Acquiring the Universal Quantifiers:
every part together or *each* part on its own?

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Roadmap

Vendler 1962
Dowty 1987
Beghelli & Stowell, 1997
a.o.

- Multiple universal quantifiers; subtle meaning differences
  - Mandatory distributivity of *each*

(1) The preacher looked at **each/every/all** member(s) of his flock

Roadmap

- Multiple universal quantifiers; subtle meaning differences
  - Mandatory distributivity of *each*
- Is acquisition sequential or simultaneous?

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- New approach – implicit measure
  - Proof of concept: *More* vs. *Most*
  - *Each* vs. *Every*

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Distributivity and *Each* / *Every* / *All*

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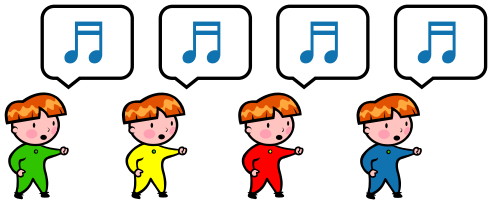
(2) a. Each boy sang happy birthday (well as a solo piece / # in perfect harmony)



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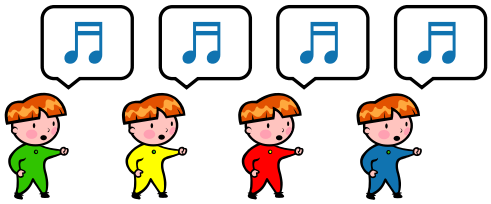

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(3) a.*Each (of the) student(s) gathered
b. ?Every student gathered
c. All (of the) students gathered

(4) a. *Each (of the) soldier(s) surrounded the fortress
b. ?Every soldier surrounded the fortress
c. All (of the) soldiers surrounded the fortress

Distributivity and *Each* / *Every* / *All*

Beghelli & Stowell, 1997

(5) It took {*each/every/all the} boy(s) to lift the piano

Beghelli & Stowell, 1997
Szabolsci 2010, 2015

Distributivity and *Each / Every / All*

(5) It took {*each/every/all the} boy(s) to lift the piano

(6) Ask someone whether **each** dragon is dangerous


✓

✓


X

Beghelli & Stowell, 1997
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Distributivity and *Each / Every / All*

(5) It took {*each/every/all the} boy(s) to lift the piano

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(7) Ask someone whether **every** dragon is dangerous X

Distributivity and *Each* / *Every* / *All*

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 ✓  ✓ 

X

(7) Ask someone whether **every** dragon is dangerous X

→ *Each* is mandatorily distributive

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Acquiring (the distributivity of) *each*

- TVJT / Picture-selection / Picture-Evaluation

  Inhelder & Piaget (1958, 1964); Bucci (1978); Freeman et al. (1982); Philip (1991, 1992, 1995); Philip and Aurelio (1991); Philip and Takahashi (1991); Roeper & de Villiers (1991); Roeper et al., (2006, 2011); Takahashi (1991); Drozd (2001); Geurts (2003); Crain et al. (1996); Brooks et al. (2001); Gualmini et al. (2008); a.o.

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- Brooks & Braine 1996
  - 4- & 5-yos (unlike adults) give collective interpretations to *each*-statements
  - Even 7-yos offer non-adult like interpretations ~25% of the time

"Each boy is building a boat"

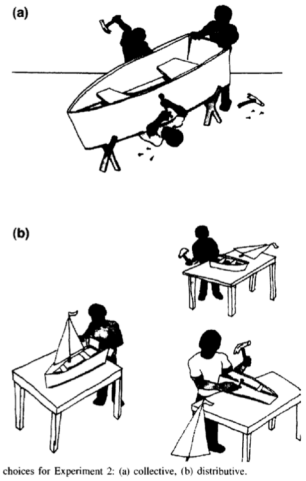

Fig. 2. Picture choices for Experiment 2: (a) collective, (b) distributive.

Acquiring (the distributivity of) *each*

- *Each* is acquired in 2 parts:
  - **Universal** component
  - **Distributive** component
- Brooks & Braine 1996
  - 4- & 5-yos (unlike adults) give collective interpretations to *each*-statements
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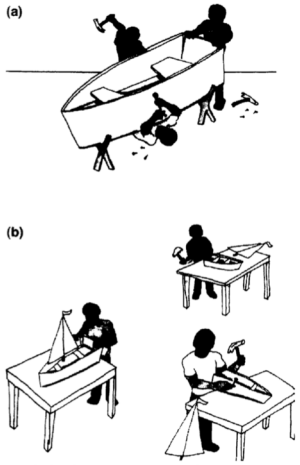
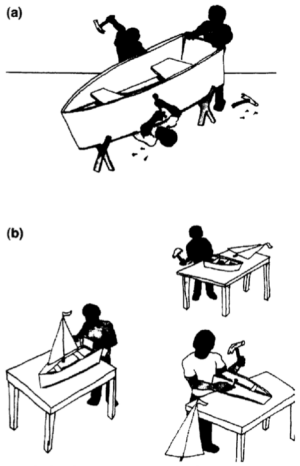


Fig. 2. Picture choices for Experiment 2: (a) collective, (b) distributive.

Acquiring (the distributivity of) *each*

- Syrett & Musolino 2013 point out
  - Relative salience of collective pictures
  - Potential preference for singular interpretation of indefinite
  - Potential bleeding across item types
  - Testing preference, not availability

"Each boy is building a boat"



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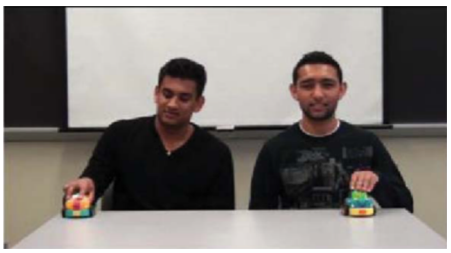
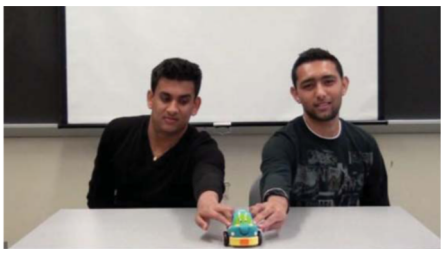
Acquiring (the distributivity of) *each*

- Syrett & Musolino 2013

"Two boys each pushed a car"

