every’ (8 trials)



Test: Is every boy riding an elephant?
Rijdt iedere jongen op een olifant?

	% correct
4-year-olds	56%
5-year-olds	65%

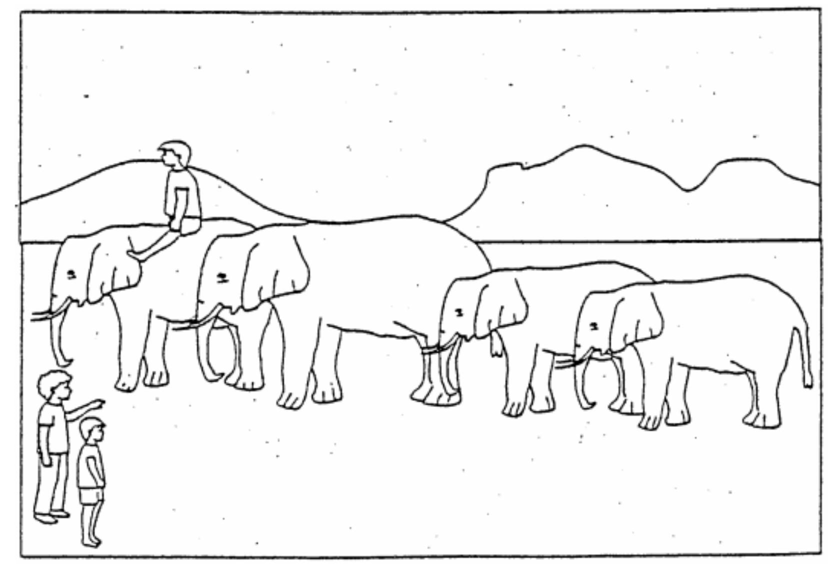
Drozd and van Loosbroek 2006

Experiment 2

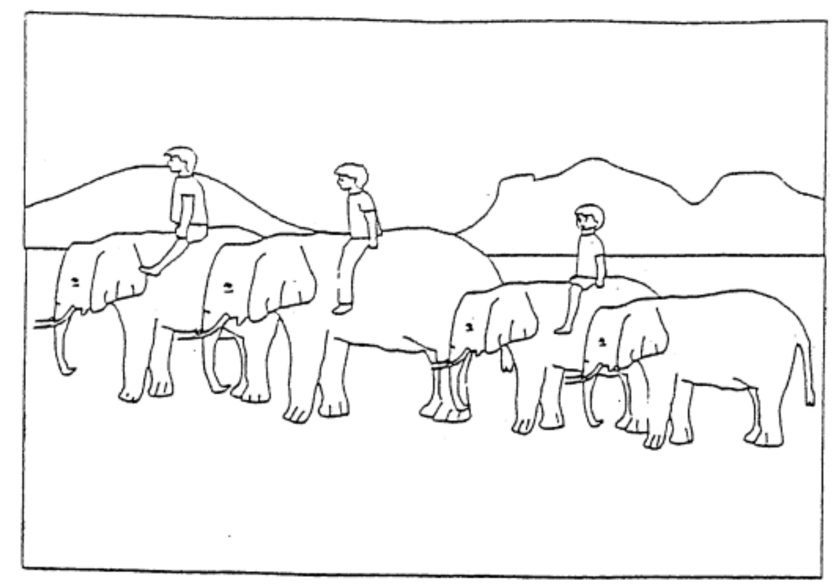
- 78 Dutch acquiring children 4-5 yo
- Y/N questions but test sentences preceded by a domain-setting context and warm up question of three types:

Context:
Dit lijkt wel een woestijn.('This looks like a desert.')
Allemaal zand en bergen. ('All sand and mountains')
En dit zijn jongens? ('And these are boys?')
Hier zie je…?(olifanten) ('Here you see…? (elephants))

- "Show me": Point to the boys!
- "Irrelevant property": Does every boy have shoes?
- "Relevant property": Is every boy sitting on an elephant?



Context



Test: Is every boy riding an elephant?
Rijdt iedere jongen op een olifant?

