

How do children interpret number words before learning their exact meanings?

Considerable research has documented the word learning assumptions that guide children's early acquisition of nouns, verbs, and adjectives. In contrast, little is known about children's first earliest interpretations of quantifiers and numerals. Clark¹ proposed that children initially treat quantity expressions as existential quantifiers, similar to "some". Other researchers have suggested that children quickly distinguish numerals from quantifiers, assuming the former denote contrasting (albeit unknown) cardinalities.²⁻⁶ However, although children contrast unknown numerals with known numerals, the evidence that numerals denote contrasting cardinalities for children is mixed, and is also consistent with the use of more general pragmatic inference.²⁻⁴

We tested children's interpretation of unknown numerals by comparing them to both existential quantifiers (*a, some*) and a novel quantifier (*blick*). In past studies, children's knowledge of quantity words was assessed using the Give-a-Number task ("Give me two/some fish").⁵⁻⁶ Because children often give a handful for both "some" and unknown numerals, this task does not differentiate a default of "some" from other candidate meanings, including total lack of knowledge. We circumvented this problem by creating the "Don't-Give-a-Number" task: if children treat an unknown number, *N*, as an existential, then when asked to "not give *N*" they should give no objects at all. However, if they interpret "*N*" as a member of a scale of contrasting alternatives, then they may interpret "Don't-Give-*N*" to be consistent with giving some other quantity, thus giving a quantity greater than zero.

In Experiment 1, children ($N=63$) were shown 5 oranges, 5 bananas, and 5 strawberries and were asked to give a character "everything", but to not give him one/two/five/a/some of the bananas. Children were classified as non-knowers, 1-knowers, 2-knowers, or 3-knowers (i.e., having exact meanings for up to 1, 2, or 3) or Cardinal Principle Knowers (i.e., having exact meanings for large amounts like 8), based on the Give-a-Number task. Children who had an exact meaning for a number rarely gave that amount when asked not to (e.g., 1-knowers correctly did not give one), and thus understood the task (Table 1). Critically, whereas the modal response for "Don't give a/some" was zero for all groups of children, this response was significantly less frequent for "Don't give one/two/five", whether or not children had an exact meaning for the word (Table 2; $ps < .05$).

In Experiment 2, we confirmed that children treat novel quantifiers as existentials.¹ We asked 3-year-olds ($N=15$) to not give the character either "a banana" or "blick of the bananas". For both requests, children frequently gave no bananas (*a*:97%, *blick*:77%), indicating they treat novel quantifiers similarly to existentials.

In conclusion, we found that although children treat novel quantifiers like *blick* like existentials, they assign stronger meanings to unknown numerals, and treat them as contrasting labels for cardinalities, even when they are not explicitly contrasted experimentally. We discuss the significance of these results to number word learning, and also to the recent debates surrounding pragmatic development, and children's ability to interpret quantity words relative to scalar alternatives.

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2. Brooks, N., Audet, J., & Barner, D. (under review). Pragmatic inference, not semantic competence, guides 3-year-olds' interpretation of unknown number words.
3. Condry, K. F., & Spelke, E. S. (2008). The development of language and abstract concepts: The case of natural number. *Journal of Experimental Psychology - General*, 137(1), 22-38.
4. Sarnecka, B. W. & Gelman, S. A. (2004). Six does not just mean a lot: Preschoolers see number words as specific. *Cognition*, 92, 329-352.
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6. Wynn, K. (1992). Children's acquisition of number words and the counting system. *Cognitive Psychology*, 24, 220-251.

Table 1

<u>Don't Give</u>	<u>Non-Knowers</u>	<u>1-Knowers</u>	<u>2-Knowers</u>	<u>3-Knowers</u>	<u>CP-Knowers</u>
One	11% (7%)	25% (13%)	3% (3%)	6% (6%)	0% (0%)
Two	17% (12%)	5% (5%)	0% (0%)	0% (0%)	0% (0%)
Five	28% (12%)	30% (13%)	18% (6%)	17% (12%)	4% (3%)

Exp. 1: Percentage giving N when asked not to, by knower level. Mean (SE)

Table 2

<u>Don't Give</u>	<u>Non-Knowers</u>	<u>1-Knowers</u>	<u>2-Knowers</u>	<u>3-Knowers</u>	<u>CP-Knowers</u>
One	50% (14%)	25% (11%)	27% (11%)	11% (11%)	33% (10%)
Two	50% (17%)	25% (13%)	27% (11%)	22% (12%)	33% (10%)
Five	61% (14%)	30% (11%)	35% (10%)	14% (9%)	35% (9%)
A	83% (18%)	65% (13%)	88% (7%)	83% (8%)	76% (7%)
Some	78% (9%)	75% (13%)	88% (5%)	78% (12%)	81% (6%)

Exp. 1: Percentage giving zero when asked not to give N, by knower level. Mean (SE)