Incremental Acquisition of Phrase Structure

Frank Wijnen

University of Groningen

1. Introduction

The nature of the phrase marker underlying children's early compositional utterances still is a controversial issue. The debate focusses on the availability of functional categories. Recently, Verrips and Weissenborn (1992) and Poeppel and Wexler (1993)—to name just a few—have argued for a 'Full Competence' hypothesis of clause structure. On the basis of distributional evidence showing a systematic relationship between verb form and verb position, these authors argue that early syntax comprises all functional categories relating to the clausal projection, i.e., IP (or its components, under a split-Infl view) and CP. On the other hand, Platzack (1990) claimed that early Swedish does not indicate the presence of functional categories. One of his arguments is that finite verbs are not consistently used where adult grammar mandates them, which suggests that the finite-nonfinite distinction does not yet have a syntactic basis (i.e., the assignment of tense through movement to Infl). Vainikka (1994) found that pronominal subjects in early English appear in non-nominative form, which she argues to result from the absence of the IP. Often, proponents of the 'Reduced Competence' hypothesis (i.e., initial syntax does not contain functional categories) assume that functional projections are acquired one by one, so that there is an intermediate developmental stage where IP is available but CP is still absent (Radford, 1994; Rohrbacher & Vainikka, 1994; Vainikka, 1994). This is what I will call 'incremental acquisition'.

Several factors may contribute to the lack of consensus. First, language type may be a crucial factor. It does not seem to be coincidental that the case for Reduced Competence has generally been made on the basis of languages with poor inflectional morphology such as English and Swedish. It might be more difficult to find evidence for functional categories in these languages than in richer languages like German or Italian (but see Radford, 1994). Alternatively, inflectionally rich languages might provide better or more cues to the learner, so that the functional categories will be triggered very early.

Secondly, it is possible that the contrasting claims have been made on the basis of language samples that diverge in terms of developmental stage. For lack of a reliable theory-independent (and cross-linguistically valid) measure of language development, data are often compared on the basis of the subjects' ages. However, it is well-known that age is at best a highly unreliable index of developmental stage. In particular, despite the claims of many studies, it is never clear whether the language samples that are analyzed actually represent the very first stage of syntactic development. Moreover, as Radford (1994) points out, evidence for the availability of the functional domain at age *x* does not preclude the possibility that it is absent at an earlier age *y*.

Thirdly, as is indicated by the brief overview of the literature above, researchers use different empirical criteria for the availability of functional categories. The question that arises is, what can be considered sufficient evidence for the availability of a functional projection? Presumably, no single criterion is by itself sufficient. We have to look for converging evidence, structural, morphological as well as distributional.

The aim of this paper is to contribute to the debate by presenting a set of data on the acquisition of Dutch verb placement. Dutch comprises the Verb Second mechanism (V2), which renders it particularly useful for studying the availability of functional categories in early child grammars. In matrix clauses, finite (parts of) verbs (or verb complexes) move to the second position, whereas non-finite verbs appear in sentence-final position, which is either considered to be the verb's base position, or the result of a derivation from a underlying (universal) SVO structure (Zwart, 1993). In V2 sentences, the subject or another argument or non-argument may precede the finite verb. Following Zwart (1993), I will assume that in subject-initial constructions the finite verb has moved to AgrS, whereas in non-subject-initial construction, its position corresponds to Comp.

The inflectional paradigm of Dutch is somewhat poorer than that of German. There is no distinction between second and third person singular forms. In regular main verbs, both have t-suffixes. In modals, first, second and third person singular forms have zero-suffixes. All plural forms are identically formed, by adding -en to the verb stem.

The data to be presented below were longitudinally collected and analyzed. The period of observation starts almost immediately after the subjects produced their first compositional utterances. Thus, to the extent that production data are a valid index of the development of linguistic competence, it is reasonably certain that the very first stage of syntactic development is captured.

