

LEXICAL growth, grammatical competence and discourse reference: potential risks for children with a hearing deficiency *

Jacqueline van Kampen
UiL OTS, Utrecht University
Jacqueline.vanKampen@let.uu.nl

Abstract

This paper compares the morpho-syntactic development for two Dutch children, a normal hearing child and a child that suffered from repeated otitis media between of 2 and 3½ years. A temporary hearing deficiency causes a leveling and distortion of phonetic processes, and a delay in lexical growth. When such a deficiency occurs during the sensitive period, it results in a temporary stagnation of the morpho-syntactic development. This stagnation showed off dramatically when the longitudinal graphs of finite verb acquisition and determiner acquisition were constructed for this particular case. Both the acquisition of finite verbs and the acquisition of determiners took twice as long for the child with otitis media. The stagnation period showed up for the period of the ear infections.

The child's delay in grammatical orientation affects the acquisition of discourse coherence and reference tracking. A system equipped with finite verbs and determiners allows the attention to be directed at specific points. As such, it delivers a powerful tool for the further extension and the maintenance of the lexicon (Van Kampen 2001, 2005). From here on, one may take an optimistic or a pessimistic view. The optimistic view is that the acquisition devices are sufficiently elastic to overcome a delay in lexical growth. The pessimistic view is that the delayed lexical growth may prevent a clear shift to a grammatical orientation, as argued in Locke (1997) and may fail to yield the further enhancement of the lexicon. In that case, a temporary hearing deficiency may cause a delay in lexical growth that results in a far longer lasting effect in grammatical competence. A long-term objective of acquisition studies must be to explore the elasticity of language acquisition in these qualitative terms.

1. Normal language acquisition

Language acquisition is a step-wise process. Some features of the mother language are acquired earlier than others. Productive child language starts with a radical and systematic reduction of the maternal input. Grammatical markings and words are mainly left out. 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/bear sleep*} and operator-like words with immediate situational deixis {e.g. *that bear*}.¹ 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 & Thal 1995).

1.1 The acquisition of <+fin>-marking and <+det>-marking in Dutch

Around the second birthday, the binary utterances get systematically enriched by grammatical markings. The first set of grammatical markings are auxiliaries, modal verbs, and copulas and finite verb endings, see (1). I will label them <+fin>-marking (finiteness).

- (1) <+fin> marking (finite verbs)
- a.. beer lief → beer **is** lief (bear nice → bear is nice)
 - b. beer slapen → beer **gaat** slapen (bear sleep(ing) → bear is sleeping)

Initial <+fin>-marking is still situation-bound. Children use at first modal verbs as a kind of pre-grammatical operator (Jordens 2002, Van Kampen 2001, 2005). These modal verbs have a pragmatic value and a fixed person value. (*ik*) *wil* ('(I) wanna'), (*het*) *moet* ('(it) must'), and (*ik*) *magwel* ('(I) may indeed') are speaker/hearer oriented in the situation at hand, see (2).

- (2)
- a. *wil*: beer/slapen ((I) want bear/sleep)
 - c. *magwel*: koekje eten ((I) may indeed cookie eat)
 - b. *moet*: beer slapen ('(it) must (be that)' bear sleep)

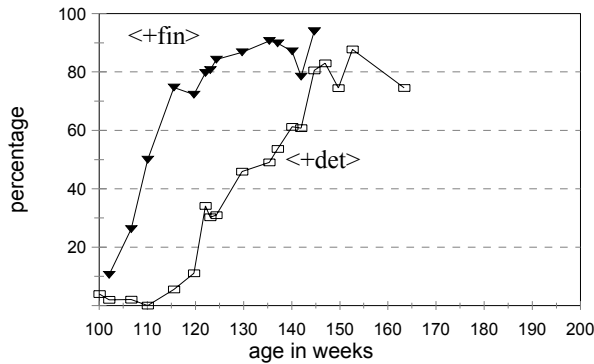
Denotational finite verbs appear only marginally in productive child language at this stage (8% versus 92% (semi-)modals: Evers & van Kampen 2001: 26).

It is only at the grammatical stage of a general <+fin>-marking for all predicates that the use of modal verbs is extended to different person values as in (3)a. Predicates with finite denotational verbs (3)b now appear systematically. They rise from the marginal 8% to 15% and subsequently towards some 30%, a percentage that matches the maternal input.

- (3)
- a. beer {*is/wil/moet/gaat*}slapen (bear is/want/must/goes sleep)
 - b. beer eet koekje (bear eat<+fin> cookie)

The rising percentage of <+fin>-marking in the speech of the child can be translated into a longitudinal graph, see (4), reproduced from van Kampen (2004). The <+fin>-graph has been constructed from the files of Sarah (CHILDES Van Kampen corpus).