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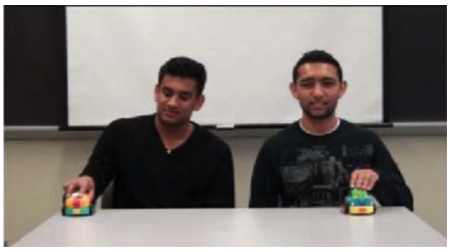
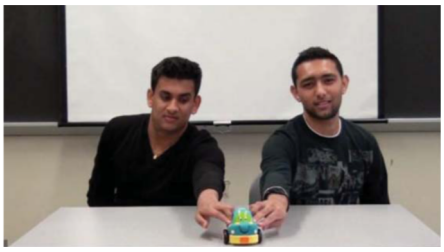

- 3- & 4-yos can access distributive interpretations…
  - …but still allow collective interpretations given adverbial *each*

Acquiring (the distributivity of) *each*

- Is *each*'s meaning learned in two parts?
  - Universal then distributive (e.g., Brooks & Braine, 1996)
- Or are learners sensitive to this property as soon as they know what *each* means?
  - Underlying competence is masked in prior work

Roadmap

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  - Proof of concept: *More* vs. *Most*
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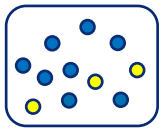
Implicit evidence

- Obvious TRUE/FALSE question



Each/Every circle is blue

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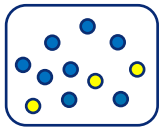

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$\forall x: Circle(x)[Blue(x)]$ $\quad$ $\text{CIRCLE} \subseteq BLUE$

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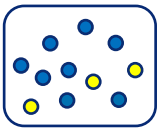
- Measure how the meaning changes what information participants represent



Pietroski et al. 2009
Lidz et al. 2011
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Knowlton et al. *in prep*

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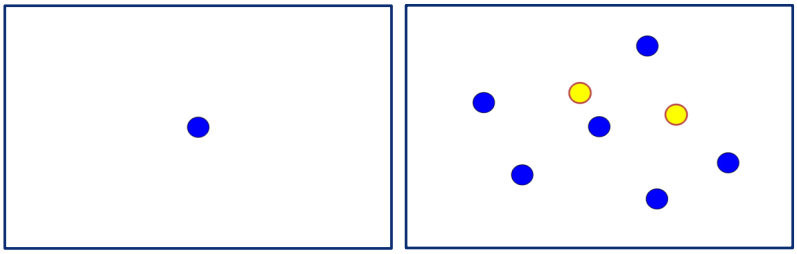
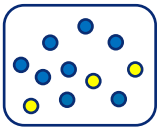


Implicit evidence

- Obvious TRUE/FALSE question
- Measure how the meaning changes what information participants represent
- (based on what they remember about the scene)



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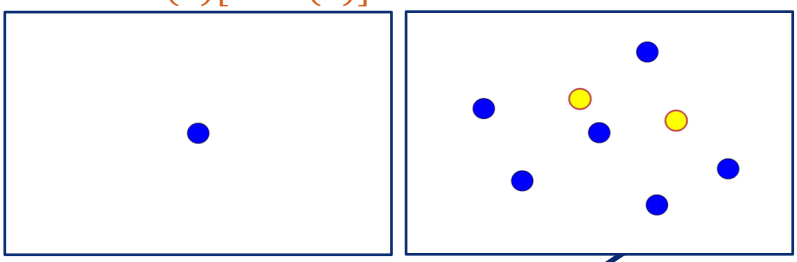

Good estimate of summary statistics (number, avg. size, **center of mass**, …)
Ariely 2001; Cohng & Treisman 2003; Feigenson et al. 2004; Burr & Ross 2008; Alvarez 2011; ao