In discussing the data, three criteria will be used for the presence of a functional head underlying Verb Second. The first is that the child actually produces finite verb forms (i.e., morphemes showing the morphological and distributional qualities of finiteness). This may sound trivial, but it should be recalled that although Full Competence predicts that all structures that are found in the target language can be represented by the early grammar, it is not refuted by a systematic lack of particular forms. However, this study starts from the assumption that it does not make sense to posit a particular syntactic category if the morphemes that supposedly instantiate it are systematically absent. This corresponds to Vainikka's (1994) 'minimalist approach': assume no more structural complexity of the underlying representations than is necessary to account for the data.

The presence of finite verbs is a necessary, but not a sufficient criterion. It is conceivable that finite verb forms are hosted by a projection that does not have the characteristics of the functional projection that is assumed to be the target of V2 in the adult grammar (see Hoekstra & Jordens, 1994, for a general formulation and motivation of this contention). A defining characteristic of the category hosting V2 (AgrS or Comp) is that lexical items move into it (i.e., they are not base-generated in this position). Consequently, we expect to find verbs (lemmata) that occur both in V2 and sentence-final position. If there is no overlap between the sets of verbs appearing in the two positions, it is difficult to maintain that finite verbs and nonfinite verbs are related through movement. De Haan (1987) has reported such a lack of overlap, and concluded that during an early phase of development of Dutch, finite and nonfinite verbs constitute separate categories.

Another essential property of the functional category enabling Verb Second is that it selects a complement VP. Thus, if the child's grammar really contains, say, AgrS, we expect the child to use sentences with so-called periphrastic verbal predicates, i.e., sentences containing both the head of AgrSP (an auxiliary) and the head of VP (a nonfinite main verb). This constitutes the third criterion. It cannot be concluded that a functional projection above VP is available until periphrastic predicates are observed.

In principle, the minimal criterion structure is Aux–Vnonfin (e.g., *kan draaien* 'can turn', *mag kijken* 'may look'). Utterances like this can be viewed as comprising a (putative) null subject and a finite periphrastic predicate. However, in view of Hoekstra and Jordens' (1994) contention that sentence-initial modal verbs or auxiliaries may be adjuncts rather than heads, it is necessary to add the requirement that an *overt* sentence–initial subject should be present, which can be taken to reflect a specifier–head structure. Thus, the occurrence of Subject-Aux-Vnonfin structures is considered to be strong evidence for the presence of at least one functional category in the child's clausal representation. Note that under this criterion, three-word utterances are capable of betraying the availability of a functional projection. Therefore, it does not run the risk of seriously overestimating the age of acquisition.

2. The data

The results reported here pertain to the order of appearance of various verbal predicate types in spontaneous language use. The data are taken from longitudinal speech corpora of two boys, Peter and Niek, who acquired Dutch in a monolingual environment. The analyses cover the period starting with the appearance of two-word utterances, and ending at the point at which the frequency of nonfinite matrix clauses ('root infinitives', Rizzi, 1994) reached a minimum level (the end of the 'optional infinitive stage'; see Wexler, 1994).

Name	Age onset	Age end	MLU onset	MLU end	N.anal. utts.
Peter	1;9	2;4	1.06	3.44	1787
Niek	2;7	3;6	1.44	2.95	2447

Table 1. Overview of the child language corpora.

The second and third columns in Table 1 indicate that Peter started to use multi-word utterances within the expected age range, while Niek was late. Additionally, Peter's rate of development was somewhat higher than Niek's. However, as will become clear, the qualitative pattern of development did not differ in any relevant way between these two children.

The rightmost column in Table 1 presents the numbers of utterances extracted from the corpora for analysis. These are all sentences containing at least one verb and one other word (with the exception of those that were discarded due to incompleteness or incomprehensibility, as well as imperatives). The selected utterances were put into separate database files and hand-coded.

3. Results

Each utterance was assigned to one of five categories, depending on the number, position and form of the verb(s): (1) single infinitive (examples 1, 2), (2) single participle (ex. 3, 4); (3) single finite verb (ex. 5, 6); (4) auxiliary/modal plus infinitive (ex. 7, 8); (5) auxiliary plus participle (ex. 9, 10).