(4) The acquisition of <+fin>-marking and <+det>-marking: Dutch Sarah



The rising percentage of <+fin>-marking is partly based on auxiliary-type verbs (auxiliaries, modals and copulas), type (3)a, and partly on the finite form of lexical denotational verbs, type (3)b. The columns S1, S2, S3 in (5) present the acquisition of finite verbs by Sarah in the beginning, the middle and the end of the <+fin> acquisition period. A trend-setting column M (mother), set on some 1000 consecutive <+fin>-marked predicates, has been added. The columns of Sarah show that the latter type (denotational V) is slower to take up its 28% share in the <+fin>-marking of the input (Evers & Van Kampen 2001).

(5) types of finite verbs: Dutch Sarah (S) and her mother (M)

age in weeks	107-110 w. <i>S1</i>	115-122 w. <i>S2</i>	129-133 w. <i>S3</i>	<i>M</i> (other)
auxiliary-type	86n 92%	140n 80%	297n 70%	731n 72%
denotational V	7n 8%	36n 20%	127n 30%	283n 28%

Within 3 months, between week 110-123, finite denotational verbs rise to an adult level of 30%. The rise of finite denotational verbs testifies a growing reliance on grammar. The grammaticalization of denotational verbs requires that the lexicon for the pre-grammatical binary structures has reached ‘a certain extension’ (first ‘lexical spurt’).

The acquisition of systematic predicate marking by finite verbs is followed by the acquisition of determiners. I will label this <+det>-marking. The <+det>-graph in (4) above marks Sarah’s rising percentage of articles before nouns. The child starts to add articles to name-like parts of the utterances, see (6).

(6) <+det>-marking (determiners)

- a. beer is lief → **de** beer is lief (bear is nice → the bear is nice)
- b. beer gaat slapen → **de** beer gaat slapen (bear is sleeping → the bear is sleeping)

Like initial <+fin>-marking, initial <+det>-marking is still situation-bound. Dutch child language is different from French and English child language. It refers to persons and

things by means of demonstrative pronouns (*die/dat/dit/deze* 'that/those/this/these'), as in (7), before they learn to apply articles and personal pronouns. Demonstratives have a clear deictic function and they are often gesture-sustained.

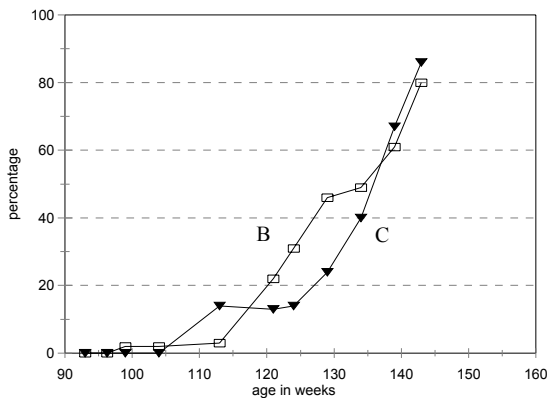
- (7) a. *die* (moet) slapen (that (must) sleep)
 b. *dat* (is een) beer (that (is a) bear)

The frequent use of demonstratives has been noticed for the initial stages of normal hearing children (Haegeman 1996, Van Kampen 2004) and for German CI-children (Szagun 2002). Demonstratives are used in early child language to highlight referents that are salient in the situation. Personal pronouns, by contrast, are basically used as free anaphoric pronouns, i.e. to refer back to previously mentioned referents (Van Kampen 2004, Rozendaal 2005). It is only at the grammatical stage of <+det>-marking that, next to articles as in (8)a, personal pronouns as in (8)b appear systematically.

- (8) a. *de* beer moet slapen (the bear must sleep)
 b. *hij* is lief (he is sweet)

Now it happens that the acquisition curve of articles coincides with the acquisition curve of personal pronouns in Dutch, see the graphs in (9) (from Van Kampen 2004).

- (9) The acquisition of <+det>-marking and 3rd person pronouns: Dutch Sarah



Graph B: Noun phrases that realize <± definite> articles in obligatory contexts in ≥ two-word utterances

Graph C: Ratio of 3rd person pronouns w.r.t. nouns measured as a percentage of the ratio in the speech of the mother within the same files.

This simultaneity supports the view that both articles and personal pronouns are D⁰-marking elements (Postal 1966). It also supports the view that <+det>-marking is a matter of discourse reference tracking. It sets up a system of <± previously mentioned> or <± presupposed>, see (10).

