Early lexical acquisition: rate, content, and the vocabulary spurt

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Early lexical acquisition: rate, content, and the vocabulary spurt*

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ABSTRACT  
The transition from slow to rapid word-learning was examined in a longitudinal study of 18 children. Beginning at age 1;2, mothers kept a diary of children's words. Diary entries were discussed during phone calls to the home every 2½ weeks. A chronological record of nouns and other word classes was coded from the diary records.

Thirteen children evidenced a prolonged period of up to three months during which rate of acquisition markedly increased. Almost three-quarters of the words learned during this period were nouns. Five children evidenced more gradual word-learning, and acquired a balance of nouns and other word classes. These results suggest that the terms 'vocabulary spurt' and 'naming explosion' best describe children who focus their early linguistic efforts on a single strategy: learning names for things. Other children may attempt to encode a broad range of experience with a more varied lexicon, a strategy that results in more gradual lexical growth.

INTRODUCTION  
Numerous observers of children's early lexical development have noted a transition from slow to rapid word-learning in the latter half of the child's second year. In her review of research on language development more than

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three decades ago, McCarthy (1954: 526) noted that 'after the appearance of
the first few words used consistently with meaning in appropriate situations,
there occurs a rapid increase in vocabulary'. First words are typically
acquired slowly, over the course of several months, and only later does
vocabulary begin to accumulate at a faster pace. In a diary study of her
daughter’s early language, Bloom (1973: 83) reports first words at nine
months of age, 25 different words used at various times by 14 months, and
a ‘great increase in the number of different substantive words’ at 17 months.
Nelson (1973) and Benedict (1979) also observed a sudden surge in new
words just prior to the achievement of a 50-word lexicon, at approximately
17–19 months.

What might account for such a change in the rate at which new words are
learned? One possibility is that this period of lexical growth, often referred
to as a ‘vocabulary spurt’, marks a change in the symbolic status of words.
Early words may function only as verbal components of specific situations,
routines, or actions, rather than as verbal terms that refer to those objects or
events (Piaget, 1951; Werner & Kaplan, 1963). Both Dore (1978) and
McShane (1980) suggest that this period of accelerated word-learning reflects
a new level of referential understanding, the ‘insight’ that words can name.
However, this view is not supported by findings suggesting that well before
the period of rapid lexical growth, children name objects, using at least some
of their words to refer to an entire class of referents across a variety of
contexts (Bates, Benigni, Bretherton, Camaioni & Volterra, 1979; Hut-
tenlocher & Smiley, 1987; Lucariello, 1987; Harris, Barrett, Jones &
Brookes, 1988). More recently, Gopnik & Meltzoff (1987) have argued that
the child begins to expand her lexicon rapidly, based on the understanding
that all things can and should be categorized. They report that children first
begin to sort randomly arranged objects into categories close to the onset of
a ‘naming explosion’, with the latter defined as the first increase of more than
10 new object words in any three-week observation. However, their study
does not examine the possibility that words other than nouns may be
increasing as well. Lifter & Bloom (1987) defined a spurt as the first three-
week interval in which children added 12 or more new words. Using this
broader criterion, they found that some children increased mostly nouns,
some added mostly relational words, and some maintained a relative balance
of nouns and other word-classes. There is also evidence that children begin
to add increasing numbers of verbs in the latter half of the second year
(Goldin-Meadow, Seligman & Gelman, 1976; Bates et al., 1979).

It is not clear, then, to what extent the onset of rapid word learning is a
naming/noun explosion, or a more general spurt in vocabulary growth.
Moreover, because studies that have explored the cognitive correlates of
rapid linguistic growth have typically defined its onset as a criterial increment
in number of new words or nouns, we do not know to what extent rate of
acquisition is changing. For example, does an increase of 12 new words or 10 new nouns represent a sharp change in rate of word-learning, or simply one increment in a more gradual pattern of acceleration? It is also unclear to what extent accelerated lexical growth continues or stabilizes following this initial increment. Gopnik & Meltzoff (1987) report that some children learned fewer nouns in the three weeks following the spurt. Why should object words decline following a three week 'naming explosion'?

In her study of children's first 50 words, Nelson (1973) reported that not all of her 18 subjects exhibited a marked change in lexical growth. Some children acquired fewer nouns and a more varied lexicon, and these children evidenced more gradual learning curves. A dramatic increase in rate of acquisition was associated with those children who learned relatively more nouns. Thus, differences in rate of acquisition were related to differences in the content of the lexicon.

