Development need not be embarrassing: The demise of the Root Infinitive and related changes in Dutch child language

Elma Blom, ACLC – University of Amsterdam

Frank Wijnen, UIL OTS – Utrecht University

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address correspondence to:

Frank Wijnen

Utrecht Institute of Linguistics OTS

Utrecht University

Trans 10

3512 JK Utrecht, The Netherlands

e-mail: frank.wijnen@let.uu.nl

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Abstract

Much recent work on early child grammar is motivated by the full competence hypothesis, according to which children have complete adult syntactic knowledge from the outset of language development. While full competence is a theoretically and methodologically sound basis for language acquisition research in general, it appears to fail in dealing with a prominent and defining characteristic of language acquisition, viz. systematic grammatical advances in children's language output. This study aims to demonstrate that such developmental changes can in fact be explained by independently motivated linguistic principles and mechanisms. The focus is on the Optional Infinitive (OI) stage. On the basis of longitudinal analyses of spontaneous speech data of six monolingual Dutch children (aged 2-3;6) we show that various developmental changes occur during this stage pertaining to the relative proportions of finite and non-finite sentences, the overlap between the sets of finite and nonfinite verbs, the pattern of subject ellipsis ('pro-drop'), and the interpretation of root infinitives. We argue that these changes have a common source, namely the acquisition of inflectional morphology, which in its turn is propelled by qualitative and quantitative lexical growth.

1. Introduction

A cornerstone of generative approaches to the acquisition of grammar is the innateness hypothesis (Chomsky, 1981, and elsewhere). Assuming that children are born with knowledge of the universal structure of language[1] has several advantages, of which we name three. First, learnability is guaranteed, as the learner's hypothesis space is constrained, and the recognition of relevant triggers is ensured. Secondly, it accounts for the general observation that children learn grammar quickly, effortlessly, and uniformly across languages and cultures. Thirdly, it explains why children go beyond the input, and overgeneralize rules.

We focus on the second point, which pertains to the developmental history of language in an individual. Rizzi (2002) has remarked that innatist approaches to this aspect of language acquistion have been less numerous and fruitful than studies of the nature of early grammar. Some researchers have explored the possibility that development is, in fact, non-existent. They assume that the target grammar is effectively in place at the time the child begins to produce structured utterances, or possibly even earlier. For example, Poeppel and Wexler write that as children begin to produce utterances with clause-like structures, they have "full knowledge of the universal principles and processes that underlie clause structure" (Poeppel and Wexler, 1993: 29). Additionally, a very early learning process (i.e., parameter setting) supplies the language-specific details of the innate grammatical matrix (see e.g. Wexler, 1998). This may be a theoretically and methodologically viable perspective, but it seems to have engendered a lack of interest for what is normally seen as the hallmark of language acquisition, viz. that children's sentences become more complete and adult-like over time. Full-competence theorists have gone at all lengths

to highlight the structural similarities between young children's utterances and adult sentences, and consequently downplay the differences between the two (see, for example Boser et al., 1992, Harris and Wexler, 1996, Pierce, 1992, Poeppel and Wexler, 1993, Sano and Hyams, 1994, Schütze, 1997, Verrips and Weissenborn, 1992, Wexler, 1994, Wexler, 1998). It seems as if any observation suggestive of a developmental difference poses an embarrassment to the basic premise of full competence. Other theorists, for instance Lebeaux (1988), Radford (1990), and Powers (1996), have attempted to address the developmental issue by assuming a single transition from an incomplete to a mature grammar, i.e., maturation of the functional projections. It should be clear, however, that such a concept is still uncomfortable with gradual developmental change.

Our contention is that a full understanding of language acquisition can only be attained by comparing children's output patterns over time, and acknowledging and explaining the changes observed. An explanation of language change in children need not be embarrassing to full competence (or, for that matter, innateness in general) at all. In this paper we argue that the gradual changes in children's linguistic output as a function of age are the result of an interplay between morphology and syntax. These two domains of grammar need to be distinguished from each other in terms of acquisition processes. We assume that (language-specific) *syntax* is a very early attainment. Productive morphology (inflection), by contrast, is the result of an extended and gradual learning process. The changes observable in children's language as a function of age reflect the effects of a gradually changing morphological system on the realization of the syntactic matrix.