Drozd and van Loosbroek 2006

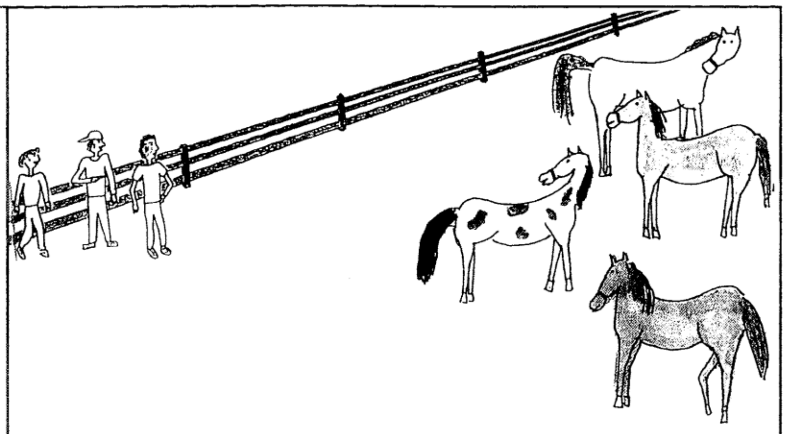
Condition	Age	% correct
Show me!	4-year-olds	75%%
	5-year-olds	65%
Irrelevant property	4-year-olds	65%
	5-year-olds	77%
Relevant property	4-year-olds	87%
	5-year-olds	81%

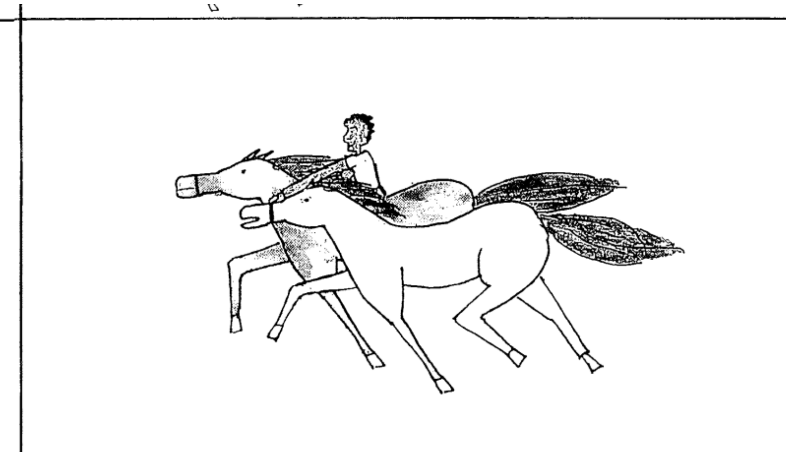
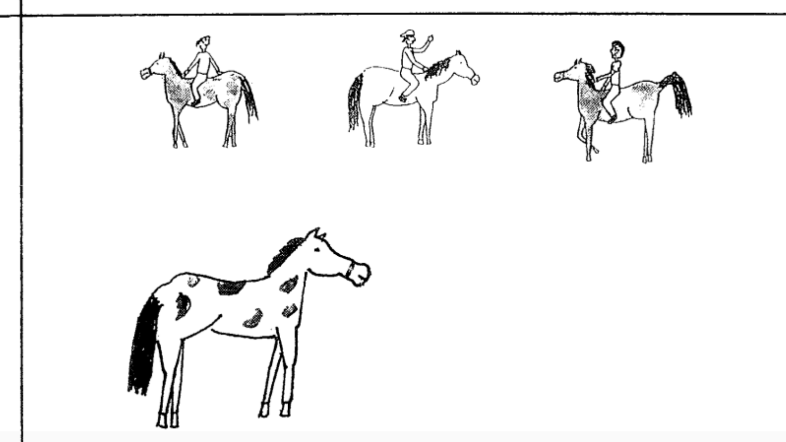
Philip 2011

- The domain can be manipulated not just be preceding discourse, but changing the visual features of the scene
- 166 Dutch acquiring 4-5-year-olds; final sample = 88
  - after elimination of 32 kids who were not attentive and 46 kids for being under exhaustive search error makers
- Question after story task
  - 2 conditions: “conspicuous" extra object (CEO) vs. “inconspicuous” extra object (IEO)
  - 1 trial per condition

