

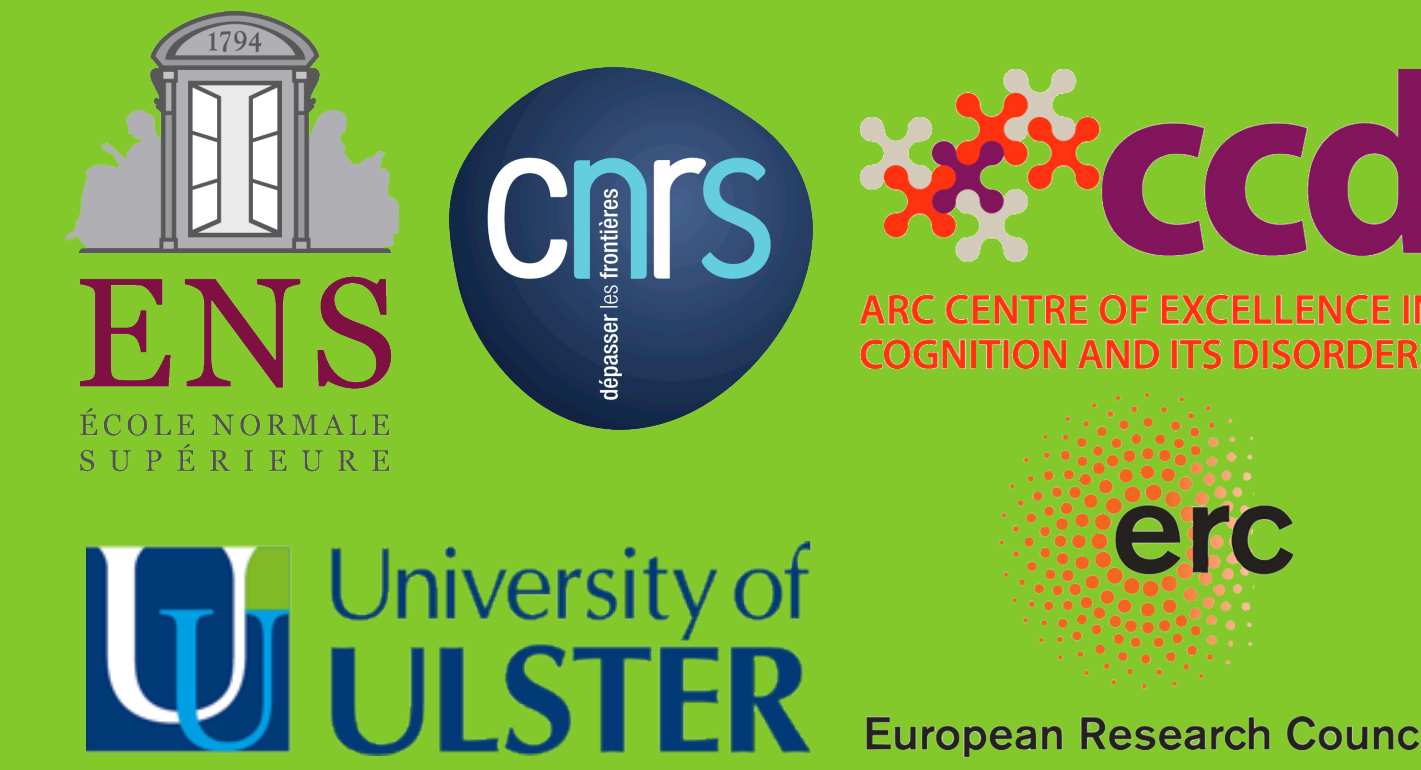
Plurality inferences are scalar implicatures: Evidence from acquisition

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Main findings

- Novel experimental evidence for scalar implicature (SI) approach to plurality inferences (PI) in English
- Children and adults compute more PIs in upward-entailing (UE) than downward-entailing (DE) environments, but children compute fewer PIs than adults
- Findings consistent with previous research demonstrating children's relative insensitivity to SIs