2. The Optional Infinitive Stage

We concentrate on a stage that has figured prominently in recent debates on children's linguistic competence: the Optional Infinitive (OI) Stage (Wexler, 1994). Children in this stage, who are generally between ages two and three, use non target-like infinitival main clauses ('root infinitives', see the examples 1-4) and adult-like finite sentences alternatingly. The observed optionality is intriguing: children seem to know how to create and use finite sentences, but nonetheless use root infinitives in contexts where adults do not (Avrutin, 1999, Ferdinand, 1996, Schütze, 1997). Despite the fact that root infinitives are a marginal phenomenon in adult language, several researchers have described the root infinitive stage as compatible with full competence (Boser et al., 1992, Hoekstra and Hyams, 1995, Rizzi, 1992, Rizzi, 1994, Sano and Hyams, 1994, Wexler, 1994, Wexler, 1998). In connection to this, they treat the Optional Infinitive Stage as a stable phase in language acquisition – we will refer to this as the *uniformity assumption*. In this section we explain the main empirical arguments in favor of full grammatical competence during the OI Stage.

(1) a. Vrachtwagen emmer doen — Matthijs 2;04.24
Truck bucket do (INF)
'put truck in bucket'

b. Jij moet de vrachtwagen in de emmer doen
You need (FIN) the truck in the bucket do (INF)
'you have to put the truck in the bucket'

(2) a. Op kist zitten — Josse 2;08.04

On box sit (INF)

'sit on box'

b. Ik wil op de kist zitten

I want (FIN) on the box sit (INF)

'I want to sit on the box'

(3) a. Ah, mij bril vallen Abel 2;05.27

Ah, my glasses fall (INF)

'my glasses fall'

b. Ah, mijn bril valt

Ah, my glasses fall (FIN)

'my glasses fall/are falling'

(4) a. Boot varen Laura 2;04.01

boat sail (INF)

'boat (is/will be) sailing'

b. De boot vaart

the boat sail (FIN)

'the boat is sailing'

Poeppel and Wexler (1993) observed a morphology-position correlation of verbs in the utterances of children who acquire German, a Verb Second language. Infinitival verb forms are almost without exception in sentence-final position, whereas verbs with finite suffixes are placed in second position, exactly as in standard adult German. Poeppel and Wexler conclude from this that the target grammar is in place

by the age of two. Analogous observations have been made in non-V2 languages. For example, in child French, the negation particle *pas* typically occurs before infinitival verbs, and after finite verbs, in accordance with adult French (Pierce, 1992). In a similar fashion Harris & Wexler (1996) showed that in early English child language morphologically finite and nonfinite verbs are virtually always positioned correctly with respect to the negator 'not'.

Subject use during the OI stage has also been argued to reflect full grammatical competence (Hamann and Plunkett, 1998, Krämer, 1993, Sano and Hyams, 1994, Schütze, 1997). The critical observation is that root infinitives predominantly have null subjects (i.e. subjects that are not phonetically realized), whereas finite sentences have spelled-out subjects.[2] Following Chomsky (1981), this pattern agrees with the properties of the adult grammar, since infinitival clauses do not license overt subjects (ignoring Exceptional Case Marking contexts). The contrast between the minimal pair (5) - (6) illustrates the point: the ungrammatical sentence in (5) contains an infinitival clause with an overt subject, whereas the alternative with a null subject – here expressed by the empty category PRO – in (6) is grammatical:

(5)	*Het	is	verkeerd	hij	weg	te	gaan
	it	is	wrong	he	away	to	go (INF)
	'it is wrong him to go away'						

(6)	Het	is	verkeerd	PRO	weg	te	gaan
	it	is	wrong		away	to	go (INF)
	'it is wrong to go away'						

We cannot review all evidence that has been brought to bear on the issue of full grammatical competence vis-à-vis the optional infinitive phenomenon. The general conclusion, however, should be clear: all grammatical principles of the target language are in place in the OI stage. The one difference between the OI-stage grammar and its adult counterpart is optionality of finiteness in the former, which may pertain to either Agreement or Tense or both (Avrutin, 1999, Hyams, 1999, Guasti & Rizzi, 2000, Schütze, 1997, Wexler, 1992, Wexler, 1994, Wexler, 1998). Various explanations have been put forward to account for this optionality. In some approaches the child's grammar is portrayed as comprising a single non-target-like feature (e.g. Wexler, 1998). Some explain it as the result of a processing limitation (e.g. Phillips, 1995), and recently the difference between children and adults has been located at the syntax-discourse interface: children have a full command of syntax, but they do yet not know in which contexts finite structures are obligatory (Avrutin, 1999, Hyams, 1999, Lasser, 1997).[3]