Philip 2011

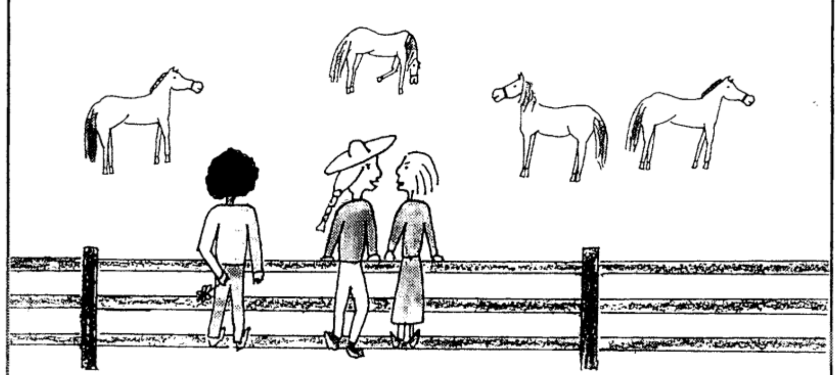
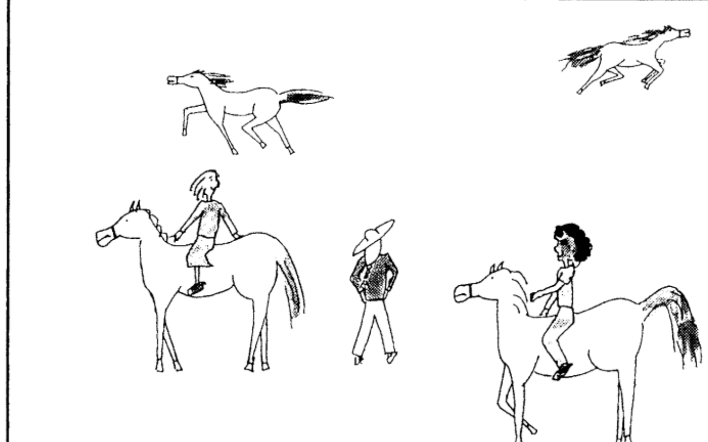
Sample CEO item

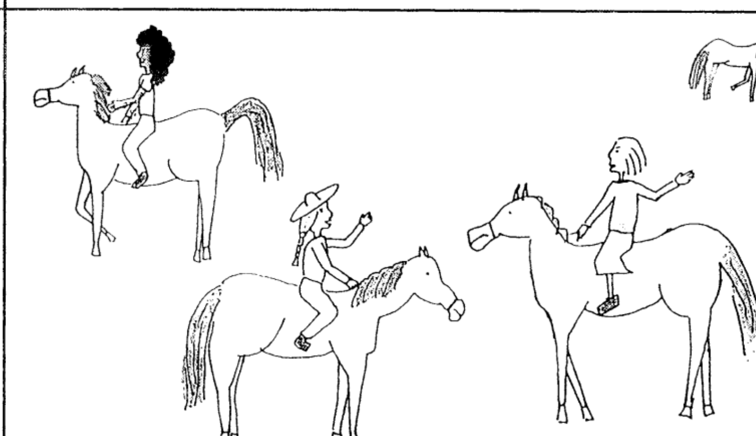
STORY-TELLER *This is a story about a bunch of horses. One day they were in a field eating grass....*[Puppet interrupts to ask how many horses and what they look like; child answers]...*Suddenly three boys appear at the edge of the field. The yellow horse with spots says, "Oh no! Boys! I bet they're going to try to ride us."*	
STORY-TELLER *And that's what the boys try to do. The brown horse and the black horse get caught and have to give a boy a ride, but the white horse and the yellow one with spots run away so the boy with a yellow hat doesn't get to ride a horse.*	

STORY-TELLER *Then the white horse is also caught by one of the boys....*	
STORY-TELLER *And now the boy with the yellow hat is riding a horse. The yellow horse with spots is happy because he doesn't have to carry any boy. Okay, Drakkie. Can you tell us something about this story?* PUPPET *Easy.* ***Each boy is riding a horse.*** CHILD *Not the yellow one with spots.*	

Philip 2011

Sample IEO item

STORY-TELLER *This is a story about a some girls. One day they were taking a walk in the country side....*[Puppet interrupts to ask how many girls and what they look like; child answers]...*After a while the girls find some horses. The girl with the yellow hat says, "Look! Horse! Let's try to ride them."*	
STORY-TELLER *And that's what the girls try to do. The girl with the red sweater catches a horse and she gets a ride, and so does the girl with the blue pants, but the girl with the yellow hat can't catch a horse so she doesn't get to ride one.*	

STORY-TELLER *Then the girl with the red sweater catches another horse....*	
STORY-TELLER *Now the girl with the yellow hat is riding a horse. Okay, Drakkie. Make a guess. Tell us something that's happening in this story.* PUPPET *Sure.* ***Each girl is riding a horse.*** CHILD *That's right.* (adult response)	

Philip 2011

Groups		n	Number subjects and percent of group giving EP responses: # subjects	% of group
Younger children	CEO group	21	9	43%
	IEO group	24	2	8%
Older children	CEO group	20	5	25%
	IEO group	23	1	4%
Child CEO group		41	14	34%
Child IEO group		47	3	6%
Adult CEO group		16	1	6%

A domain identification problem

- The puzzlingly non-adult behavior in children's interpretation of universally quantified statements is likely not *semantic*

- Rather, children may diverge from adults in identifying the appropriate domain of quantification

- But can we say more than this?