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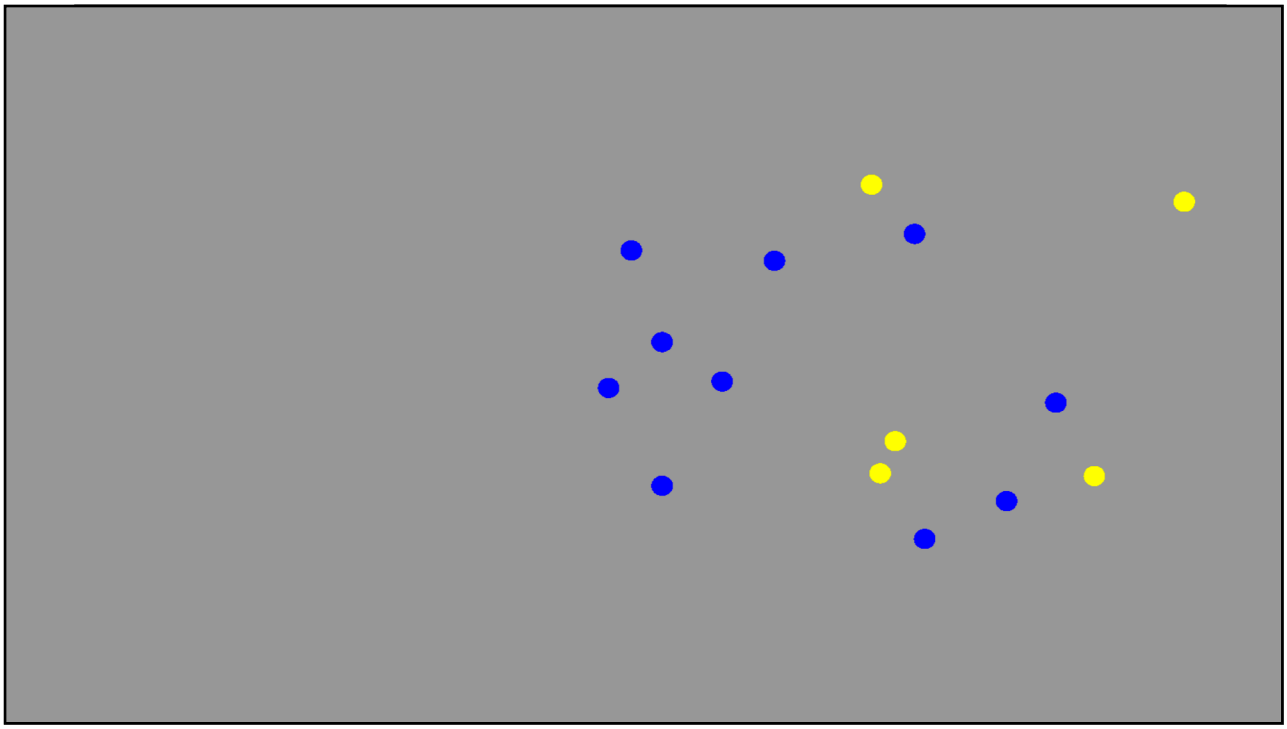
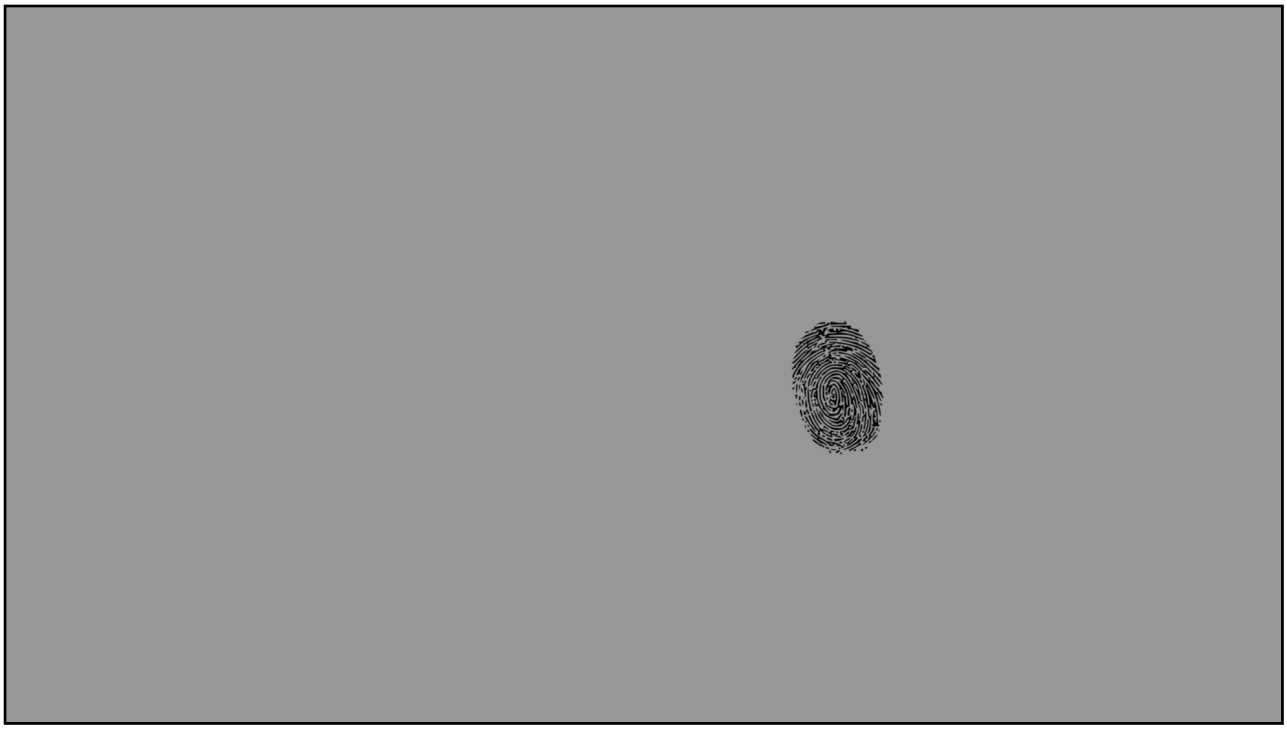
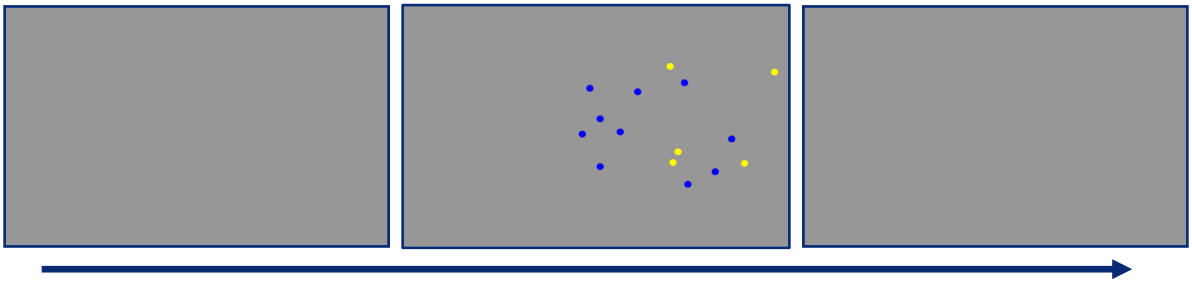




More, Most, & memory

"Did the {blue/yellow} team paint **{more/most}** of the dots?"

"Where was the middle of the {blue/yellow} dots?"



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Adult work on English, Polish, & Cantonese

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More: compare blue & **yellow**
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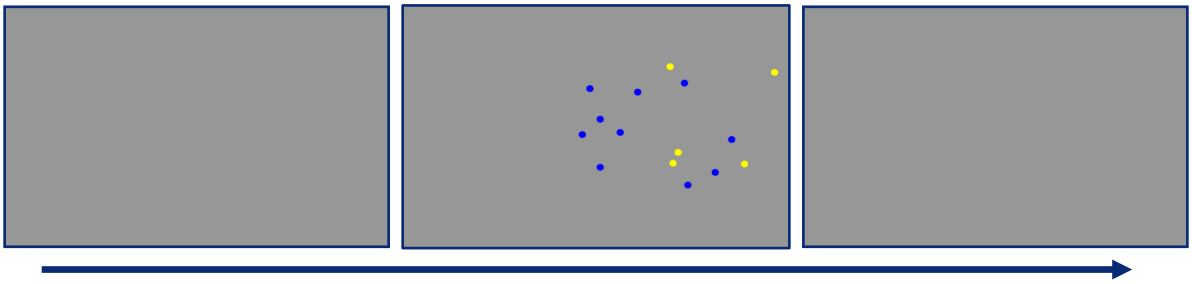