It is important to clarify these issues of rate, content, and variation as a step towards formulating an adequate theory of early lexical development. For example, if nouns increase as rate of acquisition accelerates, then theories that posit change in children's object knowledge or classification skills are plausible. However, if other word-classes are expanding at a similar rate, theory must account for a more general change in linguistic competence. Finally, as Nelson (1973) suggests, not all children may evidence a period of rapid acceleration. There may be other factors, such as the child's language environment, that influence the words children acquire and their rate of acquisition, and/or that modulate the influence of cognitive change on early lexical development.

The present study reports data from a longitudinal study of early lexical development to examine change in the rate of word-learning as children acquire their first 75 or more words. We also examine the relationship of change in rate to the kinds of words children acquire, and consider the implications of these findings for theoretical interpretations of the vocabulary spurt.

METHOD

Subjects

Twenty-four normally developing Caucasian children from middle-class, English-speaking families were recruited from local birth records for a longitudinal study of language and cognitive development. Letters describing the study were sent to parents, and follow-up phone calls were made to those who returned a post-card expressing their interest in participating. The sample included 12 first-borns (six girls and six boys) and 12 later-borns (six girls and six boys).
Procedures

Children were followed from 1;2 to 1;10 as part of a larger study of language and cognitive development. We report here only the lexical data; children were also seen at 1;2, 1;4, 1;6, 1;8 and 1;10 for a short series of laboratory assessments.

At the 1;2 visit, mothers were interviewed about the words their children were currently using. Mothers were asked to keep a diary of children's words, noting situations in which words were used, and any subsequent change in usage. Diary entries were discussed during phone calls to the home at approximately 2½ week intervals. As a further check on the diary data, mothers completed a vocabulary checklist (Reznick & Goldsmith, 1989) at each two-month laboratory visit. Each checklist included a different representative sample of items from the Communicative Development Inventory (CDI) developed by Bates and her colleagues (see Snyder, Bates & Bretherton, 1981; Bretherton, McNew, Snyder & Bates, 1983). Any discrepancies between diary and checklist were discussed, and occasional words were added to the diary record as a result of this procedure.

<table>
<thead>
<tr>
<th>Categories of nouns</th>
<th>Sample items</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animals</td>
<td>doggie, horsie, bee</td>
<td>Includes real or toy animals and insects</td>
</tr>
<tr>
<td>Body parts</td>
<td>nose, tummy, teeth</td>
<td></td>
</tr>
<tr>
<td>Clothing</td>
<td>hat, shoes, zipper</td>
<td></td>
</tr>
<tr>
<td>Food and drink</td>
<td>cookie, milk, peas</td>
<td></td>
</tr>
<tr>
<td>Household items</td>
<td>bed, bathroom, fork</td>
<td>Includes rooms, furniture, utensils</td>
</tr>
<tr>
<td>Toys</td>
<td>ball, book, Ernie</td>
<td>Includes playthings, tv and book characters</td>
</tr>
<tr>
<td>Outside items</td>
<td>lawnmower, moon, pool</td>
<td></td>
</tr>
<tr>
<td>Places to go</td>
<td>park, school, store</td>
<td></td>
</tr>
<tr>
<td>Vehicles</td>
<td>car, truck, bicycle</td>
<td>Includes real or toy vehicles</td>
</tr>
<tr>
<td>Games and routines</td>
<td>peekaboo, so big, lunch</td>
<td>Includes daily routines, games, rhymes</td>
</tr>
<tr>
<td>Verbs/locatives</td>
<td>fix, wanna, up</td>
<td>Includes greetings, affect expressions</td>
</tr>
<tr>
<td>Personal-social</td>
<td>please, hi, night-night, ouch</td>
<td></td>
</tr>
<tr>
<td>People</td>
<td>mummy, Susie, auntie</td>
<td></td>
</tr>
<tr>
<td>Pronouns</td>
<td>me, mine, you, that</td>
<td></td>
</tr>
<tr>
<td>Qualities and attributes</td>
<td>pretty, sticky, yucky</td>
<td></td>
</tr>
<tr>
<td>Quantifiers</td>
<td>more, empty, no more</td>
<td></td>
</tr>
<tr>
<td>Question words</td>
<td>what, who, where</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 1. Lexical coding categories
VOCABULARY SPURT

Only words used spontaneously on at least two different occasions were included in the analysis. The mothers of 6 children did not continue the diary beyond 60 words, and these children are not included in the present analysis. For the remaining 18 subjects, words and phrases from the diary data were coded into categories of (1) nouns and (2) verbs, pronouns, and other word classes, as presented in Table 1. These categories are adapted from the Communicative Development Inventory. For each child, words were coded according to the situations in which each word was used. Thus, the word ouch used consistently while handling a bandage was coded as an object word (Household Item), whereas the same word used only when the child was hurt or upset was coded as a Personal-Social Convention.