Chen et al. 2020

- The problem is with the *indefinite* (see also Denic & Chemla 2020)
  - in the absence of contextual support, children suppose that there's a non-accidental relation between elephants and bunnies, leading to an anaphoric relational construal of the indefinite
  - assuming universal projection of presuppositions, this leads the child to accommodate an extra unseen rabbit

every rabbit$_i$ is riding an R$_i$ elephant.
⇒ every rabbit is riding its elephant

Quantifiers at the syntax-semantics interface

Scope ambiguities

(1) John hasn’t read every novel by Tolstoy
   a. It is not the case that John has read every novel by Tolstoy.
   b. Every novel by Tolstoy is such that John hasn’t read it.

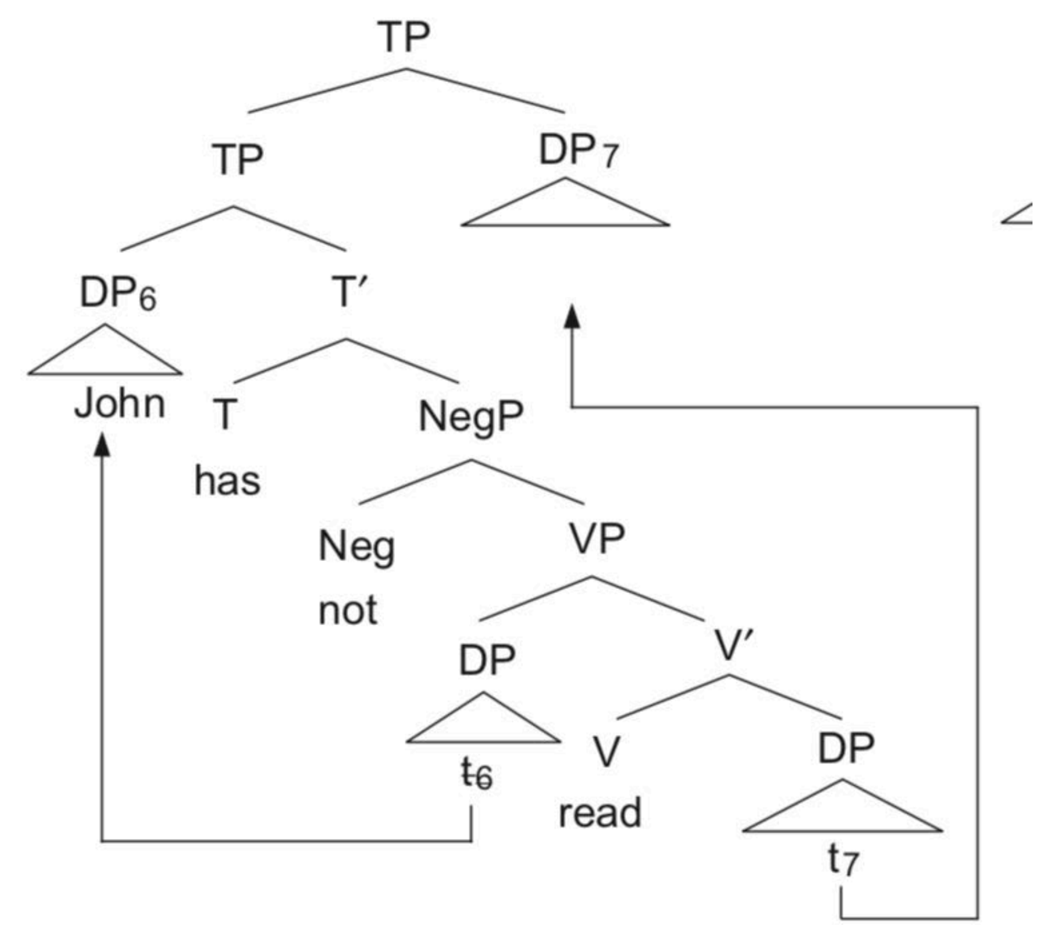
- Interpretation in (a) comes about when the negation operator *not* negates the sentence “John has read every novel by Tolstoy"
- Interpretation in (b) comes about when the generalized quantifier “every novel by Tolstoy” takes the negated predicate describing things John hasn’t read

Scope ambiguities

(1) John hasn't read every novel by Tolstoy
a. It is not the case that John has read every novel by Tolstoy.
b. Every novel by Tolstoy is such that John hasn't read it.

- Interpretation (a) is compatible with what we see on the surface; how does one derive (b)?

- Answer: **Quantifier Raising**
  - quantification noun phrases may start out in a position other than where it's interpreted; the interpretation site may not be visible in the linear order
  - as a result of QR, the QNP ends up in a position where it's sister is a derived 1-place predicate, of appropriate type to serve as its argument



Scope isomorphism?