(1) die helemaal kapot maken (N. 3;1.16)
that+one altogether broke make
'completely break that one'

(2) mama radio aan doen (P. 2;0.7)
mommy radio on do
'mommy put on radio'

(3) een schoorsteen mond gestopt (N. 3;0.10)
an exhaust pipe mouth put
'put an exhaust pipe (in) mouth'

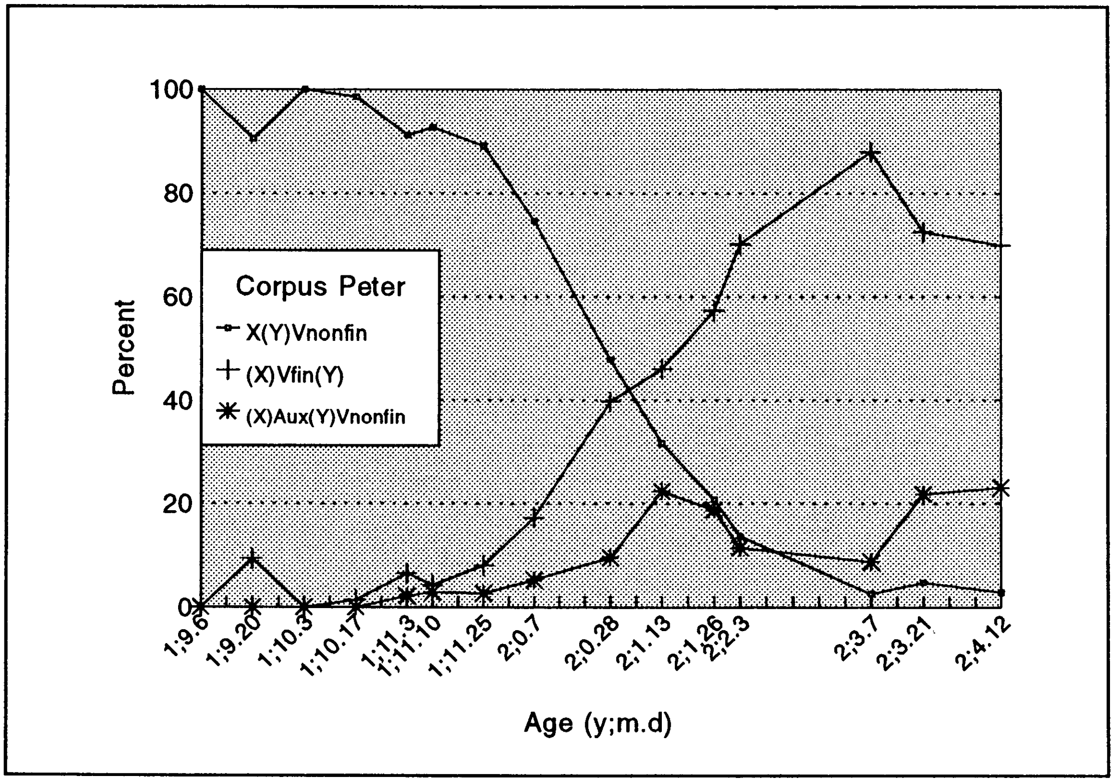

Figure 1. Percentages of various verbal predicates as a function of age (Peter).