- (10) *De kleine beer* ging naar boven. **Daar** zag *hij* het meisje. Die lag in *zijn* bedje. Ze had haar ogen dicht. Ze bewoog niet. Ze sliep.

10 <+det>-marked elements relate to each other across 6 <+fin>-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.)

Both <+fin>-marking and <+det>-marking are indicative of the coherence of discourse. <+fin>-marking marks sentences as discourse units and <+det>-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 a long-term effect on the further expansion of the lexicon. The acquisition of <+det>-marking is a crucial step in human language acquisition, since discourse reference tracking is crucial for telling a story or maintaining a conversation. Moreover, the rising use of personal pronouns is easily quantifiable and the best indication that the speaker is oriented at earlier sentences and/or presupposition. A system equipped with <+det>-marking allows the attention to be directed at specific points. As such, it delivers a powerful tool for the acquisition and maintenance of an extended lexicon (Van Kampen 2001, 2005).

Van Kampen (1997, 2004) argues that the simultaneity between <+det>-marking by articles and by free anaphors holds especially for V-second Dutch. The situation in French and English is slightly different. The free anaphoric pronouns in English (*he/she/it/him/her*) may also function in direct connection with the speech situation. They appear before the systematic use of articles. The V-second grammar of Dutch applies for such situation highlighted cases a demonstrative *die/dat* ('this/that'). It stresses the topic and is used as an A-bar pronoun in Spec,C. The A-bar property is related to the V-second character of Dutch. The picture for French is different from both English and Dutch. The French free anaphors are clitics. They can only function within discourse. Their identification follows the full acquisition of <+det>-marking. The detailed longitudinal picture in Rozendaal (2005) shows that the typological variations do not weaken the main conclusion that systematic and intensive use of <+det>-marking within the sentence is maintained to construct the discourse coherence.

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 where the switch towards grammatical devices follows from the growth of the lexicon. His view is relevant for delays in acquisition. He argues 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 offer a more selective context. The learner is forced to pay attention to the grammatical markings in the input, when the amount of combined denotational items can no longer be handled by semantic associations. A slow extension of the lexicon, by contrast, will fail to force the learner into 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”.

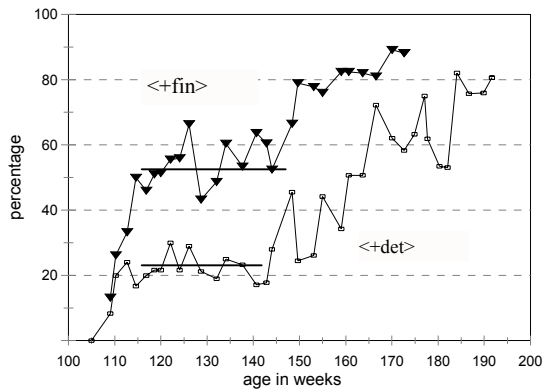
Grammatically marked language coincides with activities in the left brain hemisphere, as has been known from the earliest anatomical discoveries by Broca and Wernicke and as has now been confirmed by electro-physiological techniques that localize neural activities in the brain. The child's early and grammatically still unmarked sentences, by contrast, correspond mainly with activity in the right brain hemisphere (Mills et al. 2004). 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 second and the third 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 <+fin>- and <+det>-markings (*is/the/a* 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 2001, 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. <+fin>-marking and <+det>-marking offer a new and more selective entrance to the lexicon. This new entrance by grammatical marking is far more effective and propels the child subsequently to a further and ultimately more than tenfold higher extension of her lexicon.

2.2 The acquisition of <+fin>- and <+det>-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 3rd 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 (Marchman & Bates 1994). A case of that risk is recorded in the speech of a child that suffered from otitis media between 2 and 3½ years. Her acquisition graphs for <+fin>-marking and <+det>-marking eventually reached normal levels, but with a shift in time due to a much slower rise, see (11). The stagnation period is (provisionally) marked with a straight line.

(11) The acquisition of <+fin>- and <+det>-marking: Dutch child with otitis media



The straight line through the graph for <+fin>-marking in (11) indicate a stagnation period. The columns in (12) represent the child's acquisition of <+fin>-marking. The columns L2a and L2b reflect the <+fin>-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 <+fin>-marked denotational verbs.