3. Developmental Change in the OI Stage

It should be clear from the above that full competence analyses of the OI stage imply a single developmental transition, in which either the one non-target-like property of syntax is discarded, or the syntax-discourse interface restriction is relieved. This is based on the idealization that the OI stage is uniform: the grammatical properties of children's sentences are invariant up to the point in time where the purported transition of the grammatical competence (or interface system) takes place. In the following paragraphs, we argue that the uniformity assumption is not based in empirical fact. We discuss four developmental phenomena in the optional infinitive

stage: (1) changing proportions of root infinitives, (2) no-overlap (or non-optionality of finite and non-finite verbs), (3) changes in subject drop, and (4) the so-called 'modal shift'. Subsequently, we present a hypothesis that binds these phenomena together.

Changing proportions of root infinitives

Several studies report that finite verbs are highly infrequent or in some cases even virtually absent from children's repertoires close to the onset of syntactically significant production. Wijnen (1997) reported longitudinal data on the syntactic development of four Dutch-speaking boys. The sampling of data started when the children were in the beginning of the two-word stage, with Mean Length of Utterance values between 1.2 and 1.5. During the first 10 weeks of the observation period, the percentages of root infinitives in 3 out of the 4 children (MAT, NIE, and PET) were between 70% and 100%. The fourth child (JOS) produced relatively many finite verb tokens in some of the early samples (up to 60%), but nearly all of these were taken from the same limited set, and were used in stereotypical utterances, suggesting that productivity was still lacking. Generally, the decrease of the proportion of root infinitives was gradual, and could be characterized by an S-shaped curve.

Observations reported in other studies confirmed Wijnen's findings. Gillis (2003) notes that the Dutch-speaking girl Jolien

> "starts out with two [non-finite, EB & FW] forms: first the bare verb (at 1;5) and the infinitive (at 1;6). Except for the first month, the –en infinitive occurs much more frequently and with many more verbs (lemmas) than the bare stem. Other types of verb forms come in later: the –t form at 1;9, the past form at 1;10, the past participle at 2;1 and the present plural at 2;4. All of the latter

are infrequent when they first appear, both in terms of lemmas and tokens." (p. 188).[4]

Gillis' data support the existence of an early non-finite stage. The decrease of Root Infinitives over age is confirmed by Haegeman's (1994, Haegeman, 1996) longitudinal data from later phases of the RI stage in Dutch-speaking children. The percentages of root infinitives produced by one of her subjects, Hein, were 23 (89/385) at age 2;4 and 6 (24/397) at 3;1. In the other child, Thomas, the percentages were 56 (77/138) at 2;3 and 6.5 (23/359) at 2;11.

This developmental trajectory, characterized by a scarceness of finite verbs in the early stages and a gradual growth of finite clauses taking place at the expense of the use of root infinitives, is not limited to child Dutch, but can be seen in other Germanic child languages as well. Behrens (1993), on the basis of a longitudinal study of 7 German-speaking children, concludes that early verbs are mostly nonfinite. Finite verb forms attested early generally appear to represent fixed (non-analyzed) forms; Behrens does not find evidence for productive tense or agreement marking in the early stage.

In a recent single case study of Icelandic acquisition, Sigurjónsdóttir (2005) notes that in the earliest recordings, between ages 1;1.1 – 1;2.29, 73% of all verbs (47 out of 64) are infinitives. However, from the 17 a majority (15) contained the form *á* 'owns' or *má* 'may'. Since these verbs have irregular infinitives which children generally do not use until they are much older, Siggurjónsdóttir argues that the attested forms are not generated by a (productive) morphosyntactic process. Only the finite verb *liggur* 'lies', which is uttered twice during this early period, is a true finite form. Discarding *á* and *má* leaves 49 unambiguously classifiable verbs, of which 47 (96%) are infinitives. Just as in the Dutch and German data, the proportion of

infinitives drops gradually in the Icelandic child's output. Between ages 1;3.0 – 1;4.27, 448 out of 496 unambiguous verb forms (90.3%) are infinitives. Between 1;4.15 and 1;4.27 the percentages is down to 88; two months later it is 44%, and percentages around 10 and lower are reached at approximately age 2;3. The decline of root infinitives in Icelandic, as well as Dutch and German, is mirrored by a commensurate growth of finite constructions of various types. This is in clear opposition to the uniformity assumption, and, perhaps even more importantly, it contradicts a defining characteristic of the OI stage: During the earliest phase of grammatical development, finiteness is not optional, it is non-existent.