For each 2½ week interval, the number of new nouns and the number of all new words were calculated from the diary records for each child. For purposes of comparison with other studies, any interval in which total vocabulary increased by 10 or more words was designated a 'spurt' interval. We examined the frequency and distribution of 'spurt' intervals in the first 75 or more words, and the relative proportion of nouns acquired during non-spurt and spurt intervals.

RESULTS

There were two different patterns of word-learning evident in these early lexicons. Thirteen children demonstrated a prolonged period of accelerated lexical growth that represented a marked change from an earlier, slower rate of acquisition. For these children, rate of acquisition changed dramatically, before they had acquired 50 words ($M = 28$ words, range = 15-48), at an average age of $1;7$ (range = $1;3$-$1;10$). The first increment of 10 or more words marked the beginning of continued accelerated development, with from three to five contiguous spurt intervals recorded for each child. As many as 60 words were added during a 2½ week diary interval. Thus, for 13 children, the first recorded 'spurt' marked the beginning of a period of up to three months of rapid word-learning. Included in this group were eight first-borns (five girls and three boys) and five later-borns (two girls and three boys).

For the two children shown in Fig. 1, the spurt occurred at a relatively early age. Subject 8 had a lexicon of 15 words at the beginning of the study at $1;2$. Two-and-a-half weeks later, she had learned 19 new words, and she continued to add vocabulary at the rate of about 12 new words each week. Within three months, she had acquired a lexicon of 167 words, and 80% of these were nouns. For subject 22, with 10 words at $1;2$, the first spurt interval was recorded by age $1;4$, and subsequent new words were added at the rate of about 8 words each week. By $1;6$ she had a lexicon of 101 words, and 64% of these were nouns.
Five children evidenced a clear spurt at 1;5, 1;6, or 1;7 (see Fig. 2). At 1;2 their lexicons ranged from 0 to 20 words ($M = 6.0$). For several months thereafter, these children added words slowly, at an average rate of 1.79 words per week. After the first recorded spurt interval, the average rate of acquisition showed a more than fourfold increase to 8.32 words per week. Total lexicons ranged from 85 to 133 words ($M = 110.8$), with 64% nouns.
The six children presented in Fig. 3 evidenced a relatively late spurt, at 1;8, 1;9, or 1;10. These children had a longer period of initially slow growth, averaging less than one (0.95) word per week for six months or more. Despite a slow start, the first recorded spurt interval marked the beginning of a dramatic acceleration. Rate of acquisition increased to an average of 8.22 words per week. Within two to three months time, lexicons ranged from 75 to 120 words ($M = 101.16$), with 65% nouns.

For each of these 13 children, the period of rapid word-learning could be described as a 'naming explosion'. As vocabulary size increased, nouns accounted for an increasing proportion of the total lexicon. Prior to the first recorded spurt interval, less than half ($M = 0.48$, range = 0.19–0.65) of all vocabulary consisted of nouns. Throughout the period of rapid word-learning, 71% (range = 0.60–0.84) of the words that were added were nouns. A Wilcoxon matched pairs signed-rank test comparing the proportion of nouns in the lexicon prior to the spurt with the proportion of nouns in the lexicon throughout the spurt showed this increase to be significant ($z = -3.1798, p = 0.001$).

Five children (2 later-born girls and 3 later-born boys) did not show this rapidly accelerating lexical growth, nor did they evidence a 'naming explosion'. Instead, their learning curves appeared to be more gradual, with occasional spurt intervals alternating with intervals of slower growth, as can be seen in Fig. 4. At 1;2, these children had larger lexicons than all but three of their peers ($M = 12.8$, range = 9–16). However, they subsequently added words at a steadier pace, with no prolonged burst of accelerated development.
Fig. 4. Rate of word learning: no spurt. — , S; — , S; — , S; — , S; — , S; — , S.