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Representing a group → Good estimate of summary statistics (number, avg. size, **center of mass,** …)
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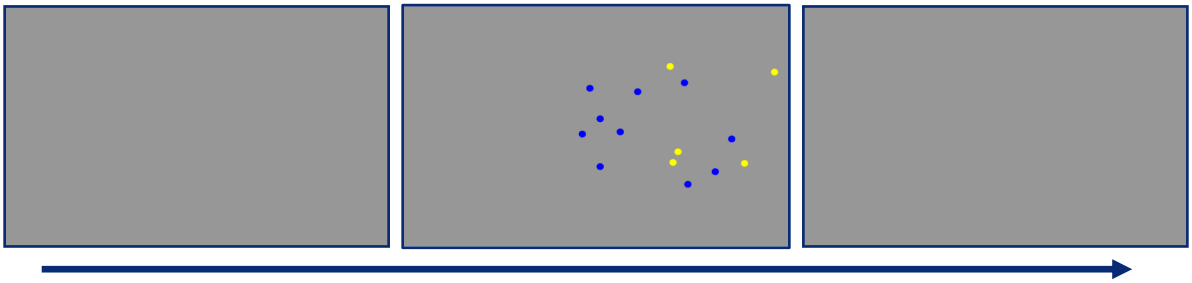
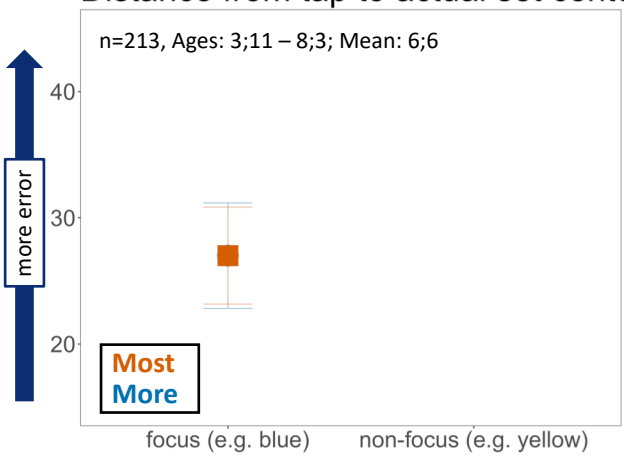
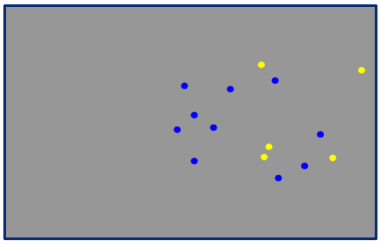


More, Most, & memory

Distance from tap to actual set center



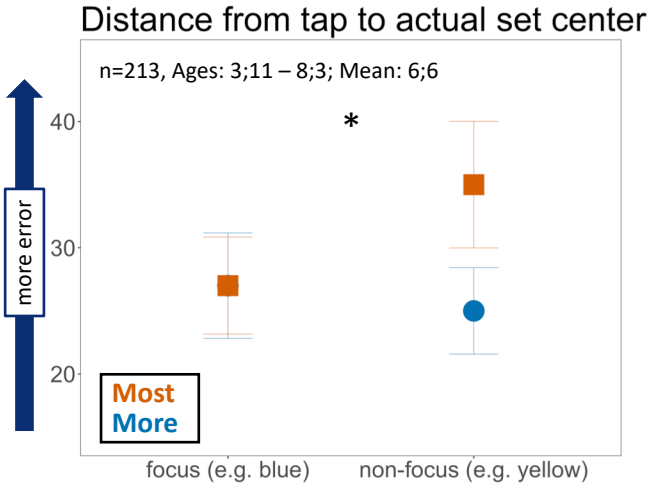


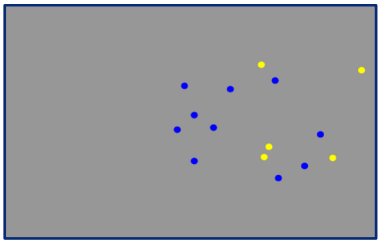
Did the **blue** team paint {more/most} of the dots?

Touch the center of the **blue** dots

→ Participants encode the focused set given either quantifier

More, Most, & memory





Did the **blue** team paint {**more**/**most**} of the dots?