No overlap

In a qualitative analysis of the utterances of one Dutch boy, G. De Haan (1987) observed that the verbs in the child's repertoire constituted two classes, which were semantically, morphologically and syntactically distinct. He labeled them *Aux* and *V*. The Aux elements were morphologically finite, occurred in V2 position, and comprised modals and state verbs. V elements, on the other hand, were nonfinite, sentence-final, eventive verbs. Subsequent studies of Dutch child language provide support for De Haan's observations (Jordens, 1990, Wijnen, 1998, Wijnen, 2000), although the no-overlap claim has remained controversial, in particular for methodological reasons. Poeppel and Wexler wrote:

> "... the argument that there is no syntactic similarity between verbs used in second position and verbs used in final position is hard to defend in this context. Moreover, the claim that there is no semantic overlap between sets [finite and non-finite verbs, EB & FW] is difficult to maintain ..." (Poeppel and Wexler, 1993 p. 12).

If true, 'no overlap', and its corollary, increasing overlap (since, eventually, the adult grammar evidently will allow all verbs to be used both as finite and infinitive forms), pose a challenge to the uniformity assumption. Moreover, 'no overlap' would contradict a strong interpretation of 'optionality' with regard to the OI stage. If particular verbs exclusively appear as finite forms, and others exclusively as infinitives, optionality of finiteness obviously does not exist at the level of lexical items.

Subject drop

One of the arguments used to support a full competence analysis of the OI stage comes from the observation that children's finite clauses are associated with lexical subjects, whereas root infinitives tend to have null subjects. A longitudinal analysis of subject use in the OI stage, however, necessitates an alteration of this picture. Blom and Van Geert (2004) described the development of subject use in the finite sentences and root infinitives in six Dutch-speaking children (the same children that we study in this paper). During the first phase of the OI stage[5] the proportions of dropped subjects in root infinitives and finite sentences decreased in parallel. In the subsequent phase, subject drop in finite clauses continued to decrease, but at the same time it *increased* in root infinitives. Averaging over the six children, it turned out that during the OI stage the proportion of dropped subjects in finite sentences shows an ongoing decrease from an initial proportion of 91.7 % at the onset of the OI stage to a final proportion of 22.8% at the end of the OI stage. The proportion of dropped subjects in root infinitives was initially 100%, then drops to 67.5%, but, crucially, goes up again to 83.7% at the end of the OI stage.

Only at the end of the OI period, there was a clear distinction between finite and nonfinite clauses, similar to what we see in adult Dutch: subjects were normally absent in root infinitives and normally present in finite sentences (at the end of the OI stage, 83.7% of the root infinitives contains a null subject and 77.2% of finite sentences contains an overt subject). Thus, what Blom and Van Geert report is a U-shaped developmental pattern for the use of null-subjects in root infinitives (relative decrease followed by relative increase; for details on the statistical significance of this pattern, we refer to Blom (2004 p. 208-212), and for a replication of the findings, see Gillis (2003).[6] This pattern goes against the uniformity assumption, and may also indicate that the principles regulating subject realization are subject to change.[7]

Modal shift

As the full competence hypothesis concerns morphosyntax, it may seem strange to discuss the *interpretation* of finite clauses and root infinitives here. However, recent work has shown that this can shed light on the structure underlying early finite and nonfinite sentences (Ferdinand, 1996, Hoekstra and Hyams, 1998, Wijnen, 1998). The phenomenon we concentrate on is a gradual change in the interpretations of young children's root infinitives within the time/aspect/modality domain. Blom (Blom and Wijnen, 2000, Blom, 2002, Blom, 2003) found that at the outset of the OI stage, Dutch-speaking children use root infinitives to denote ongoing activity (~ present tense/progressive) as well as future or possible events (~ modal). On average, the proportion of modal root infinitives in the data of six children – again the same six studied in this paper – initially ranges between 52% and 78% (average: 63%). This has been taken to mean that infinitival verbs are underspecified in the tense/aspect domain.[8] Later in the OI stage the proportion of root infinitives with a modal

interpretation rises in the data of all six children (range: 65% - 87%; average: 80%). Thus, as the proportion of finite sentences increases, the root infinitive gradually acquires a more restricted denotation. Statistical details on the relevant data can be found in earlier work (Blom and Wijnen, 2000, Blom, 2002, Blom, 2003).