- Several studies on the acquisition of quantification have shown that preschoolers, unlike adults, display a strong preference for the isomorphic/surface-scope interpretation of ambiguous sentences.

"Every horse didn't jump over the fence"

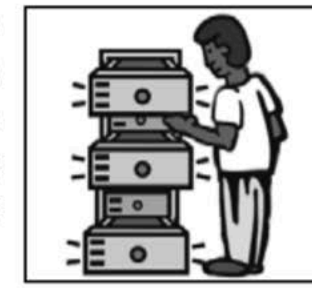
Children: "Yes" 15%
Adults: "Yes" 92%

(Musolino 1998; Musolino et al. 2000; Lidz and Musolino 2002; Musolino and Gualmini 2004; Noveck et al. 2007; image from M1998)

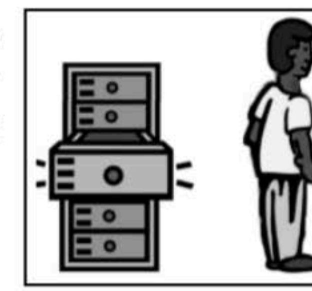
Scope isomorphism?

- Yet others show that children *do* access the inverse scope readings

Researcher: "This is Peter and these are drawers that are all in his dresser and he's closing them. Peter's dad told him to close all of the drawers before going outside to play. Let's see what happens."



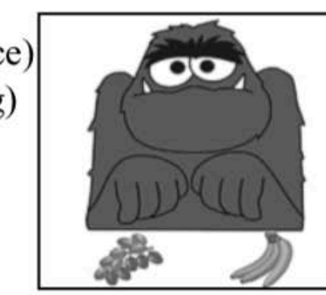
Researcher: "Look. Now Peter is going outside to play. But wait! What about this one? He didn't close this one. Let's see if the monster can say what happened."



Monster: "Peter didn't close a drawer." (recorded voice)

a. Peter didn't close one of the drawers (a > neg)

b. Peter didn't close any drawers (neg > a)



	Target Sentence	Adults	Children
1.	Mary didn't paint an egg	100% (10/10)	90% (18/20)
2.	Susan didn't erase a letter	100% (10/10)	95% (19/20)
3.	Peter didn't close a drawer	100% (10/10)	85% (17/20)
4.	Timothy didn't blow out a candle	100% (10/10)	95% (19/20)
	TOTAL	**100%**	**91%**

Table 3. Experiment 2a: Percentage of wide-scope readings

Gualmini (2004), Musolino and Lidz (2006), Felber (2002), Miller and Schmitt (2004); image from MS2004

Gualmini et al. 2008

The role of context:

- “[M]any—if not all—cases in which children do not select inverse scope when it is available for adults [are such that] the discourse created by the experimental setting makes a particular question salient. The sentence that is evaluated by the child constitutes an appropriate answer to that question only under its surface scope interpretation.”

Gualmini et al. 2008

- **Prediction:** if the congruent answer to the most salient q requires accessing inverse scope readings, children should succeed

Gualmini et al. 2008

- negation and indefinites
  - 17 children 3;10 to 5;3 (M=4;6) in a TVJT
  - “Grover calls the Troll at the pizza store and asks for four pizzas. Grover promises the Troll a big tip if he manages to deliver the pizzas quickly. On the way to Grover’s house, the Troll starts driving too quickly and accidentally drops two pizzas. Thus, the Troll arrives at Grover’s house with only two pizzas.”

(1) *The Troll didn’t deliver two pizzas.*
Assumed QUD: Did the Troll deliver all of the pizzas?
Surface-scope: It’s not the case that the Troll delivered two pizzas, i.e. he delivered 1 or 0 (False; not a good answer to QUD)
Inverse-scope: There were two pizzas that the Troll failed to deliver. (True; good answer given QUD)

  - Children: 75% Yes

Gualmini et al. 2008

- negation and universal quantifier
  - 19 children 3;0 to 5;11 (M=4;8) in a TVJT
  - “This is a story about Caillou and Rosie. Rosie is expecting four important letters, which Caillou is supposed to deliver. Rosie calls Caillou at the post office to inquire about the four letters and Caillou promises to deliver them right away. Caillou jumps in his mail delivery truck and starts driving towards Rosie’s house. On the way to Rosie’s house, Caillou starts driving too fast and accidentally drops one letter. When Caillou reaches Rosie’s house, he realizes that one letter is missing”

(1) *Every letter wasn’t delivered.*
Assumed QUD: Was every letter delivered?
Surface-scope: Every letter was such that it wasn’t delivered (False; not a good answer to QUD)
Inverse-scope: It wasn’t the case that every letter got delivered (True; good answer given QUD)

- Children: 80% Yes

Gualmini et al. 2008

- Direct test of Isomorphism vs. QAR
  - “Grover calls the Troll at the pizza store and asks for four pizzas. Grover promises the Troll a big tip if he manages to deliver the pizzas quickly. On the way to Grover’s house, the Troll starts driving too quickly and accidentally drops two pizzas. Thus, the Troll arrives at Grover’s house with only two pizzas.”