(12) types of finite verbs: Dutch child with otitis media and her mother (M)

age in weeks	110-115 <i>L1</i>	122-127 <i>L2a</i>	134-141 <i>L2b</i>	159-164 <i>L3</i>	<i>M</i> (other)
auxiliary-type	72n 94%	155n 87%	156n 88%	242n 73%	690n 69%
denotational V	5n 6 %	18n 13%	22n 12%	88n 27%	303n 31%

Like the acquisition curve for articles (<+det>-graph in (11)), the acquisition of personal pronouns shows a serious stagnation. The child '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. For another recorded case of otitis media, a comparable delay

in <+fin>-marking and <+det>-marking has been reconstructed. See Rach et al. (1991), Bishop (2003) for temporary hearing deficiencies and their effect on first language acquisition.

3. Elicitation tests and spontaneous speech recordings

The view on grammar as a new and more effective entrance to discourse coherence and the further expansion of the lexicon has been proposed for normal language acquisition in Van Kampen (2001, 2005) and its delay for children with a hearing deficiency in Van Kampen (2003). These studies relied on the construction of successive longitudinal graphs. The method has potential relevance for the neurological model of Locke (1997). The construction of longitudinal graphs can also be used for the validation of elicitation tests. The validation of such tests by a more elaborate method of construction longitudinal graphs is recommendable, since elicitation tests are more sensitive to the stylistics of question-answering conventions.

I mention here the results of two studies that underline the importance of this. Firstly, Van der Velde (2003) elicited the use of determiners in the speech of Dutch and French children. The questions triggered short sentences, as in (13).

- (13)
- | | | |
|----|-------------------------------|--------------------------------------|
| | <i>Dutch</i> | |
| a. | wat doet het jongetje hier? | (what is the little boy doing here?) |
| | hij vangt de blauwe vinders | (he catches the blue butterflies) |
| | <i>French</i> | |
| b. | que fait le petit garçon ici? | (what is the little boy doing here?) |
| | il attrape les papillon bleus | (he catches the blue butterflies) |

There was a great discrepancy between the two groups as to the use of <+fin>-marking. The Dutch children often produced sentences without a verb (22% for the 3-4 years old, and 12 % for the 4-5 years old) and when they did use a verb, it was in the majority of the cases a non-finite verb (87% for the 3-4 years old, and 48% for the 4-5 year old). Even children as old as 6 still marked only 90% of the verbs for finiteness. French children virtually always used a full sentence with a finite verb. So, at an age that Dutch children already use systematic <+fin>-marking in spontaneous speech (cf. the <+fin>-graph in (4)), elicitation tests may still trigger sentences without a finite verb. This is a stylistic result that masks the underlying competence.

The second study, a pilot study, intended to elicit the use of <+fin>-marking (with a 3rd person singular subject) by two Dutch children with CI. The pilot elicitation test was carried out at the University Hospital Utrecht (UMCU) by the author, Koster (Speech and language pathologist UMCU) and De Vries (master student UU), in July 2005. The children were both pre-lingual deaf, implanted at an early age and around 4 years old. The elicitation test was designed by De Jong (Van Alphen et al. 2004). One of the two children virtually did not use a finite verb, neither in her spontaneous conversation, nor in the elicitation test. The outcome of the elicitation task for the other child was remarkable. Up to half of the session, she consistently used a non-finite verb, but at some point she discovered

the trick of the task and she switched to the use of a finite verb for the remaining of the session.

This suggests that the test results can be highly sensitive to the stylistic register. Ongoing research is likely to turn more and more to the effectiveness of elicitation tasks, especially to check the effectiveness of intervention methods in the follow-up of children with a hearing deficiency. For that reason, it is recommendable to check the results of the tests with the scores in spontaneous speech conversation (taking the adult conversation partner as the norm to be approached). For instance in Dutch, but (probably) not in French, it is part of informal language use, but completely grammatical, to answer the question in (13)a as in (14).

- | | |
|----------------------------------|--------------------------------------|
| (14) wat doet het jongetje hier? | (what is the little boy doing here?) |
| blauwe vlinders vangen | (catch blue butterflies) |

In a formal environment of the elicitation task, older children and adults will avoid giving answers as in (14), but the younger children won't.

4. Conclusion and further research

There is a 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 lasting language impairment. When the child's lexical expansion sets in later, it may be too slow to cause the shift towards a primary grammatical orientation (cf. Kauschke 2000). The child's delay in grammatical orientation subsequently affects the acquisition of discourse coherence and reference tracking. To check when this applies, and whether an effective intervention is possible, it will be mandatory to have a detailed picture of the actual progress of children with a hearing deficiency.

Endnotes

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1. Part of these utterances has been discussed as 'optional infinitives' in Wexler (1998), but the source is the systematic reduction in all the grammatical markings (Van Kampen 1997).

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