1. Plurality inferences as scalar implicatures^{1,2}

- (1-a) appears equivalent to (1-b) and different from (1-c)
 - English plural morphology associated with 'more than one' meaning³
 - 'More than one' meaning seems to disappear under negation: (2-a) better paraphrased as negation of a singularity (2-c)
- (1) a. Emily fed giraffes. (2) a. Emily didn't feed giraffes.
 b. Emily fed more than one giraffe. b. Emily didn't feed more than one giraffe.
 c. Emily fed a giraffe. c. Emily didn't feed a (single) giraffe.
- Spector (2007): plural (PL) and singular (SG) are equivalent, both associated with a weak semantics (3-a)
 - PI arises as a higher-order type of SI^{2,4}
 - SG typically compared to (3-b), yielding SI in (4-a)
 - PL directly compared to SG enriched with its SI (4-a), generating (4-b)
- (in a model with three giraffes, *a*, *b*, and *c*)
- (3) a. $[[\text{giraffes}]] = [[\text{giraffe}]] = \{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$
 b. $[[\text{more than one giraffe}]] = \{a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$
- (4) a. $[[\text{giraffe}]] \wedge \neg[[\text{more than one giraffe}]] = \{a, b, c\}$
 b. $[[\text{giraffes}]] \wedge \neg[[\text{giraffe}]] \wedge \neg[[\text{more than one giraffe}]] = \{a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$
- SIs not typically derived in DE contexts; explains pattern in (1)-(2)
 - Postulating local SI under scope of negation accounts for additional reading of (2-a) that excludes singularity, i.e. (5) (typically read with emphasis on plural -s)
- (5) Emily didn't feed giraffes, because she fed only one!

2. Predictions for acquisition

- If PIs are derived as a kind of SI, the pattern of children's PIs is expected to mirror performance with other SIs
- Children compute SIs less than adults do^{5,6,7,8}
- Sauerland et al. (2005): 3-5-year-olds' compute fewer PIs than adults in polar questions, e.g., *Does a dog have tails?*
- Potential limitations of the study:^{9,10}
 - (i) PIs typically disappear in polar questions
 - (ii) Stimuli involved generic interpretations, which could have been misinterpreted by children as containing dependent plurals, e.g., *Do dogs have tails?*
- We designed a Truth Value Judgment Task¹¹ to assess interpretations of SG and PL sentences in both UE and DE environments








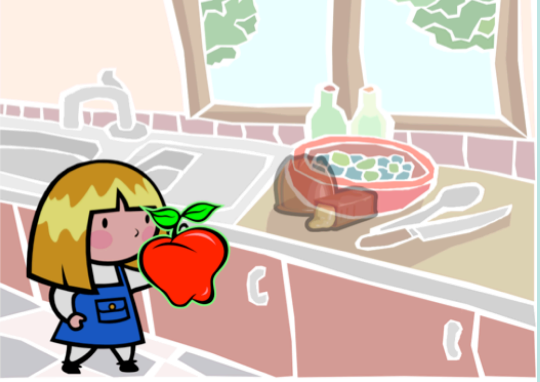
3. Experiment (Truth Value Judgment Task¹¹)

- 2x2x2 design:**
- ▶ *group* - adults vs. children
 - ▶ *number* - SG vs. PL, between subjects
 - ▶ *monotonicity* - UE vs. DE, within subjects

- Participants:**
- ▶ 28 English-speaking children (4;01-5;09, M=4;11)
 - ▶ 43 adult native speakers of English

- 6 test + 8 control items:** (criterion for inclusion: pass at least 6/8 controls)
* Critical trials: if participants computed the PI in the PL-UE condition, they were expected to reject the PL test sentence