    Assumed QUD: Were all the pizzas delivered?

    (a) Some pizzas were not delivered.
    Isomorphism: Success; **QAR:** Success

    (b) Some pizzas were not lost.
    Isomorphism: Success; **QAR**: Difficulty

Gualmini et al. 2008

- Direct test of Isomorphism vs. QAR
  - "Grover calls the Troll at the pizza store and asks for four pizzas. Grover promises the Troll a big tip if he manages to deliver the pizzas quickly. On the way to Grover's house, the Troll starts driving too quickly and accidentally drops two pizzas. Thus, the Troll arrives at Grover's house with only two pizzas."

    Assumed QUD: Were all the pizzas delivered?

    (a) Some pizzas were not delivered.
    Isomorphism: Success; **QAR:** Success — **88% Yes**

    (b) Some pizzas were not lost.
    Isomorphism: Success; **QAR**: Difficulty — **43% Yes**

Upshot

- Children's behavior with QNPs in scopally ambiguous contexts influenced heavily by context, but indicative of competence:
    - they *can* access both surface and inverse scope readings
- Suggestive evidence that QR is in place

ACD

- Scopal ambiguities, however, can be accounted for in theories that do not require QR
- A more reliable test of competence with QR: Antecedent Contained Deletion (ACD).

ACD

- Phenomenon found in certain VP ellipsis contexts, where the elided VP appears to be properly contained inside the only possible antecedent VP.

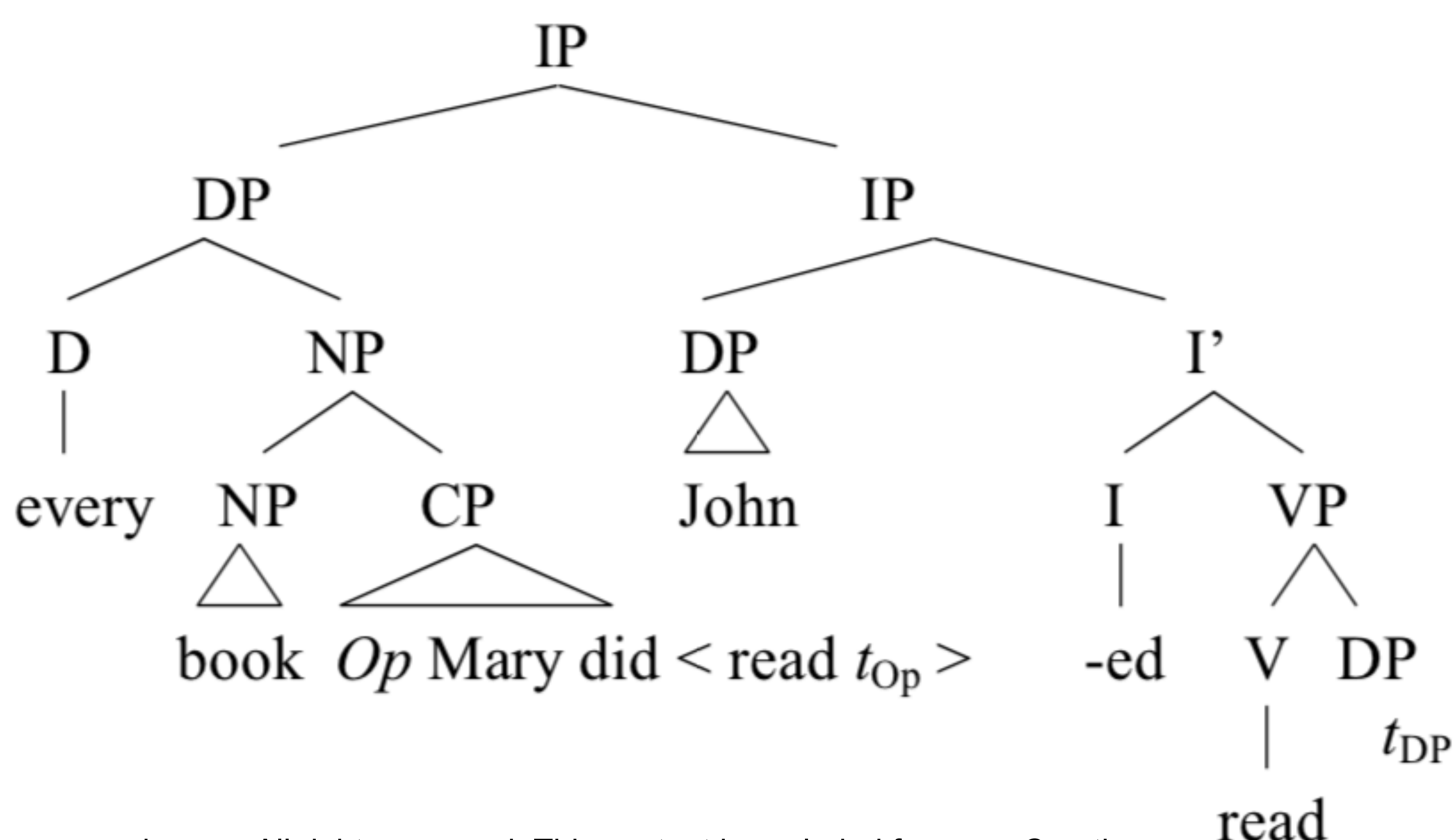
(1) John read a book and Mary did <   >, too.
John read a book and Mary did <~~*read a book*~~>, too.