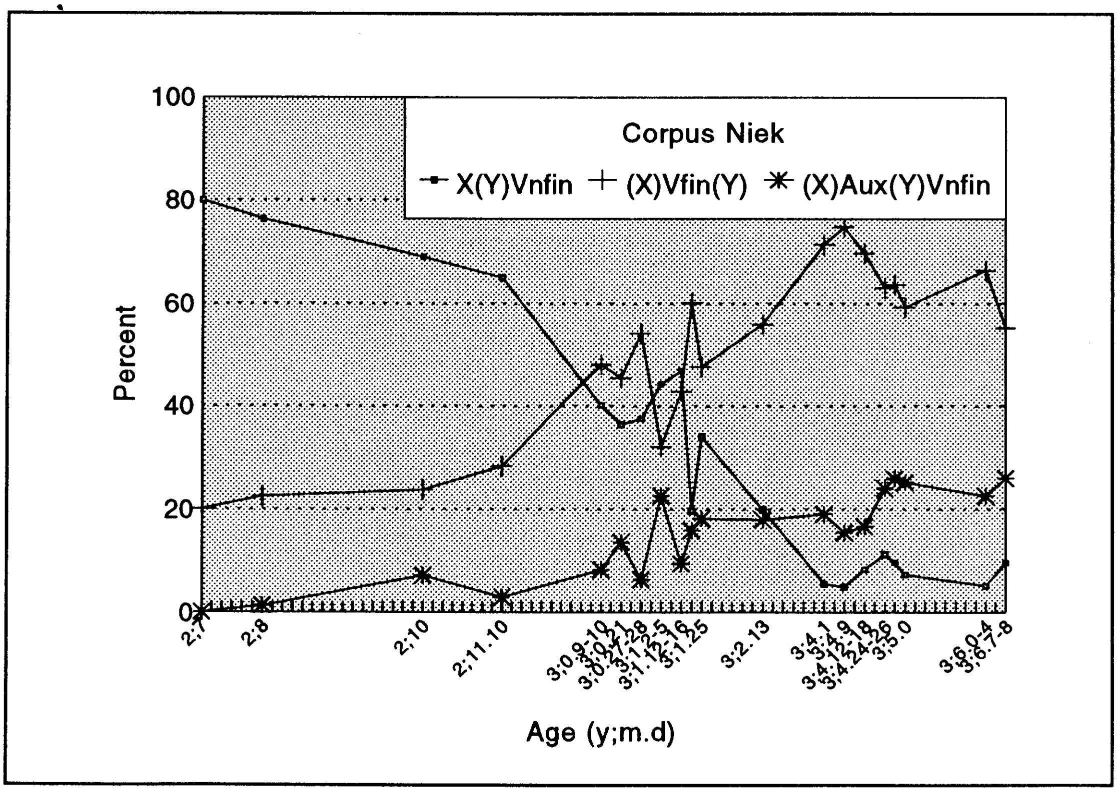

Figure 2. Percentages of various verbal predicates as function of age (Niek).

(4) Peter emmer daan (P. 1;10.3)
Peter bucket done
'Peter put (in) bucket'

(5) komt ∂ nog meer? (N. 2;11.10)
comes still more?
'does any more come?'

(6) (stof)zuiger doet t # niet (P. 1;11.10)
vacuum cleaner does it not
'vacuum cleaner doesn't work'

(7) mag ∂ ik trein zoeken (N. 3;0.10)
may I train search
'can I look for (the) train'

(8) Frank moet op grond zitten (P. 2;1.26)
F. must on floor sit
'F. must sit on (the) floor'

(9) ik heb die gevonden (N. 3;1.17)
I have that found
'I found that one'

(10) Jiska heef(t) stukgemaakt (P. 2;0.28)
J. has broke made
'J. broke (this)'

In some cases, the observed utterances could not be classified, for various reasons. The numbers of sentences that had to be excluded were 114 for Niek (4.7%) and 48 for Peter (2.7%). Figures 1 and 2 give an overview of the relative frequency of different types of verbal predicates as a function of age for both subjects. Types 1 and 2, and types 4 and 5 are merged, which is motivated by the fact that, by and large, infinitives and participles obey the same ordering rules in adult Dutch. The numbers of participles are small, anyway. Niek's corpus contains 14 single participle predicates (0.6%) and 89 aux–plus–participle predicates (3.8%), the latter occurring mostly in the late samples. In Peter's corpus, 7 single participles were found (0.4%), and the number of aux-plus–participle predicates is 30 (1.7%).