Fig. 5. Proportion of nouns as a function of vocabulary growth. — , 'spurt'; — , 'gradual'.

Rate of word-learning during non-spurt intervals averaged 1.95 words per week, which rose to a comparatively modest 5.14 words per week during sporadic spurt intervals. Lexicons ranged from 75 to 99 words ($M = 86$).

Moreover, there was little change in the proportion of nouns as words were
added to the lexicon. Instead, nouns and other word classes were about evenly added throughout lexical development. Fig. 5 presents the proportion of nouns in the lexicon when vocabulary totalled 25, 50, and 75 words for the 13 children with a clear spurt, and the five children with a more gradual growth curve. A repeated measures ANOVA using a general linear models procedure indicated no main effect of group. There was, however, a significant main effect of size of the lexicon, $F(2,15) = 15.5, p < 0.001$, and a significant interaction between group and size of lexicon, $F(2,32) = 5.34, p < 0.01$. As total vocabulary increased, the two groups began to diverge. For those children who exhibited an extended period of rapid word-learning, nouns steadily increased as vocabulary expanded beyond the 25-word level. For children with more gradually accelerating growth, nouns accounted for about half of the total lexicon at all three vocabulary levels.

Finally, there were no gender differences evident in the two groups. However, there was a significant effect of birth order. There were more first-borns among children with a clear vocabulary spurt (8 of 13), whereas all five children with a more gradually accelerating rate of acquisition were later-born (Fisher exact probability test, $p = 0.05$).

**DISCUSSION**

During the months in which children acquired their first 75 or more words, 72% of our subjects evidenced a period of rapid word-learning often referred to as the 'vocabulary spurt'. This period of rapid lexical growth could be characterized as a 'naming explosion'; almost three-quarters of the words added during this time were nouns. These children typically learned their first 30 words over the course of several months, but subsequent rate of word-learning more than quadrupled in the two to three months following the first increase of 10 new words. These findings confirm the work of Nelson (1973) and Benedict (1979), who report that word-learning begins to accelerate as children approach a 50-word lexicon at 1;5–1;7. In addition, we find that vocabulary continues to expand rapidly for several months beyond the 50-word level, which suggests that this period may be more aptly characterized as a long-term vocabulary 'surge' rather than a short-term 'spurt'.

Five children (28% of our sample) learned their first 75 to 100 words at a more gradual pace, marked by occasional modest spurts, some dips, and a few plateaus in the number of new words added to the lexicon. These children maintained a steady balance of nouns and other kinds of words throughout this period of lexical development. Although they began the study at 1;2 with somewhat larger lexicons, their diary records showed only sporadic increments of relatively faster growth, and no evidence of a 'naming explosion'. Word-learning never dramatically accelerated, and nouns never
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predominated in the lexicon. Instead, these children tended to learn a more balanced distribution of nouns and other word classes at a moderate, steady pace.

These results suggest that a 'spurt' or 'surge' may best describe children who concentrate their early linguistic efforts on a single strategy: learning names for things. This single-minded focus would allow children to accumulate words rapidly. Children who learn words at a more gradual pace may be manifesting an alternative strategy, one that attempts to encode a broad range of experience. Thus, their lexicons are more evenly distributed across nouns, verbs, modifiers, pronouns, and other word-classes, and their lexical growth is slower.

Horgan (1981) has also suggested that children who attend to more than one aspect of the language-learning task may evidence relatively slow progress when a single measure is used to assess their productive language. Horgan used MLU to match pairs of children who differed by six months of age. She found that the more precocious (younger) children emphasized nouns in their speech and made more syntactic errors, whereas the slower (older) children performed better on measures of comprehension, made fewer errors, and tended to use more varied sentence constructions, main verbs, and auxiliaries. Thus, a cautious but multifaceted approach to language made the older children appear to be less progressive when language was measured solely by MLU.

What might contribute to a dramatic increase in the rate at which nouns are learned, and how can we account for children who do not manifest this change? It is unlikely that the rapid acceleration in word-learning we observed can be explained by a change in the symbolic status of words. The diary records demonstrated that children used many of their early words to indicate and request objects in varied contexts. Among the first ten words of one child, for example, we find ball used for toy balls, pictures of balls, balloons, and pictures of circles. Another child used woof when he heard a neighbourhood dog barking, or saw a dog, toy dog, picture of a dog, or an animal on Sesame Street. Other studies that have used audiotaped or videotaped spontaneous speech samples (Huttenlocher & Smiley, 1987; Harris et al., 1988) or the introduction of novel objects and words under controlled laboratory conditions (Lucariello, 1987) also report that children use object names symbolically, to encode object categories and to serve a variety of communicative functions.