(2) John read every book that Mary did <   >.
John read every book that Mary did <~~*read every book that Mary did*~~ <~~*read every book that Mary did*~~ <~~*read every…*~~ >>>

ACD

- Solving the infinite regress problem: the object DP QRs to a higher syntactic position (see tree below), to yield an LF like (1)

(1) [every book that Mary did < ~~read *t*~~ >] [John [VP read *t*]]]



ACD in child language

- Sugawara et al. 2016
  - Children’s ability to resolve short (i) and long (ii) ACD in a TVJT

(i) **Short ACD:**
Cookie Monster wanted to be the same thing that Dora is. [= same thing Dora was]

(ii) **Long ACD:**
Cookie Monster wanted to be the same thing that Dora did. [= same thing Dora wanted to be]

Sugawara et al. 2016

- 74 participants, split into two groups (short vs. long)
- 4 test trials (target response = No)

Table 1: Summary of participants

	Short condition	Long condition	Total
All subjects	**45** 3;6-7;8 (M=5;3)	**29** 3;8-6;10 (M=5;0)	**74** (M=5;2)
Yes/No sayers	17	5	22
No completion	1	1	2
Filtered	**27** 3;6-7;5 (M=5;4)	**23** 4;1-6;10 (M=5;2)	**50** (M=5;3)
Adult control	5	5	10

Sugawara et al. 2016

This is a story about Dora and Cookie Monster. Dora and Cookie Monster are very lucky – they met a Genie that will make their wishes come true!
Dora: I would like to become a tall tree so I can see everything from above!
Genie: Hm, if you would like to see everything from above, you should be a cloud. I will do that. <poof, Dora becomes a cloud>
Dora: Oh no!

Cookie Monster: I would like to know what it's like to have flowers. So I would like to become a tall tree, too!
Genie: Then you should be a rose bush, because rose bushes have pretty flowers!
Cookie Monster: Oh no! <poof, CM becomes a rose bush>
Puppet: I know what happened.
Cookie Monster wanted to be the same thing that Dora was.

Cookie Monster: I would like to know what it's like to have flowers. So I would like to become a rosebush!
Genie: No, I think you should become a cloud, too!
Cookie Monster: Oh no! <poof, CM becomes a cloud>
Puppet: I know what happened.
Cookie Monster wanted to be the same thing that Dora did.

Sugawara et al. 2016

Table 2: Accuracy rates

	Target Accuracy rate	Per item				Filler Accuracy rate
		a	b	c	d	
Short	61.1%	67%	44%	63%	70%	66.7%
Long	79.3%	87%	91%	65%	74%	61.7%