3.1 The early samples: predominance of non-finite forms

Figures 1 and 2 show that during the initial part of the period of observation, i.e., the first three to four months, up to and including age 1;11.25 in Peter, 2;11.10 in Niek, finite sentences, (type 3, 4, or 5 predicates) are scarce; nonfinite constructions (types 1 and 2) dominate. The simple finite predicates that occur in the first two to three samples appear to be isolated cases, which do not reflect a productive syntactic mechanism. In Peter's corpus, the rise in the finite verb curve at age 1;9.20 represents two occurrences of the utterance *is ∂ beh* 'is a baah (= sheep)'. The next occurrence of the copula *is* is not observed until three months later, at 2;0.7, which warrants the classification of the early utterance as an unanalyzed string. The 20% finite predicates in Niek's first sample (age 2;7) represent 5 tokens of the same type, viz *mag niet* 'may not'.

Age	Vfin	Vnonfin	Total	Overlap
1;9.6	0	3	3	0
1;9.20	1	12	13	0
1;10.3	1	14	15	0
1;10.17	2	23	24	1
1;11.3	6	33	38	1
1;11.10	8	40	45	3
1;11.25	9	46	52	3
2;0.7	12	51	58	5
2;0.28	15	56	64	7

Table 2a. Cumulative numbers of verbs in V2-position, sentence-final position; overlap between the two sets. Peter's corpus, first half.

The percentage of simple finite predicates increases slowly over the first three months. At 1;11.3, Peter produces a nontrivial number of finite verb types, all of which are modals: *ga* 'go', *kan* 'can', *moet* 'must', and *mag* 'may'. At age 2;8, nearly all Niek's finite constructions are of the form *(adverb +) verb + negator/adverb*, in which the verb is one of the modals *gaat* 'goes', *hoeft* 'needs', *kan* 'can', *mag* 'may', or the main verb *past* 'fits'. At 2;10, the finite main verbs *doet* 'does', *pak* 'take', *hou* 'hold' and *komt* 'comes' are added.

Age	Vfin	Vnonfin	Total	Overlap
2;7	1	10	11	0
2;8	5	20	24	1
2;10	10	20	28	2
2;11.10	13	29	36	6
3;0.9-10	20	43	54	9
3;0.21	22	45	58	9
3;0.27-28	25	50	63	12
3;1.2-5	31	61	76	16
3;1.12-16	33	72	86	19

Table 2b. Cumulative numbers of verbs in V2-position, sentence-final position; overlap between the two sets. Niek's corpus, first half.

Do these early forms reflect a productive, syntactically motivated distinction between finiteness (V2) and nonfiniteness? Tables 2a and 2b present the numbers of verbs appearing in the V2 position (i.e., finite forms) and in the sentence-final position (i.e., nonfinite forms), as well as the overlap between these two sets. In the first three samples, none of Peter's finite forms, and only two of Niek's (*past* 'fits' and *doet* 'does') have non-finite counterparts. In other words, during the first few months of the period of observation, the children appear to have two largely distinct set of verbs, one with nonfinite morphological and distributional features, the other with finite characteristics. Similar observations have been reported by De Haan (1987), for Dutch, and, recently, by Ferdinand (1994), for French. Thus, it seems that the distinction between finite and nonfinite is lexical, rather than syntactic.

3.2 The appearance of periphrastic predicates

Figures 1 and 2 show that periphrastic predicates appear later than simple predicates. In view of the critical nature of this structure with respect to the availability of a functional category, the order of appearance of subject-initial and non-subject initial sentences with simple and periphrastic predicates is shown in Tables 3a and 3b. It can be observed that the first periphrastic predicates do not involve subjects, or, if a subject is present, they display the inverted S-Vfin order. This pattern appears to mirror that of the simple finite predicates. The first periphrastic predicates with a sentence-initial subject occur at age 2;0.7 in Peter, and 3;0.9 in Niek.