Gopnik & Meltzoff (1987) have suggested that the naming explosion reflects the understanding that all things can and should be categorized. The fact that children typically acquired approximately 30 words in their productive lexicon before they evidenced rapid word-learning suggests that language itself may facilitate this realization. The child that already uses nose and eyes, doggy and kitty, cookie and apple may attend more readily to input...
that provides labels for other body parts, animals, and foods. Thus, the
naming explosion may also depend upon the understanding that all things in
the environment CAN BE NAMED. When this conceptual/linguistic achieve-
ment is added to the understanding that things belong in categories, and that
words refer to category members across varied contexts, the child may begin
to make rapid progress in word-learning.

However, if cognitive changes such as these underlie the naming explosion,
then we might conclude that the five children with no dramatic burst in
vocabulary have yet to achieve these milestones. This explanation is insuf-
ficient for at least two reasons. First, it seems unlikely that children could
acquire up to 100 words (and half of them nouns and used across varied
contexts) and not yet understand that objects can be categorized and named.
Secondly, all children in the Gopnik & Meltzoff (1987) study demonstrated
two-category grouping between 1;3 and 1;8, well within the age-range of
children observed in the present study.

One explanation for the more gradual growth we observed in five of our
subjects is that the language environment may modulate the influence of
conceptual change on children’s language development. The finding that
first-borns tend to evidence a clear ‘naming explosion’, whereas later-borns
are more gradual word-learners with a more varied lexicon is some support
for this notion. Parents of first-born children may have more time and greater
motivation to engage their children in the kinds of naming rituals that are
associated with learning nouns (Nelson, 1973; Dore, 1974; McShane, 1980;
Goldfield, 1986, 1987). Input that emphasizes nouns and the naming
function of language may enhance the effects of changes in children’s
understanding of categories of objects, resulting in the strong nominal
strategy we observed in 72% of our sample. On the other hand, the input
available to later-borns will typically come from several sources, including
the language of an older sibling, and adult language addressed to that same
sib. Thus, the input to later-borns may be more varied, and less focused on
pointing out and labelling things in the environment. Jones (1984), for
example, reports that one-year-olds experienced less maternal speech in-
tended to ‘teach’ language (e.g. naming objects) when engaged with mother
and a pre-school age sibling than when they were alone with their mother. If
the input is more varied and less focused on naming, any change in the
child’s level of object knowledge may have a less striking effect on the lexicon.

A more radical hypothesis suggests that language input may have a greater
role in the onset of the ‘naming explosion’. Gopnik & Choi (1987) report that
children learning Korean, a language that emphasizes verbs rather than
nouns, learned fewer nouns and performed less well on sorting tasks when
compared with children learning English and French, languages that high-
light nouns. This suggests that the input language may influence both the
lexicon and the kinds of classification skills children exhibit when given
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objects to sort in laboratory experiments. For many children learning English in middle-class families, there is considerable exposure to the 'naming game' (Brown, 1958), and many opportunities to learn that things can be grouped and named. For example, parents who draw attention to the family pet, toy cats, neighbourhood cats, and pictures in books with a verbal 'kitty' may alert the child to the 'categorizability' of various instances of cat as well as to the use of the word to refer to any member of the category. Bridges (1986) also suggests that the 'nominal advantage' is shared by many speakers in Western culture, and influences early language development as much as children's attentional preferences. However, further work with languages other than English and experimental manipulations of the effects of input on children's classification skills are needed to test this hypothesis.

Finally, it is certainly the case that those children who acquired their first 75 or more words at a more gradual pace will learn their fair share of nouns, and may subsequently show a more dramatic increase in rate of word-learning. There are probably numerous shifts and plateaus in the course of lexical growth, as has been demonstrated for other aspects of development (Werner, 1948; Fischer & Bullock, 1981). Moreover, factors not examined in the present study, such as a shift from a whole-word to a phonemic-sequence acquisition strategy (Ferguson & Farwell, 1975; Locke, 1988) may also influence the change from slow to rapid word-learning. The present study has examined only the initial phase of a long and complex process of semantic development. There may be more than one way to build a lexicon, and more than a shift in object knowledge may be needed to explain the patterns we observed.

REFERENCES


