Lexical growth and grammatical competence: potential risks for children with a hearing deficiency

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1 Normal language acquisition

Language acquisition is a step-wise process. Some features of the mother language are acquired earlier than others. The first utterances of the child consist of names and single words. In a next step, the child simplifies the input to (mainly) binary combinations of words with denotational content \{e.g. bear sweet\} and operator-like words with immediate situational deixis \{e.g. that bear\}. The combinatorial use of words enhances the opportunities to acquire new words. The number of words productively used within the binary constructions rises to something between 300 and 500 (first lexical spurt) (Bates, Dale and Thal 1995).

1.1 The acquisition of I-marking and D-marking in Dutch

Around the second birthday the binary utterances get systematically enriched by grammatical markings. The first set of markings are auxiliaries, modal verbs, copulas and finite verb endings. I will label them I(mfl)-marking. In the stage of binary constructions, Dutch children use at first modal verbs as a kind of pre-grammatical operator, see (1)a (Jordens 2002, Van Kampen 2005). These modal verbs have an affective and social value. They are speaker/hearer oriented in the situation at hand. It is only in the next stage that the use of modal verbs is extended as in (1)b. Moreover, I-marked predicates with finite lexical verbs now appear systematically.

\[(1) \text{a. wil beer / magwel koekje eten (wanna bear, (I) may indeed cookie eat)} \]
\[(1) \text{b. beer } \{\text{is/wil/moet/gaat}\} \text{ slapen (bear is/want/must/goes sleep)} \]
\[(1) \text{c. beer slaap} \]

The acquisition of I-marking can be captured in a longitudinal graph. The I*-graph in (2) marks Sarah’s rising percentage of finite verbs towards the adult norm in some 20 weeks.

(2) Sarah (Van Kampen corpus)
The rising percentage of I'-marking is partly based on auxiliary-type verbs (auxiliaries, modals and copulas), patterns (1)a and (1)b, and partly on the finite form of lexical content verbs, pattern (1)c. The columns S1, S2, S3 in (3) present the acquisition of I-marking by Sarah in the beginning, the middle and the end of the acquisition period. A trend-setting column M (mother), set on some 1000 consecutive I-marked predicates, has been added. The columns of Sarah show that the latter type (lexical V) is slower to take up its 28% share in the I-marking of the input (Evers and Van Kampen 2001).

(3) I-marking for Sarah (S) and her mother (M)

<table>
<thead>
<tr>
<th>age in weeks</th>
<th>107-110 w.</th>
<th>S1</th>
<th>115-122 w.</th>
<th>S2</th>
<th>129-133 w.</th>
<th>S3</th>
<th>M (mother)</th>
</tr>
</thead>
<tbody>
<tr>
<td>auxiliary-types</td>
<td>86n</td>
<td>92%</td>
<td>140n</td>
<td>80%</td>
<td>297n</td>
<td>70%</td>
<td>731n</td>
</tr>
<tr>
<td>lexical Vs</td>
<td>7n</td>
<td>8%</td>
<td>36n</td>
<td>20%</td>
<td>127n</td>
<td>30%</td>
<td>283n</td>
</tr>
</tbody>
</table>

The rise of finite lexical verbs testifies a growing reliance on grammar. To make that step towards the grammaticalization of lexical verbs, the lexicon needs to have a certain extension (first lexical spurt), due to the pre-grammatical binary structures.

I-marking is followed by the acquisition of D(eterminer)-marking. The child starts to add articles to name-like parts of the utterances. The D-graph in (2) marks Sarah’s rising percentage of articles before nouns in (again) some 20 weeks. Like initial I-marking, initial D-marking is still situation-bound, as in (4)a. Dutch children refer to persons and things by means of demonstrative pronouns (die/dat/dit/deze “that/those/this/these”) before they learn to apply articles and personal pronouns (Van Kampen 2004). Demonstratives have a clear deictic situation-bound value and are often gesture-sustained. It is only in the next stage that D-marking with articles and pronouns appears systematically in discourse-oriented grammar, as in (4)b.