It could be argued that the Vfin-Subject structures are CPs in which the finite verb has moved to Comp, and the subject remains in the specifier of IP. If the Complementizer Phrase were available, we would expect to find at least some instances of non-subject topicalization, and, possibly, Wh-question formation. The first object topicalizations occur in Peter at age 2;1.26, concurrently with the first Wh-questions. Niek produces his first object topicalization at 3;0.28, and the first sentence that can be analyzed as a Wh-question (in fact the preposed element is a clitic [t]) is found at 3;1.16. There is one utterance scored as Wh at age 2;11.10, but this appears to be an unanalyzed string. Examples of object topicalizations are given in (11) and (12). Early Wh-questions are illustrated in (13) and (14). Non-subject topicalizations are attested at earlier ages, but virtually all of these involve locative adverbs. The status of these elements is unclear. They may, by nature, be adjuncts, and they are as such uninformative with regard to the category of the clausal projection.

(11) dat heb ik ∂ Jopie (ge)kregen (N. 3;2.13)
that have I J. got
'I got that from J.'

(12) dat heef(t) Peter gedaan (P. 2;1.26)
that has P. done
'Peter did that'

(13) (wa)t is dat hee? (N. 3;1.16)
what is that hey?
'what's that?'

(14) waar (i)s ie nou? (P. 2;1.26)
where is he now?

Peter	Single Vfin			Periph. Predicate		
Age	NoS	SVfin	VfinS	NoS	SVfin	VfinS
1;9.6	–	–	–	–	–	–
1;9.20	2	?1	–	–	–	–
1;10.3	–	–	–	–	–	–
1;10.17	–	?1	–	–	–	–
1;11.3	3	1	5	2	–	1
1;11.10	–	2	1	2	–	–
1;11.25	–	2	1	–	–	–
2;0.7	2	7	4	3	3	–
2;0.28	4	20	5	1	8	–
2;1.13	4	22	9	–	16	1
2;1.26	12	28	18	2	16	4
2;2.3	19	34	39	2	8	10
2;3.7	32	119	149	5	14	14
2;3.21	8	93	52	6	37	5
2;4.12	12	151	77	6	47	42

Table 3a. Peter: finite predicates (tokens). NoS: no subject; SVfin: subject-finite verb (normal order); VfinS: finite verb-subject (inversion order).

It might be the case that the Vfin-Subj sentences that are observed before the appearance of overt object-topicalizations and Wh-questions are instances of *topic drop*. That is, a phrase may have moved to the specifier of CP, and subsequently dropped. This process is ubiquitous in both adult and child Dutch (see De Haan & Tuijnman, 1988). Some of the Vfin-initial sentences in the corpora appear to involve null object topics or Wh-phrases (examples 15 and 16). This may be interpreted as evidence for the early availability of the CP projection. However, the first putative cases of topic drop are observed when the corresponding overt constructions have not yet appeared. This prohibits the conclusion that these null topics are in effect represented in the underlying phrase marker at this stage. At best, they are inferred by adult listeners.

(15) ə gaat Peter dicht doen (P. 2;1.26)
goes P. close do
'Peter's going to close (this)'

(16) heeft jij (ge)daan? (N. 3;1.17)
has you done?
'(what) have you done?'

Niek	Single Vfin			Periph. predicate		
Age	NoS	Svfin	VfinS	NoS	SVfin	VfinS
2;7	5	–	–	–	–	–
2;8	10	2	6	–	–	1
2;10	4	1	5	–	–	3
2;11.10	15	8	6	3	–	–
3;0.9–10	9	27	17	6	3	3
3;0.21	1	8	1	–	4	–
3;0.27-28	5	19	2	2	1	1
3;1.2-5	2	27	5	12	10	4
3;1.12-16	8	38	9	5	4	3
3;1.17-18	25	85	30	10	25	12
3;1.25	4	12	5	6	1	1
3;2.13	7	17	4	4	7	1
3;4.1	15	43	84	5	24	17
3;4.9	7	29	41	3	6	12
3;4.12-18	12	22	58	4	7	18
3;4.24-26	10	60	58	8	23	21
3;4.27	7	26	53	4	12	20
3;5.0	3	39	31	7	19	14
3;6.0-4	13	11	67	2	6	31
3;6.7-8	37	49	86	22	32	55

Table 3b. Niek: finite predicates (tokens). NoS: no subject; SVfin: subject-finite verb (normal order); VfinS: finite verb-subject (inversion order).

