

A Naturalistic Study of Input Effects on the Development of Number Concepts

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Introduction

Parental input plays a key role in language acquisition (e.g. Huttenlocher *et al.*, 1991), and major theories of quantitative development also stress the importance of language input in the development of number concepts (e.g. Gelman & Gallistel, 1978). However, it is unknown whether input at early ages, when children say few number words, plays a different role than input at later ages when children are already proficient counters. Existing reports of parental influences on children's number concepts are laboratory studies of parent-child interactions or parental reports, and may not reflect the typical input children experience at home (Durkin *et al.*, 1986; Saxe, Guberman & Gearhart 1987). Our naturalistic study examines parental input effects on children's production of number words, counting and cardinality concepts from 14-42 months

Methods & Results

From 14-42 months, 58 children and their primary caregivers were recorded for 90 minutes in their homes at 4-month intervals. Transcriptions were searched for the number tokens two-ten (as "one" is also used as a pronoun).

Our first analysis examined whether parental input predicts children's production of number words. Pairwise correlations showed that caregiver input was significantly related to children's production of number tokens at the same session at 22, 30, 34, 38, and 42 months ($rs > .34$, $ps < .01$). More interestingly, caregivers' number tokens predicted children's subsequent number tokens; specifically, input at 18 months and 30 months was related to child's production at 22 and 38 months, respectively ($rs > .32$, $ps < .05$), remaining positive and significant even after controlling for parent's other verbal tokens.

Starting at 30 months, children were asked to count a row of ten dots; correct performance had no more than one error. Parental input significantly predicted children's counting scores at 38 months, but this was only for input from 14-18 months ($r = .35$; $p < .05$). Parents of correct counters (67% of 38-mos-olds) said more number tokens than parents of errorful counters from 14-18 months ($\mu = 24.3$ vs. 11.2 number tokens). No other significant relations were found.

In the cardinality task, children were asked to select sets of 1-6 squares for 16 forced-choice trials. A median split divided children into high and low scorers on the cardinality task. Parents of children with high scores said more number tokens from 14-34 months and again this difference was only significant for input from 14-18 months ($t = -3.89$, $p < .01$; $\mu = 27.3$ vs. 8.8 number tokens).

Conclusion

Parental number word input, particularly from 14-18 months of age, is positively related to children's number word production, counting, and cardinality. During this time frame, children may be more sensitive to input, parents may provide input that is particularly well-matched to their children's existing knowledge or both. Number concepts, like other vocabulary do not develop in a vacuum, rather, early variation in the use of number words in parents' speech to children has meaningful effects, even years later.

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