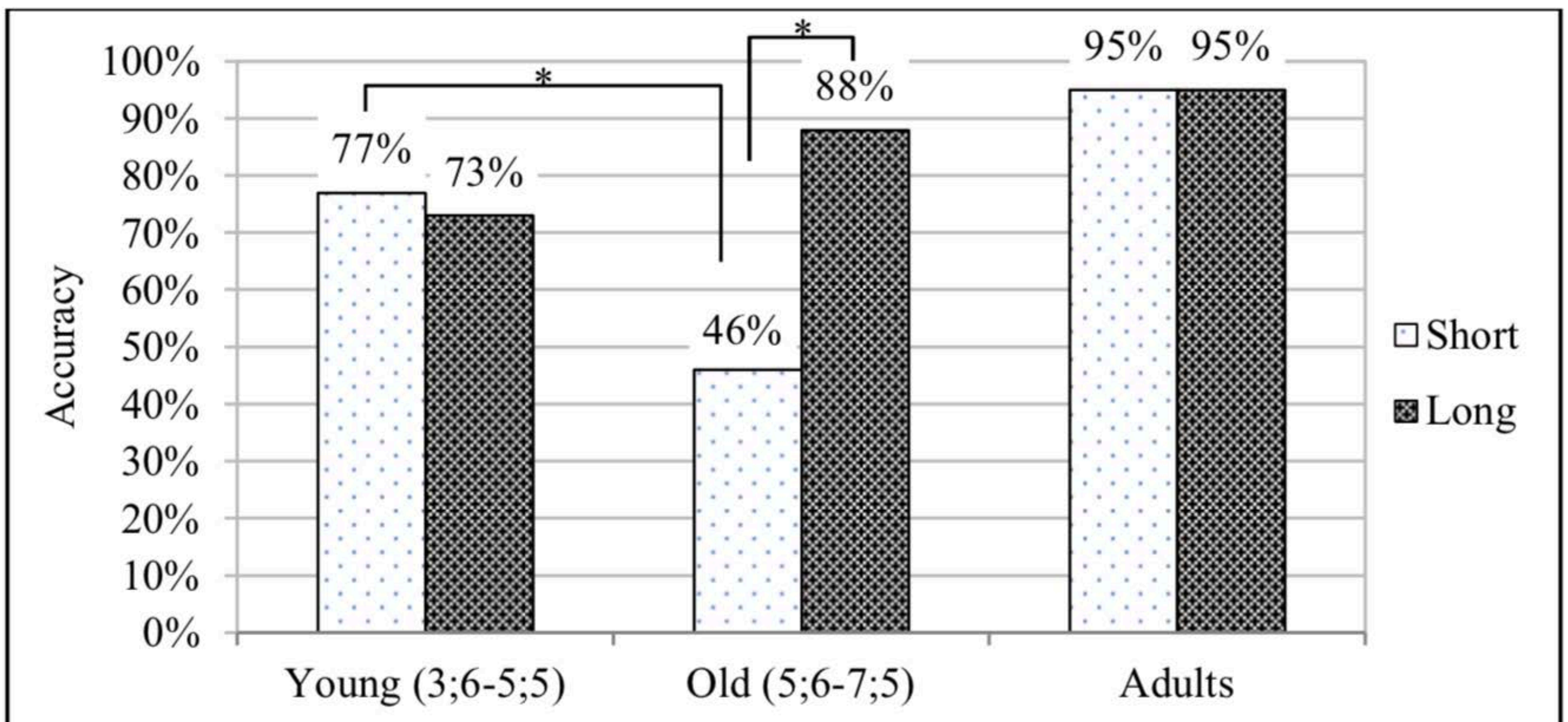


Figure 1: Accuracy rates across age groups

Sugawara et al. 2016

- Success across age groups on the long conditions indicate that the grammatical mechanism for using QR to feed ACD resolution is in place

- Older children’s difficulties with short ACD: a progressive error

    - due to the development of a preference for matching the size of QR with the size of ellipsis in a sentence (Scope-Matching Preference)

All in all

- Children's initial hypotheses about quantifier meanings may mirror typologically robust generalizations about possible lexicalizations and kinds of meanings
- Children's knowledge of quantifiers includes the ability for meaning interactions implemented via syntactic movement, at least as young as 4-5.
- Cases where children differ from adults may be explained by two aspects of development: (a) processing preferences and (b) interaction with pragmatic reasoning

Lots of things we haven't discussed or don't yet know

- cross-categorical trends:
  - always > sometimes > mostly ???
  - have to > can ???
- polarity-sensitivity:
  - NPI- vs. PPI-hood (prediction: any > some)
- syntactically complex quantifiers:
  - domain-restriction part of the lexicalization: *both, neither*
  - indeterminates+particles: *vala-ki* (someone, Hungarian), *dare-mo* (everyone, Japanese), *aar-oo* (someone_epist, Malayalam)
  - exceptives: *every student but John*
- syntax:
  - constraints on QR (see Syrett & Lidz 2011)
  - floating
  - multiple roles (e.g. *each*, *either*)

Next time: number/numerals

- **All read:**
  Feigenson et al. 2004
  Carey chapter on number

- **Read one:**
  Barner & Bachrach 2009
  Hartshorne et al. 2019
  Huang, Spelke & Snedeker 2012

- **Read one:**
  Musolino 2004
  Syrett and Kennedy 2018