Table 1: Test conditions

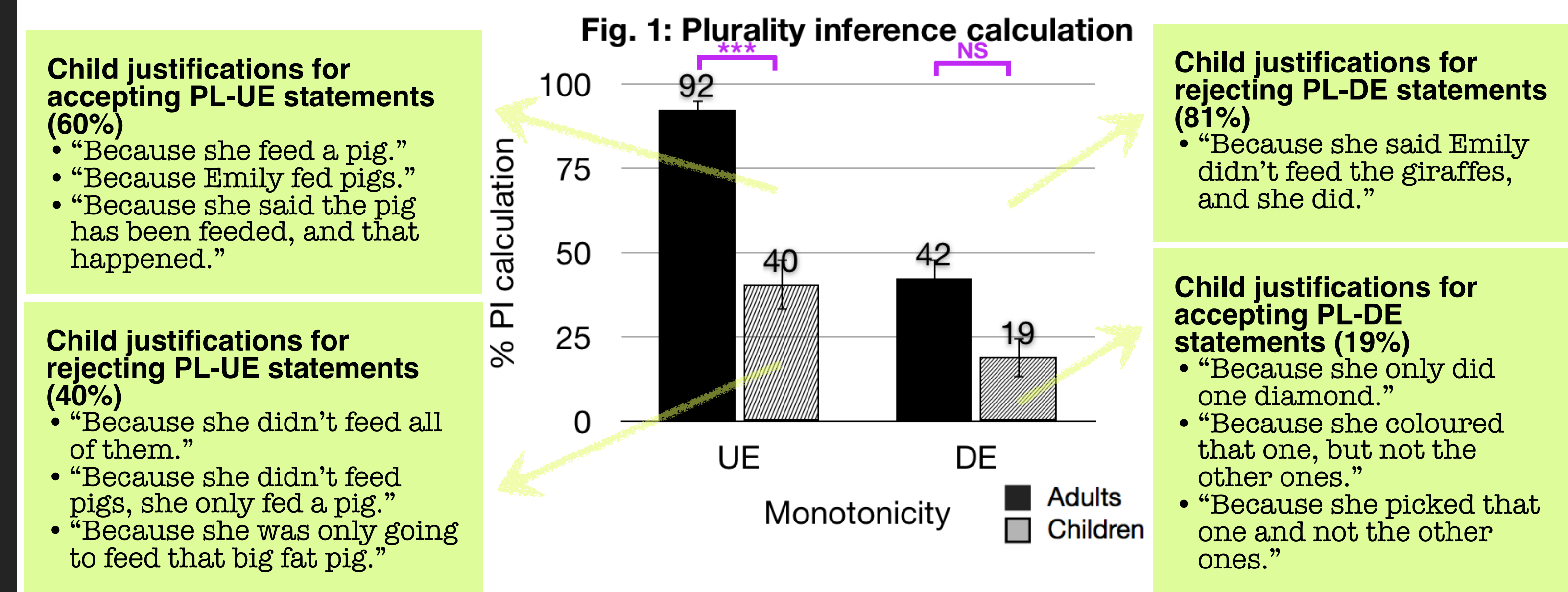
		PL condition	SG condition
UE condition	test (3)	"Emily fed pigs" (if PI, target: NO) 	"Emily fed a pig" (target: YES)
	control (2)	"Sammy painted birds" (target: YES) 	"Sammy painted a tree" (target: NO) 
DE condition	test (3)	"Emily didn't feed giraffes" (target: NO; if local PI, target: YES) 	"Emily didn't feed a giraffe" (target: NO) 
	control (2)	"Sammy didn't draw dogs" (target: YES) 	"Sammy didn't draw a dog" (target: YES) 
	negation control (4)	"Sally didn't eat the chocolate" (target: YES) "Sally didn't eat the apple" (target: NO) 	

4. Results

- A 2x2x2 ANOVA on participants' responses revealed:
 - ▶ A significant main effect of monotonicity ($F(1,134)=114.81, p<.001$)
 - ▶ A significant main effect of number ($F(1,134)=21.52, p<.001$)
 - ▶ Globally, group was not a significant predictor ($F(1,134)=3.15, p=.08$)
 - ▶ There was a significant interaction between monotonicity, number, and group ($F(1,134)=19.55, p<.001$)