(4) a. die (moet) slapen (that (must) sleep)
    b. de beer/hij moet slapen (the bear must sleep)

Both I-marking and D-marking are indicative of the coherence of discourse. I-marking marks sentences as discourse units and D-marking indicates whether something has been mentioned before and is presupposed (de/het “the”). Due to these devices, language is no longer and necessarily situation-bound. It becomes discourse-oriented. This new orientation has in its turn a long-term effect on the further expansion of the lexicon.

The acquisition curve of articles, the D-graph in (2), coincides with the acquisition curve of personal pronouns (Van Kampen 2004). This simultaneity supports the view that both articles and pronouns are D-marking elements (Postal 1966). It also supports the view that D-marking is a matter of discourse reference tracking. It sets up a system of <± previously mentioned/±presupposed>, see (5).

10 D-marked elements relate to each other across 6 I-marked units (sentences)
\{ het, meisje, die, ze, haar, ze, ze \} \{ de beer, hij, zijn \} \{ boven, daar \}
(The little bear went upstairs. There, he saw the girl. That (= she) was lying in his bed. She had her eyes closed. She didn’t move. She was asleep.)

The acquisition of D-marking is a crucial step in human language acquisition. Discourse reference tracking is crucial for telling a story or maintaining a conversation. Moreover, the rising use of personal pronouns is the best indication that the speaker is oriented at earlier sentences and/or presupposition. A system equipped with D-marking allows attention to be directed at specific points. As such it delivers a powerful tool for the acquisition and maintenance of an extended lexicon.

2 Children with a hearing impairment

It stands to reason that hearing impairments in children will delay the identification and the acquisition of lexical items. Hearing impairments will in addition hamper the access to sentence structure and its discourse orientation. As a result, word finding is bound to remain slow and the use of language will continue to be an intellectual effort, rather than an intellectual short cut.

2.1 A neurolinguistic model of delayed language acquisition

Locke (1997) offers a neurolinguistic model for the switch towards grammar. His view is relevant for delays in acquisition. He holds the view that an early expansion of the lexicon (first lexical spurt) marks the shift towards a primary grammatical orientation. Grammatical frames offer a much better entrance to the lexicon, because they provide a more selective context. A slow extension of the lexicon, by contrast, will hamper a dominant grammatical orientation. The initial and crucial “rapid” extension of the lexicon may get stuck by a variety of factors (social, neural, perceptual), all leading to a more or less serious language specific impairment. Locke (1997) states this succinctly “A lexicon delayed is a grammar denied”.

Grammatically marked language coincides with activities in the left brain hemisphere, as has been known from the earliest anatomical discoveries by Broca and Wernicke and has now been confirmed by electro-physiological techniques that localize neural activities in the brain. The child's early and grammatically still unmarked sentences (1st and 2nd stage), by contrast, correspond mainly with activity in the right brain hemisphere. This tallies well with the affective and social function of one- and two-word utterances. Affective and social values are better represented in the right hemisphere. This implies that the acquisition of formal grammar, the early grammaticalization between the 2nd and 3rd birthday, correlates with a shift in the major brain activity from the right to the left hemisphere. Locke (1997) explains this shift in the following way. Both brain sides process the incoming signals. The affective and social values of the signal provoke activity in the right hemisphere. An initial right-hemisphere dominance for such values is thereby enhanced. The grammatical markings for I0 and D0 (is/de/het etc.) are noticed only as mere
phonological particularities, not reacted upon and left out. For that reason the grammatical markings are better noticed by the less involved left hemisphere.