Figures 1 and 2 show that both subjects continue to use root infinitives after the appearance of periphrastic (Aux-V) predicates, although at this time the frequency of this construction type diminishes more rapidly than in the preceding period. Boser, Lust, Santelmann and Whitman (1992) have suggested that root infinitives are in fact Aux-V constructions which contain a phonetically unrealized (null) auxiliary. However, extending the first criterion for the availability of V2 mentioned in the Introduction, it is assumed that as long as overt auxiliaries are not observed, there is no ground to assume the existence of null auxiliaries. This implies a structural contrast; early root infinitives lack an AgrS, whereas late root infinitives may have one that is not realized.

One possible prediction is that, if nonfinite constructions contain a null auxiliary, we should be able to find topicalized non-subjects in them, e.g., object–(null aux)–subj–Vnonfin (Poeppel & Wexler, 1993). However, such constructions are systematically absent. Boser et al. (1992) suggest that the reason for this is that null auxiliaries need to be identified in a spec-head configuration by a subject that bears the same phi-features as the auxiliary.

Another way to test the hypothesis would be to assess the intended meanings of the nonfinite constructions. The assumption here is that a null auxiliary's contribution to the meaning of utterance is similar to that of a corresponding overt auxiliary. Obviously, the lexical content of a phonetically unrealized auxiliary is unknown. However, on structural grounds, it is likely that it will correspond to one of the modals. The prediction then is that root infinitives have an *intensional* reading, i.e., refer to a desired-for or future event or action. Krämer (1993) reports evidence in support of this prediction, based on contextually based interpretation of Dutch and German child utterances. If root infinitives do not comprise a null-auxiliary, they are expected to refer to an ongoing event or action. This can be labelled *extensional* meaning (the terminology is taken from van Zonneveld, 1993).

In summary, we expect a contrast between root infinitives occurring before and after the acquisition of the overt auxiliary construction with respect to their (potential) meaning. After the acquisition of Aux-V, we expect them to systematically display a meaning akin to that of a sentence containing an overt modal. Before, it is not impossible for the root infinitives to display a modal meaning, but, crucially, we would expect them to occasionally have a non-modal, i.e., an extensional, reading as well.

To test this prediction, all subject-containing root infinitives produced by Niek from 2;7 through 3;2.13 and by Peter from 1;9.6 through 2;1.26 were classified as having either an *intensional* or an *extensional* meaning, on the basis of cues taken from the ongoing conversation, in particular the adult interlocutor's utterances before and after the child's utterance, and the information on the non-linguistic context.

Peter	Intensional	Extensional	???	Total
1;9.6-1;1-1.25	138 (59.7%)	33 (14.3%)	60 (25.9%)	231 (100%)
2;0.7-2;-1.26	69 (75.8%)	3 (3.3%)	19 (20.9%)	91 (100%)

Niek	Intensional	Extensional	???	Total
2;7-2;1-1.10	18 (35.3%)	3 (5.9%)	30 (58.8%)	51 (100%)
3;0.9-3;-2.13	43 (52.4%)	3* (3.7%)	36 (43.9%)	82 (100%)

Table 4. Interpretation of subject-initial root infinitives. *Note: all of these have past reference.

Table 4 presents the results of this analysis. The corpora were split into two parts: before and after the appearance of subject-initial sentences with periphrastic predicates. The tables show that a fairly large proportion of the utterances could not be classified. It is clear that the majority of all classifiable infinitives have an intensional reading, both before and after the appearance of Aux-V structures. Nonetheless, the number of extensional readings is considerably less in the late sections of the corpora than in the early sections. In Peter's corpus, the numerical difference between the two sections reaches statistical significance ($\chi^2 = 9.19$, df= 1, $p < .005$). For Niek's data, the chi-squared statistic is not significant ($\chi^2 = 1.07$, df = 1). However, it should be noted that the 3 cases of extensional reading in Niek's late section are exceptional, in that they all represent past reference.