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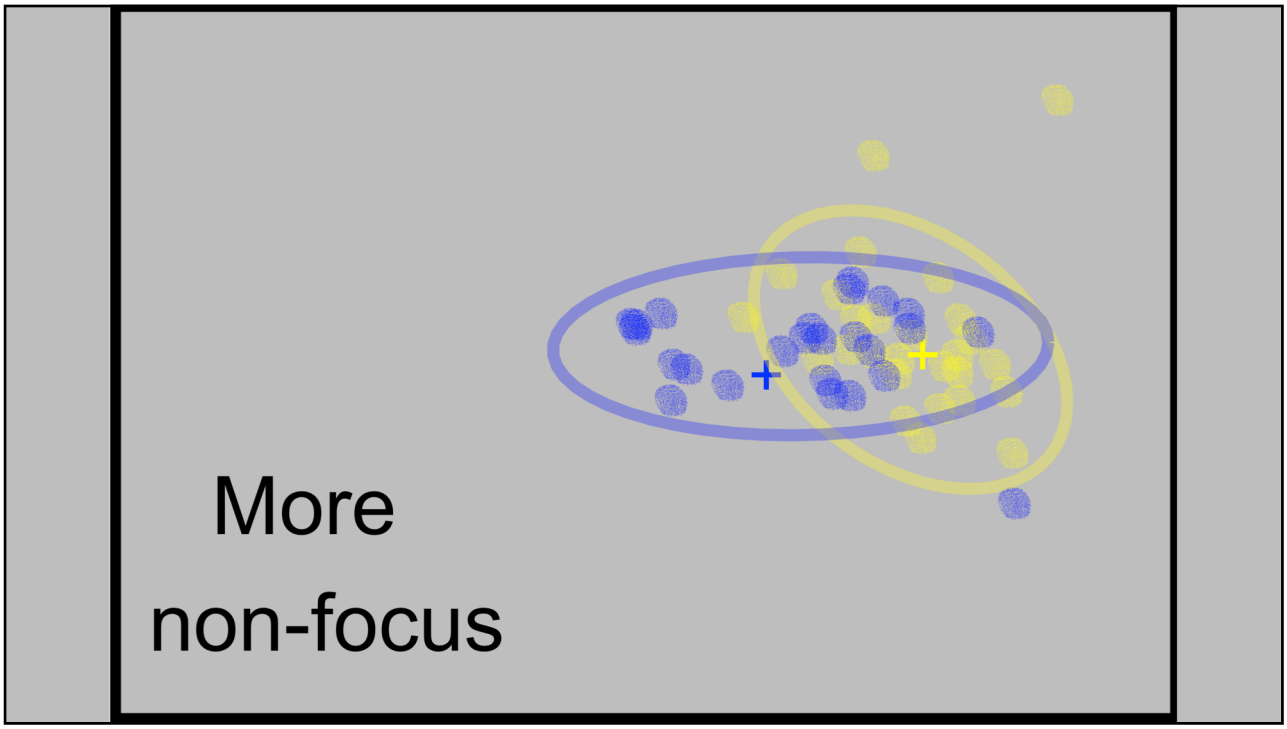
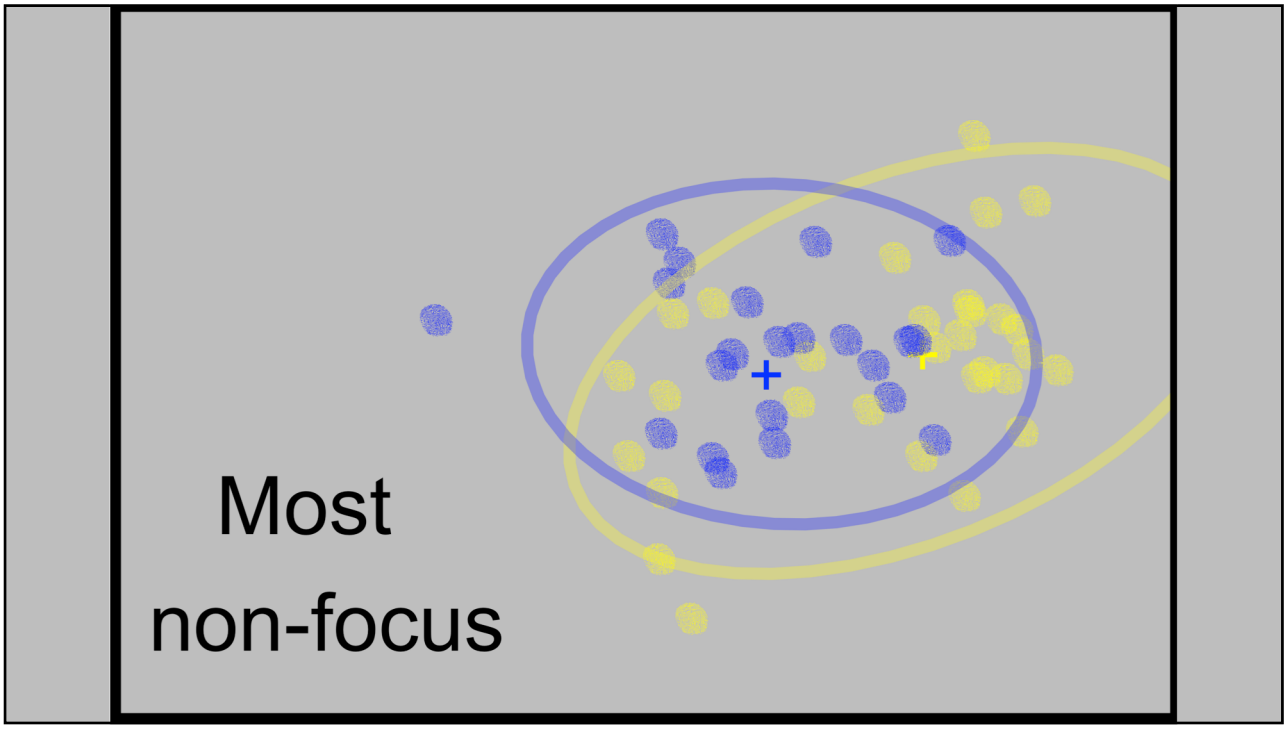
→ Only participants evaluating *more*-statements encoded the non-focused set!





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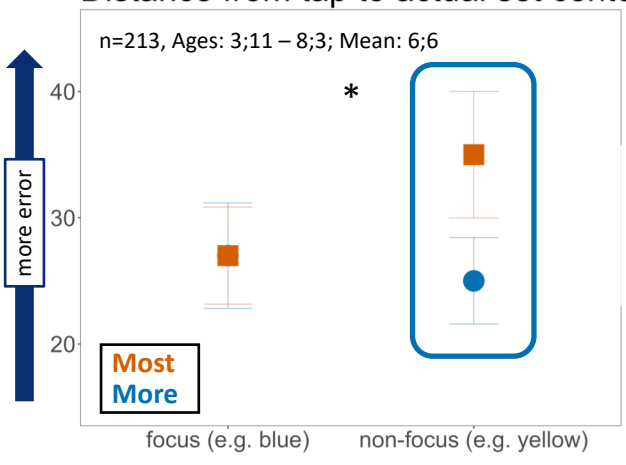

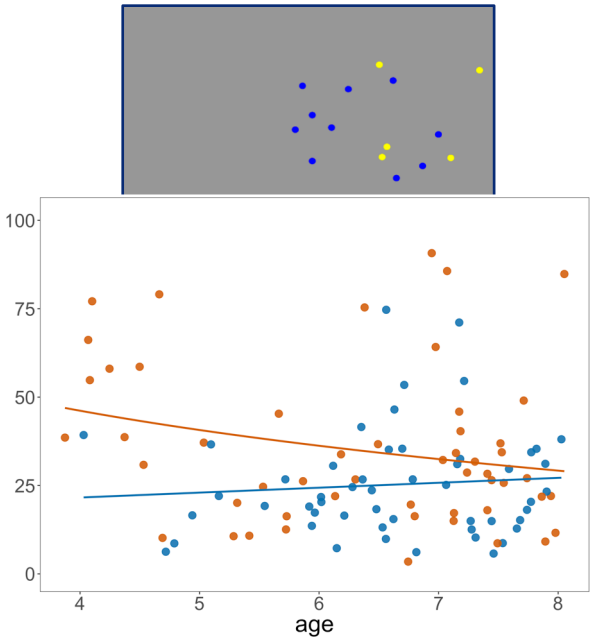

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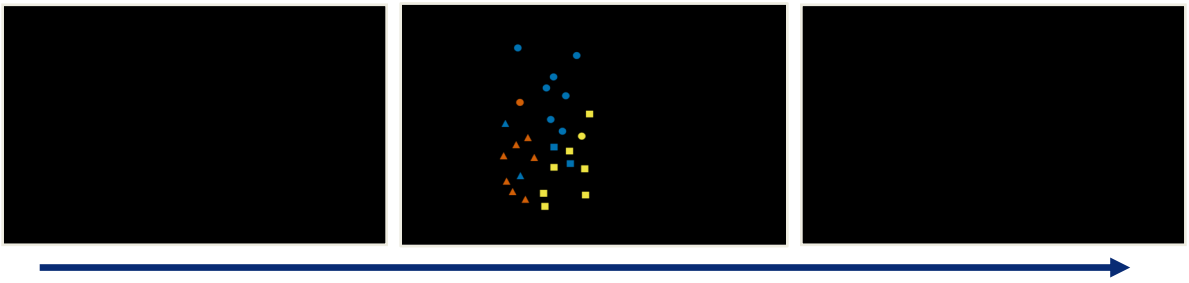
Each vs. *Every*

"Is {each/every} circle blue?"