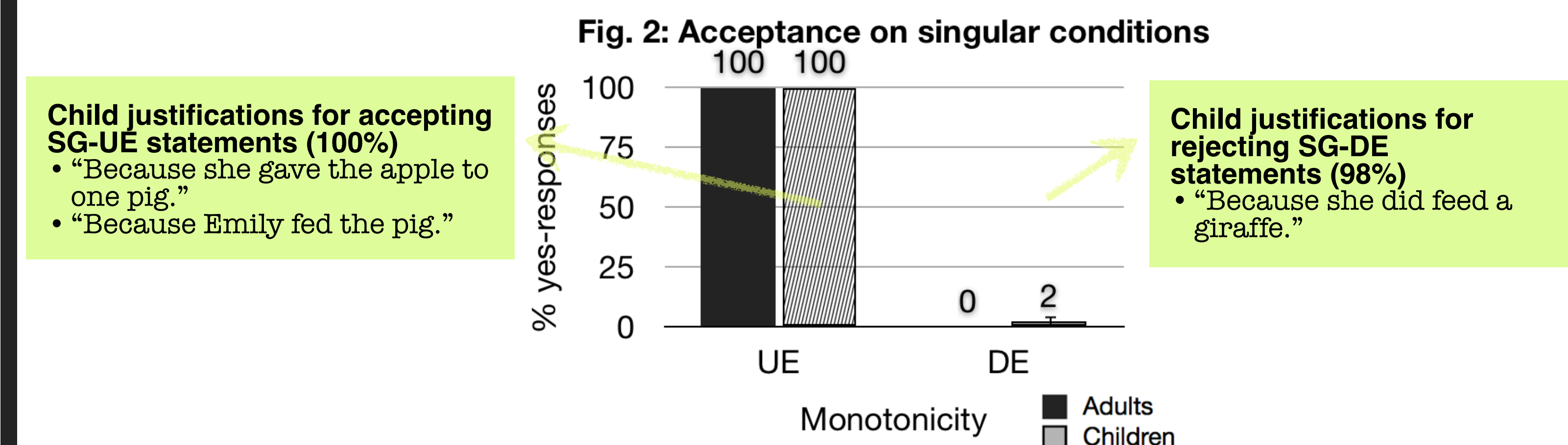
Plural condition

- Both groups were significantly more accepting on DE than on UE condition (Tukey HSD, both $p<.01$)
- In terms of PI calculation (Fig. 1)
 - ▶ UE condition: no-response \Rightarrow PI calculation
 - ▶ DE condition: yes-response \Rightarrow (local) PI calculation
 - ▶ Results reveal both groups computed more PIs in UE than DE condition
- PL-UE condition: children computed fewer PIs than adults (Tukey HSD, $p<.001$)
- ▶ Result consistent with previous findings that children compute SIs less than adults do
- PL-DE condition: children did not differ significantly from adults
 - ▶ 42% of adults and 19% of children in the PL-DE condition appeared to access the interpretation in (5), made available by locally computing the PI in the scope of negation



Singular condition (Fig. 2)

- Both groups were significantly more accepting on UE than DE condition (Tukey HSD, both $p<.001$)
- Children were adult-like on both UE and DE singular conditions



5. Conclusion

- Children compute PIs less often than adults do
- Findings mirror those of previous studies revealing relative insensitivity to SIs
- Provides novel empirical evidence for SI approach to PIs

References

¹ Sauerland, U. 2003. A new semantics for number. In R. Young and Y. Zhou, eds., *Proceedings of SALT 13*, 2. Spector, B. 2007. Aspects of the pragmatics of plural morphology: On higher-order implicatures. In U. Sauerland & P. Stateva, eds., *Presuppositions and implicatures in compositional semantics*, 243-281. ² Lesossich, P. 1985. *Plurality, Conjunction and Events*. Dordrecht: Kluwer Academic Publishers. ³ Magri, G. To appear. An account for the homogeneity effects triggered by plural definites and conjunction based on double strengthening. To appear in S.P. Reda, ed., *Semantics, Pragmatics and the Case of Scalar Implicatures*. Palgrave. ⁴ Chierchia, G., S. Crain, M.T. Guasti, A. Gualmini, & L. Meroni. 2001. The acquisition of disjunction: evidence for a grammatical view of scalar implicatures. In A.H.-J. Do, L. Dominguez & A. Johansen, eds., *Proceedings of the 25th University Conference on Language Development*, 157-168. Somerville, MA: Cascadia Press. ⁵ Gualmini, A., S. Crain, L. Meroni, G. Chierchia, & M.T. Guasti. 2001. At the semantics/pragmatics interface in child language. In *Proceedings of SALT 11*, 231-247. ⁶ Noveck, I. 2001. When children are more logical than adults: experimental investigations of scalar implicature. *Cognition* 78, 165-188. ⁷ Papafragou, A. & J. Musolino. 2003. Scalar implicatures: experiments at the semantics-pragmatics interface. *Cognition* 86, 253-282. ⁸ Sauerland, U., J. Andersen & K. Yatsushiro. 2005. The plural is semantically unmarked. In S. Kepser & M. Reis, eds., *Linguistic Evidence*, 413-434. Berlin: Mouton de Gruyter. ⁹ Pearson, H. M., Khan, & J. Snedeker. 2010. Even more evidence for the emptiness of plurality: An experimental investigation of plural interpretation as a species of implicature. In *Proceedings of SALT 20*, 489-508. ¹⁰ Crain, S. & B. Thornton. 1998. *Investigations in Universal Grammar: A Guide to Experiments on the Acquisition of Syntax and Semantics*. The MIT Press, Cambridge, MA.