We refer to this phenomenon as the *modal shift*. Similar observations have been reported by various researchers, working on various languages. Sigurjónsdóttir's (2005) Icelandic case study reveals that before age 1;4, when finite verbs are still virtually absent, infinitives can refer to ongoing, past as well as not-yet-realized events, whereas finite verbs only refer to ongoing or past events. Later on, at 1;4.27, approximately 50% of the root infinitives have a modal interpretation, and after this age, the percentage of modally interpreted root infinitives rises further, from 66% at 1;5 to over 70% at 2;3.9. The upshot is that infinitives in the early phase are used both modally and non-modally. By contrast, in later phases, when finite verbs have gained firm footing, infinitives are mainly associated with modal interpretation.

Reports on German, Hebrew and Swahili child language contain remarks supportive of the modal shift as a cross-linguistic phenomenon. Behrens (1993), in her study of temporal reference in German language writes that in the early phases, "infinitives are used to encode prior, simultaneous and future situations as well as abstract properties and occasional references to the remote past." (o.c., p. 142). Armon-Lotem (1995) writes about Hebrew: "Declarative root infinitives, are almost nullified after person morphology is acquired, while modal use of root infinitives is the last to disappear." (p. 77). Deen & Hyams (2001) report that "the Swahili results are reminiscent of the "modal shift" that occurs in the acquisition of Dutch" (p. 138), referring to an increase of subjunctive verbs (tokens) – which Deen & Hyams identify

as the Swahili equivalent of the infinitival form in languages like Dutch – as well as an increase of the variety of subjunctive verbs and irrealis meanings (types).

Note that the free temporal/aspectual interpretation of root infinitives in the early stages is in itself not incompatible with a full competence analysis of the OI stage. After all, since infinitival verbs are temporally/aspectually underspecified in the adult language, we expect the same in child language. The modal *shift*, however, poses a problem for the uniformity assumption.

4. A proposal

We have reviewed a number of observations indicating that the OI stage is not uniform with respect to the observable properties of children's sentences. Verbs that appear as infinitives and as finite forms initially have been claimed to constitute non-overlapping sets, which gradually merge into one. In parallel with this, the proportion of root infinitives decreases over time. With respect to subject use, root infinitives and finite sentences gradually come to conform to the adult grammatical standard. Finally, the range of possible interpretations of root infinitives shrinks as they reduce in number and finite sentences gradually become the preferred option. In this section, we argue that these developmental changes are intrinsically related. We sketch a hypothesis explaining the observed pattern of development, which has as a crucial characteristic that it disentangles syntax and morphology.

Studies advocating full grammatical competence in the OI stage often argue that knowledge of both syntax and morphology is complete at a very early stage. According to Wexler (1998 p. 74): "Children set parameter values correctly at the earliest observed ages (*Very Early Parameter Setting*). Moreover, they are masters of inflectional morphology, at least with respect to the central cases that have been investigated (*Very Early Knowledge of Inflection*)." Less explicitly, Wexler assumes

that properties of inflectional elements and properties of syntactic variation are basically the same thing (Wexler, 1998 p. 25). Hyams (2001) argues for "early morphosyntactic convergence": children in the two-word stage understand verb morphology to the extent that they associate different affixes with different features (e.g., the infinitival affix is mapped to a modal feature). As another example in point, Guasti (1994) observes that Italian children under the age of two hardly make errors in subject-verb agreement, and concludes that (morphological) inflection as well as (syntactic) specifier-head agreement are in place.

To understand the developmental patterns reported in the previous section, it is crucial to distinguish between the development of syntactic and morphological competence. We start by assuming that there is an *asymmetry* in the acquisition of syntax and morphology; as stated in (9).