"Where was the middle of the circles?"



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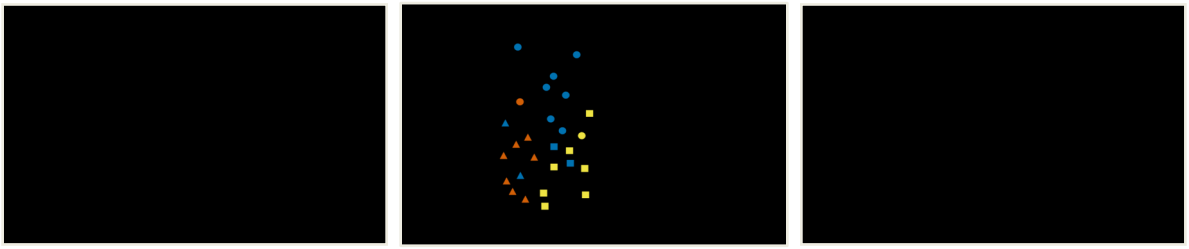

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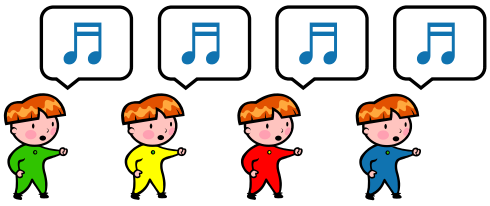

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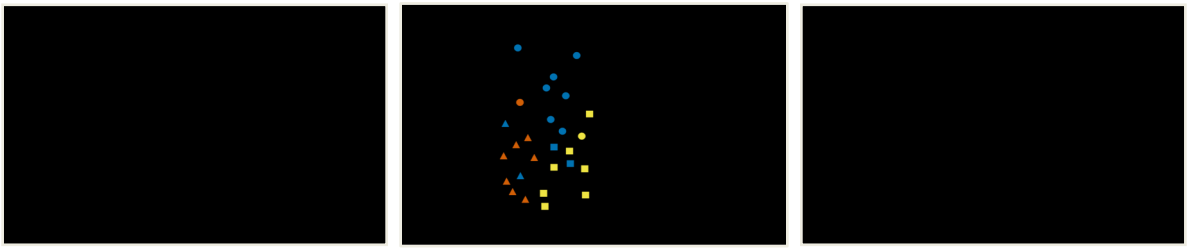

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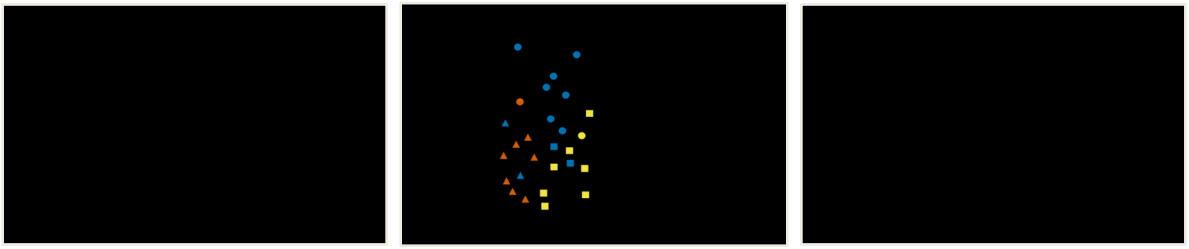