4. Discussion

The results provide evidence for an early 'nonfinite' stage in the acquisition of Dutch. During the first samples the subjects did not use finite verb forms (with the exception of a few isolated cases, which can be interpreted as unanalyzed strings). This finding agrees with previous suggestions that younger children produce higher proportions of nonfinite structures than older children (Platzack, 1990; Krämer, 1993; Wijnen & Bol, 1993). More specifically, it is in exact correspondence with Behrens (1993) results from an extensive analysis of spontaneous speech data of 7 German children. Also, cross-sectional studies of the acquisition of Dutch morpho-syntax indicate an early nonfinite stage (Verhulst-Schlichting, 1985; Bol, 1994).

The results further show that the three criteria for the presence of a functional head hosting Verb Second are attained in succession. First, isolated finite forms appear but these do not have non-finite counterparts (i.e., no overlap between the sets of finite and non-finite verbs). In the next phase, finite and nonfinite constructions do not only appear next to one another, also—crucially—**the same verbs** (lemmata) may optionally surface with finite and nonfinite attributes. This may be called the optional infinitive stage (Wexler, 1994). Finally, some 3 (Peter) to 5 (Niek) months after the onset of compositional speech, the subjects start to use Aux-V predicates. At this time, there is sufficient evidence for the availability of a functional projection above the VP. Since only subjects (and some locative adverbs) occur left-adjacent to the finite verb, there is reason to believe that this projection corresponds to AgrSP. It is remarkable that finite predicates with inversion order appear somewhat earlier than those with the canonical order, but there is no positive evidence that these are CPs.

The results do not *refute* the Full Competence hypothesis, since all attested structures can be generated by an adult-like grammar. However, at the same time, it seems that Full Competence significantly overgenerates, particularly for the early stages. Moreover, the systematic changes in the children's syntactic repertoire over time are hard to explain with a Full Competence approach. It is not clear why a complete clausal representation system would at first be incapable of representing finite verbs, and subsequently accept single finite verbs but not periphrastic predicates, before it generates all possible verbal predicates (unless certain far-reaching auxiliary assumptions are made, which turn out to be quite problematic; see Wijnen, in prep.).

It is relatively easy to interpret the present results in terms of incremental acquisition. Initially, the sentential projection would correspond to VP. The early single finite predicates may represent a second type of VP—one that is head-initial rather than head-final. Alternatively, in the light of the lack of subjects in the very first finite sentences, it is possible that they do not belong to the verbal category at all. The transition from the nonfinite stage to the optional infinitive stage reflects the acquisition of the first layer of the functional architecture. The finding that early root infinitives may have an extensional meaning whereas those produced after the appearance of periphrastic predicates are exclusively intensional agrees with this interpretation.

Incremental acquisition is not only suggested by the order of first production of the various verbal predicate types, but also by a remarkable pattern in the relative proportions of verbal predicates as a function of age. For both subjects, the frequency of nonfinite predicates decreases gradually during the first part of the period of observation. After approximately 4 months, the curves' slopes steepen. Interestingly, the change of slope occurs at the time when the subjects' language output fulfills the three criteria for the presence of a functional category. Specifically, the first Subj-Aux-V constructions co-occur with the onset of the accelerated decrease of nonfinite structures (age 2;0.7 in Peter, 3;0.9 in Niek). Most plausibly, the fast decline of nonfinite constructions indicates that the syntactic machinery underlying Verb Second is in place and operational at that time. Thus, the qualitative and quantitative results converge.

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Departments of Psychology and Linguistics
University of Groningen
Grote Kruisstraat 2/I
9712 TS Groningen, Netherlands

f.n.k.wijnen@ppsw.rug.nl
http://www.let.rug.nl/Linguistics/Wijnen.html