The irrelevance of grammatical markings for affective and social values is counterbalanced by another type of prominence. Counts in child-directed speech (Van Kampen 2005) show how each of the grammatical markings has a frequency that is some 300 times higher than any arbitrary content word that is processed by the right hemisphere. The cognitive coherence between the meaningful content words \{beer/lief/weg/op/eten/slapen “bear/sweet/away/gone/eat/sleep”\} begins with a limited number of stereotypes, as is stressed in Tomasello (2003), but when new content words stream in and the number of possible combinations increases accordingly, the holistic and cognitive understanding of the right hemisphere gets more difficult and slows down. As soon as the highly repetitive left-hemisphere phonological structures (order, stress, grammatical markings) begin to be recognized as schemes for coherence, there is a shift from right to left. The left-hemisphere phonetic image offers the abstract orientation for predication and argument structure. I-marking and D-marking offer a new entrance to the lexicon. This new entrance is far more effective. The grammatical orientation propels the child subsequently to a further and ultimately more than tenfold higher extension of her lexicon.

### 2.2 The acquisition of I-marking and D-marking: a Dutch child with otitis media

Perceptual factors that may lead to a delayed lexicon (and a grammar denied) are various hearing deficiencies before the 3\textsuperscript{rd} birthday, such as persistent otitis media and a deficient function of the cochlea. These children are at risk to remain locked up in a limited frame of lexical orientation as they fail to develop a primary grammatical orientation based on merely phonetic clues in the sentence form. A case of that risk is recorded in the speech of a child L. that suffered from otitis media between 2 and 3½ years. Her acquisition graphs for I-marking and D-marking eventually reached normal levels, but with a shift in time due to a much slower rise. The stagnation period is (provisionally) marked with a straight line.

(6) Dutch child L. with otitis media

![Graph showing L's acquisition of I-marking and D-marking](image)

The columns in (7) represent L’s acquisition of I-marking. The straight line through the graph for I-marking in (6) indicate a stagnation period. The columns L2a and L2b reflect the I-marking at the beginning and the end of the stagnation period. The
columns show that during the stagnation period there was no rise in the number of I-marked lexical verbs.

(7) I-marking (auxiliary-types + lexical V) for o.m. child (L) and mother (M)

<table>
<thead>
<tr>
<th>age in weeks</th>
<th>110-115</th>
<th>L1</th>
<th>122-127</th>
<th>L2a</th>
<th>134-141</th>
<th>L2b</th>
<th>159-164</th>
<th>L3</th>
<th>Mother</th>
</tr>
</thead>
<tbody>
<tr>
<td>auxiliaries</td>
<td>72 n</td>
<td>94%</td>
<td>155 n</td>
<td>87%</td>
<td>156 n</td>
<td>88%</td>
<td>242 n</td>
<td>73%</td>
<td>690 n</td>
</tr>
<tr>
<td>lexical Vs</td>
<td>5 n</td>
<td>6 %</td>
<td>18 n</td>
<td>13%</td>
<td>22 n</td>
<td>12%</td>
<td>88 n</td>
<td>27%</td>
<td>303 n</td>
</tr>
</tbody>
</table>

Like the acquisition curve for articles (D-graph in (6)), the acquisition of personal pronouns shows a serious stagnation. L. “overuses” demonstratives for a much longer period than Dutch children with a normal language development.

Later on, this child with repeated otitis media, of normal intelligence and perfect hearing, turned out to have serious problems with reading, writing and word finding. She was diagnosed as dyslectic.

In sum, I- and D-marking establish the discourse network for lexical extension. Their rise follows from the pressure of new lexical items. Longitudinal graphs may support the thesis (Locke 1997) that “a lexicon delayed is a grammar denied”. There is certain elasticity in the period that a grammar can be acquired, but this elasticity is limited. Children with a hearing deficiency before the age of three are at risk to run out of time. They may develop a serious language impairment. The child’s lexical expansion will set in later and may be too slow to cause the shift towards a primary grammatical orientation. To check whether this is true, we need a detailed longitudinal picture of the actual progress of children with a hearing deficiency.

References