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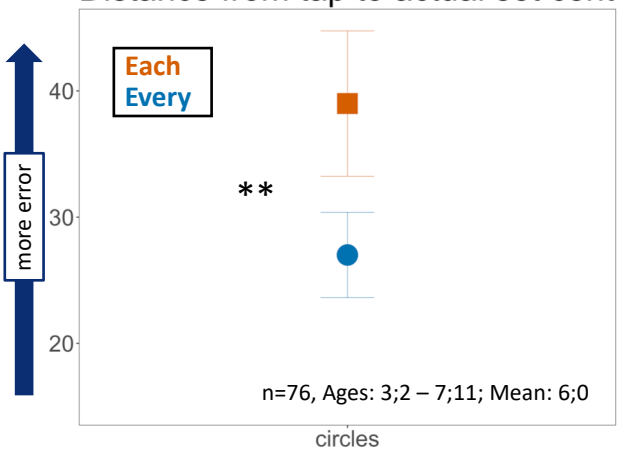
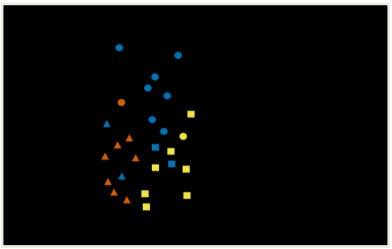
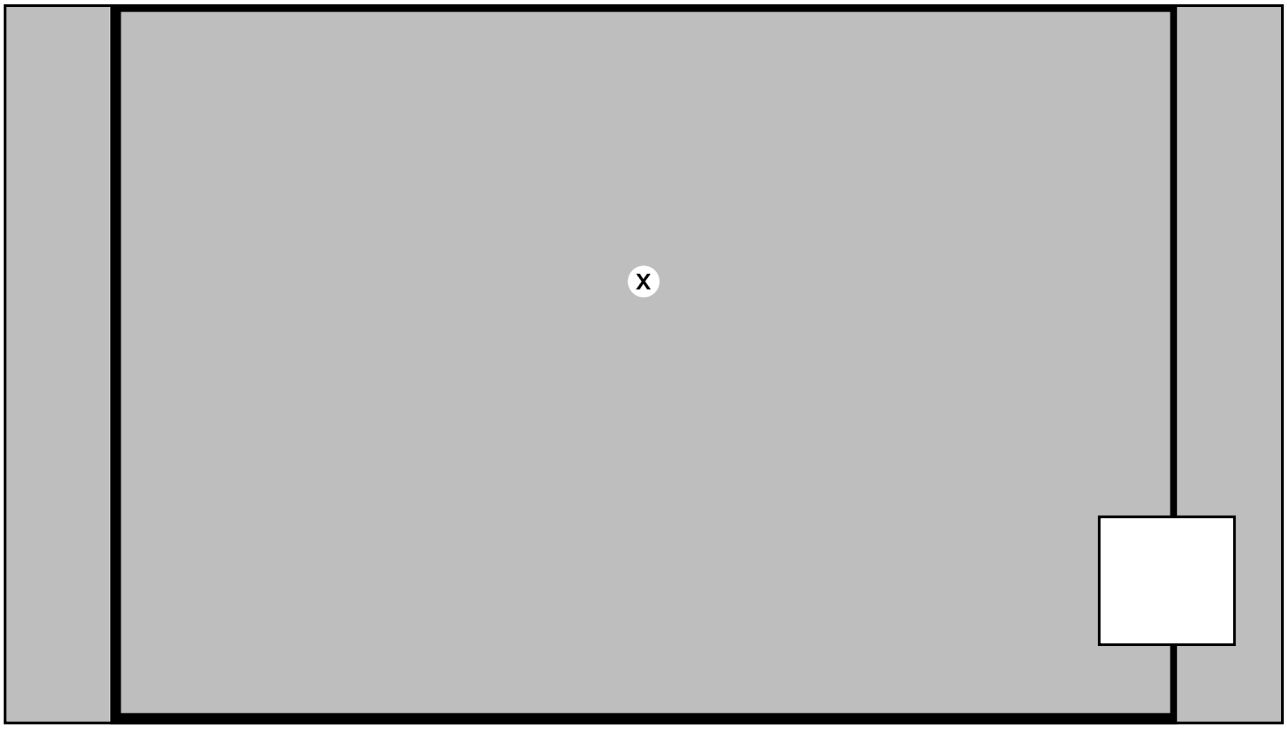