(9) SYNTAX-MORPHOLOGY ASYMMETRY: Syntax is early, morphology is late.[9]

The observation that finite verbs are initially restricted to a small set of verb types that do not also surface as infinitives is difficult to reconcile with an early command of morphology. Conceivably, that particular verbs occur only as one form (e.g. infinitive), but not another (finite) might be due to some unknown filter – grammatical or otherwise. However, there is no principled hypothesis at this time about the nature of such a filter. The simplest assumption is that a certain form does not occur because the child's linguistic system is incapable of generating it. Our interpretation, therefore, is that children cannot freely select a verb stem to add finite or infinitival morphology to. Rather, the observed growth of lexical overlap between verb types in finite sentences and root infinitives suggests that verbal inflection *becomes* productive

during the OI stage. Our assumption is that the syntactic matrix is in place very early, but this assumption does by no means force the conclusion that children always make use of adult syntactic rules from onset on. It has repeatedly been suggested that children make use of word combinations stored in memory without having been fully analyzed (e.g. Freudenthal et al., in press, Mintz, 2003, e.g. Tomasello, 2003). We surmise that if this is so, they continue to do so until they have access to the morphological knowledge required to apply syntactic rules.[10]

According to various theoretical proposals, the acquisition of inflectional rules consists of three sub-processes: *mapping*, *segmentation* and *learning of exceptions* (Bittner et al., 2003, Peters, 1982, Pinker, 1984). Mapping is the listing of arbitrary pairs of phonological forms and grammatical features. With respect to verbal inflection in Dutch, a child must ultimately arrive at the list of mappings for the finite paradigm given in (10). We assume here a simple feature system with privative features and underspecification, based on feature systems as proposed by Kerstens (1993) and Harley and Ritter (2002). PRES stands for 'present tense', SP for 'speaker' – the speaker-addressee distinction provides an alternative description of the more traditional system that distinguishes between 1st, 2nd and 3rd person – and PL for 'plural':

(10) *-ø* → [PRES, SP]
-en → [PRES, PL]
-t → [PRES]

It is expected that acquiring target-like mappings is associated with mapping errors, such as those in (11).

(11) a. en jullie **heeft** (← hebben) ook een mes Abel 3;01.07
and you(PL) have_3SG also a knife
'and you have a knife too'

b. als ik **zwemt** (← zwem)
when I swim_3SG
'when I'm swimming'

c. tjoeketjoeketjoeke **zeg** (← zegt) de trein Josse 2;11.09
choochoo say_1SG the train
'the train goes choochoo'

d. moeder geit **gaan** (← gaat) boodschapjes doen Daan 3;02.25
mother goat go_PL shoppings do
'mother goat is going to do shopping'

Segmentation is the analysis of large chunks extracted from the input – 'indigestible chunks' in Pinker's terms (1999) – into smaller parts. Unanalyzed chunks can, but do not have to, exceed adult word boundaries. Well-known examples from English child language are *wazda* ('what is that?'), *didja* ('did you') or *wanna* ('want to'). With respect to verbal inflection, unanalyzed chunks are units that are not segmented into a verb stem and an inflectional affix. Stems and affixes are not yet listed as separate vocabulary items. As soon as children begin to segment verbal chunks, specific errors are expected. A prototypical segmentation error is the selection of a wrong stem in the case of stem-vowel-changes. Some examples are given in (12).

(12) a. deze **benne** (←zijn) ook nodig Abel 2;04.23

	these	are	also	necessary	
	'these are necessary too'				
b.	langs	**maggen** (← mogen)		komen	Josse 2;07.20
	by	may		come	
	'(be) allowed to come by'				
c.	die	**heef** (← heb)	ik	nodig	Matthijs 2;09.15
	that	have	I	needed	
	'I need that one'				

In (12a), Abel uses the first person singular form *ben* as the stem, and attaches regular plural morphology (i.e., *schwa*, as in normal colloquial usage). The correct plural target form here is, however, the irregular *zijn* and not *benne(n)*. Analogously, in (12b), Josse has taken the singular form *mag* as a basis for the stem. The target plural is *mogen*. In (12c), Matthijs incorrectly selects the non-existent form *heef* as the stem, based on the second/third singular form *heeft*, and attaches a zero-suffix (which is in itself correct). The target form, however, is *heb*.

