Journal of Experimental Child Psychology 103 (2009) 421–440

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

Cross-linguistic relations between quantifiers and numerals in language acquisition: Evidence from Japanese

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ARTICLE INFO

Article history:
Received 30 July 2008
Revised 27 November 2008
Available online 21 January 2009

Keywords:
Counting
Quantifiers
Bootstrapping
Language acquisition
Semantic development
Number
Japanese

ABSTRACT

A study of 104 Japanese-speaking 2- to 5-year-olds tested the relation between numeral and quantifier acquisition. A first study assessed Japanese children's comprehension of quantifiers, numerals, and classifiers. Relative to English-speaking counterparts, Japanese children were delayed in numeral comprehension at 2 years of age but showed no difference at 3 and 4 years of age. Also, Japanese 2-year-olds had better comprehension of quantifiers, indicating that their delay was specific to numerals. A second study examined the speech of Japanese and English caregivers to explore the syntactic cues that might affect integer acquisition. Quantifiers and numerals occurred in similar syntactic positions and overlapped to a greater degree in English than in Japanese. Also, Japanese nouns were often dropped, and both quantifiers and numerals exhibited variable positions relative to the nouns they modified. We conclude that syntactic cues in English facilitate bootstrapping numeral meanings from quantifier meanings and that such cues are weaker in classifier languages such as Japanese.

Introduction

Early in language development, children acquire words rapidly, learning up to 10 words a day from 18 months of age (Bates & Goodman, 1997; Caselli, Casadio, & Bates, 1999; Fenson et al., 1994; Goldfield & Reznick, 1990). Children's early vocabularies are filled with names for things and even include a sprinkling of words that denote actions and events (Nelson, Hampson, & Shaw, 1993). However, before 2 years of age, most children lack words that denote the properties of sets. For example, quantifiers

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doi:10.1016/j.jecp.2008.12.001

and number morphology such as singular–plural marking are largely absent from children's language production before 24 months of age (Dale & Fenson, 1996; Fenson et al., 1994). Also, children's comprehension of quantifiers develops gradually between 2 and 5 years of age. The relative absence of number marking and set-relational quantifiers in early language suggests that these words pose a special challenge in acquisition (Barner, Chow, & Yang, 2009; Bloom & Wynn, 1997; Wynn, 1992).

Like quantifiers, numerals such as *one, two*, and *three* typically emerge in children's speech at around 2 years of age. Also, children's emerging comprehension of numerals in English is significantly correlated with their developing comprehension of quantifiers (Barner et al., 2009). Although many children can recite numerals in the count list by 2 years of age, learning their meanings normally takes an additional 18 to 24 months (Fuson, 1988; Le Corre & Carey, 2007; Le Corre, Van de Walle, Brannon, & Carey, 2006; Sarnecka, Kamenskaya, Yamana, Ogura, & Yudovina, 2007; Schaeffer, Eggleston, & Scott, 1974; Wynn, 1990; Wynn, 1992). By 2.5 years of age, many English-speaking children have acquired the meaning of the word *one*. These "one-knowers" give one object when asked for one but give more than one for all other numbers. Children often spend a number of months as one-knowers before they acquire the meaning of *two* (becoming two-knowers) and then *three* (becoming three-knowers). By the time children understand *four,* they often demonstrate an understanding of all numerals in the count sequence that they can recite. These children have transitioned from naming sets on the basis of associations between words and set sizes to inferring their cardinality based on their understanding of the cardinal principle, that is, that the last number recited in the counting routine refers to the cardinality of the set (for a review, see Carey, 2004).

As English-speaking children learn the meaning of each numeral, their knowledge of quantifiers also grows. For 2- to 5-year-olds, knowledge of quantifiers and determiners such as *a, some, most, all,* and *none* predicts greater comprehension of numerals (number-knower level) independent of effects due to age (Barner et al., 2009). Furthermore, this correlation between number knowledge and quantifier comprehension is true of nearly all quantifiers and determiners individually (i.e., it is not driven by one or two quantifiers). Thus, English children who show delayed numeral comprehension also tend to show delayed quantifier comprehension, whereas children who are advanced in one domain are also advanced in the other domain.

Why does knowledge of integers and quantifiers emerge so late in language development relative to other words, and why are the two word types so tightly yoked in acquisition? Wynn (1992) noted that to learn integers, children must discover that (a) numerals denote the properties of *sets,* (b) numerals denote the cardinalities of sets, and (c) *two* denotes 'two,' *three* denotes 'three,' and so forth—that is, they must learn which specific cardinality each numeral denotes. Quantifiers pose a similar learning problem. As with numerals, children must first discover that quantifiers denote properties of sets rather than properties of individual things. Second, they must discover that quantifiers denote set relations (e.g., *all, every, some*) or, in certain cases, proportions of sets (e.g., *most, many, few*). Finally, they must discover which specific relations or proportions quantifiers denote.

As Wynn (1992) observed, the first step in this process poses a significant problem. By denoting the properties of sets rather than of individual things, quantifiers and numerals differ from nearly all other words that children learn during their first 2 years of life. Words such as *five* and *many* (unlike nouns such as *cat*) can be applied to a set of things without being true of any single individual in isolation (e.g., in a set of five cats, no single cat has the property of "fiveness"). As Bloom and Wynn (1997) noted, "Sets are notoriously abstract entities. One can see and hear cats, but nobody has ever been wakened in the middle of the night by the yowling of a set" (p. 512).

Figuring out that a word denotes the property of a set is surely hard. Harder still, however, would be to learn this separately for each quantifier and numeral that is confronted in acquisition. To ease this burden, Bloom and Wynn (1997) suggested that children might use cues from both the syntax and semantics of known words to bootstrap the meanings of unknown quantifiers and numerals. Bootstrapping mechanisms can take multiple forms involving semantic inferences based on syntactic facts (Gleitman, 1990), syntactic inferences based on semantics (Grimshaw, 1981; Macnamara, 1982; Pinker, 1984) or inferences within a domain. Three variations on these bootstrapping mechanisms are relevant to the problem of acquiring quantifiers and numerals.

First, as noted by Bloom and Wynn (1997), the syntax and semantics of English noun phrases (NPs) might signal that both quantifiers and numerals denote the properties of sets. In English, both can be