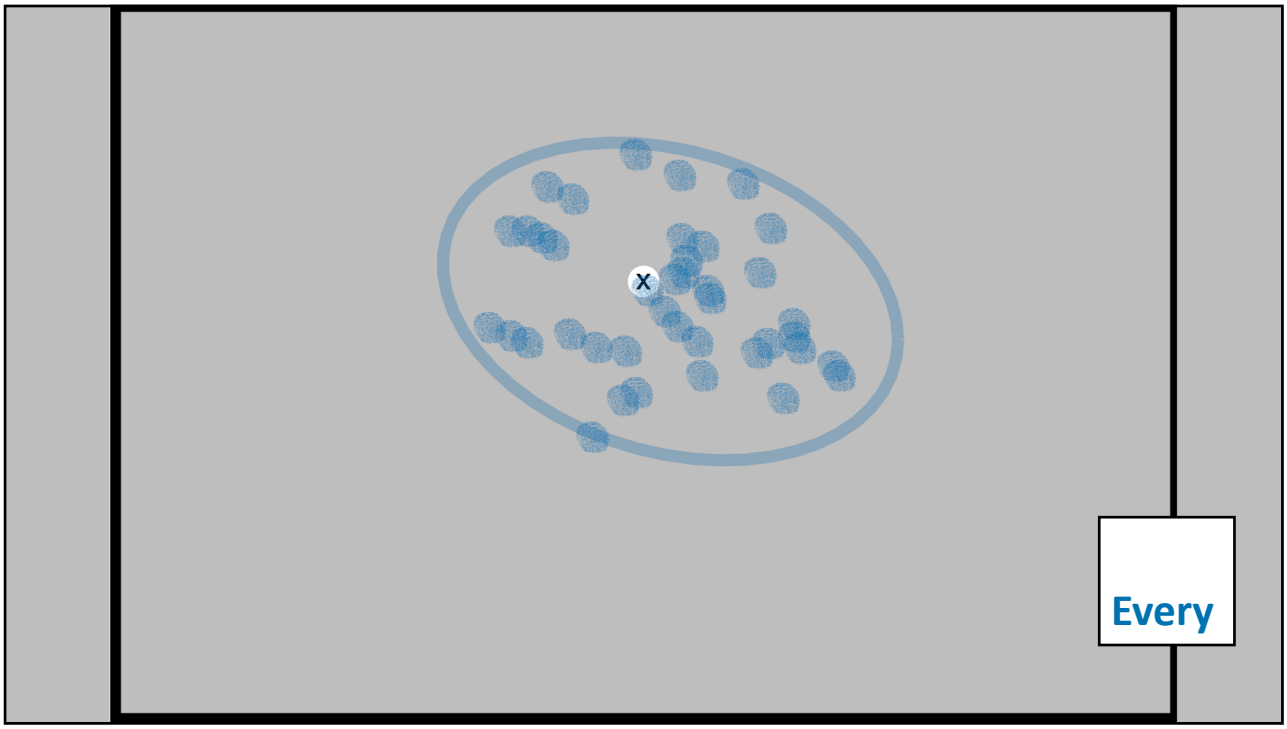


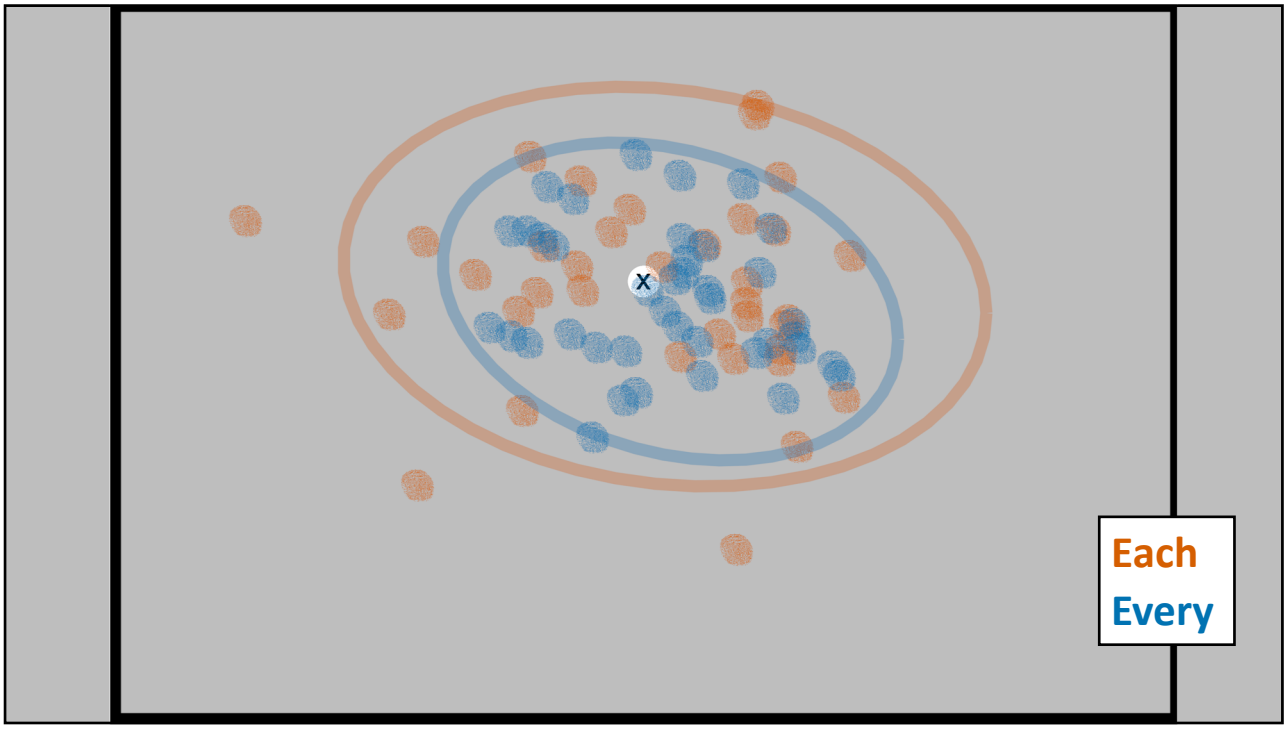
Is {**each**/**every**} circle blue?

Touch the center of the **circles**

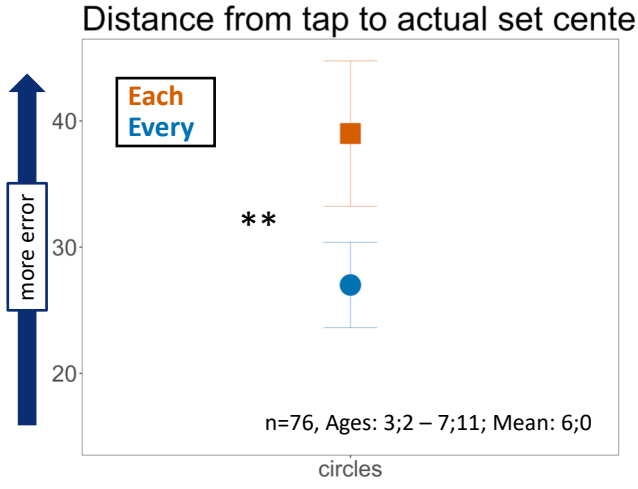
→ Participants encoded the set circles better following *every*-statements

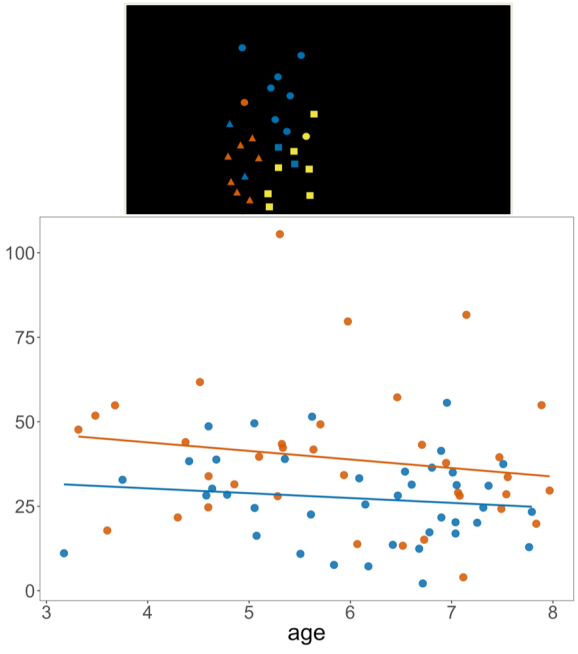

x


x
Every



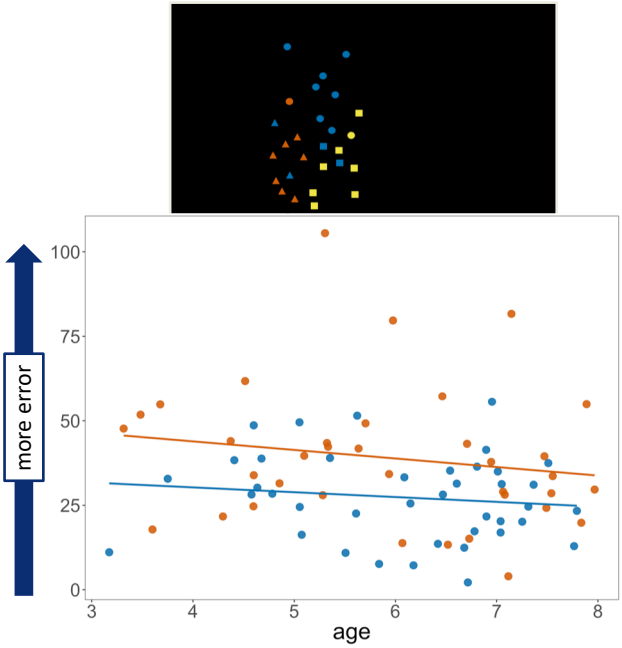
Each vs. *Every*





Each vs. *Every*

- Sequential hypothesis predicts effect of age; contra the simultaneous hypothesis
- We find no age effect
  - As soon as participants know ***each***, they use an individual-based strategy
  - Ditto for ***every*** and a group-based strategy



Conclusions

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  - Even when that information is incidental to the T/F judgement
- **Empirical**: Learners are sensitive to the distributivity of *each* as soon as they acquire the word
- **Theoretical**: How do learners acquire this distinction?
  - For next year!

Thanks!

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