The third sub-process is the inclusion of irregular forms. Overregularization is the prototypical error for this process: it shows that children know a rule (i.e., have segmented and mapped) but (incidentally) fail to exempt certain elements from its application. Under a rule-blocking approach to the production of irregulars (see e.g. Pinker, 1999), overregularizations are the result of a failure to retrieve an irregular item from lexical memory, which might either be due to absence of the element in the child's lexicon, or, as Marcus et al. (1992) argue, to a transitory processing problem. We would argue that these two possibilities represent successive phases in the process of including irregularity in the verbal morphological system. The examples in (13)

demonstrate how children go beyond the input. In (13a), the regular *–t* suffix is attached to the irregular modal form *kan* (13a), and in (13b), the regular past tense *–ten* suffix is combined with the irregular singular past tense form *was*.

(13) a. zo **kant** (← kan) ie niet Daan 2;04.00
so cans he not
'it doesn't work that way'

b. dat **wasten** (← waren) mooie trommels en trompetten
that was-ed_PL nice drums and trumpets
'those were nice drums and trumpets' Josse 2;11.09

Segmentation and mapping have been proposed to be achieved by analyzing the set of vocabulary items stored in the lexicon, as well as evaluating the input. We concentrate on the former. Peters (1982) pointed out two preconditions for morphological analysis: lexical and paradigmatic variation. Paradigmatic variation refers to the combination of different affixes – e.g. verbal inflections – with one and the same root or stem. Lexical variation refers to the set of different roots/stems that occur in combination with a particular affix. In order to assign morphosyntactic features to words (as long as paradigms consist of whole words) or to affixes (when word-specific paradigms are generalized to sets of affixes), minimally contrasting words or affixes are required (Pinker, 1984). For example, to be able to assign the feature 'plural' [PL] to a lexeme such as *spelen* 'play', or to the plural affix *–en*, the singular form *speel* 'play', or the null affix [–ø], has to be included in the lexicon. To determine that the lexeme *speelt*, or the suffix *–t* is [PRES], a constrasting word, such

as *spelen* or a contrastive suffix, e.g. *–en*, is needed that is not specifically associated with finite contexts.

In summary, the growth of the verb lexicon – both in terms of *lemma's* (i.e., abstracting away from inflectional morphology) and *lexemes* (inflected forms) is a necessary condition for morphological segmentation and mapping. In order to construct verbal inflectional paradigms, the learner's vocabulary must contain minimally different items, i.e., different (inflected) lexemes associated with the same verb lemma. To attain productivity of the morphological finiteness contrast, the lexicon must contain finite and nonfinite forms of the same verbal items – or, in other words, overlap. Lexical acquisition obviously is a gradual process, and, consequently, coming to grips with verbal morphology is expected to be a gradual, extended process as well. Morphological segmentation and mapping incrementally provide the materials that can be "filled in" in the syntactic matrix. Increasing overlap and the decrease of the proportion of root infinitives over age are the direct corollaries of growing morphological productivity. The question is how the changes in subject drop and the modal shift fit into the picture.

Subject drop

As pointed out earlier (Syntax-Morphology Asymmetry), we assume that syntactic principles are in place very early. Young language learners know that every sentence requires a subject (the Extended Projection Principle), that overt NP's need to be licensed (Case Theory) and that finite verbs are proper subject licensors.[11] However, as long as children have not yet specified finite verbs for finiteness and agreement features, and have thus made a distinction between finite verbs and infinitives, this grammatical knowledge is vacuous. As a consequence, we will not see a systematic

association between, on the one hand, finite sentences and lexical subjects and, on the other, root infinitives and null subjects. Acquiring the morphological distinction between finite verbs and infinitives is a prerequisite for adult-like subject selection. Since the acquisition of morphological finiteness is gradual (and may proceed on an item-by-item basis), attaining an adult-like subject-distribution takes time. Blom and Van Geert's findings (see above), in particular the observation that patterns of subject drop in root infinitives and finite sentences begin to diverge late in the OI period, are compatible with this hypothesis.

Modal shift

Dutch children's earliest verbal projections are root infinitives and root participles (i.e., equivalents of root infinitives with a past participle instead an infinitival main verb). The observed distributions of these two non-finite constructions indicate that children specify participles as [+perfective], whereas infinitives are non-specific, i.e., they appear with a wide range of temporal and modal meanings (Blom, 2003). Infinitives, however, do not appear in perfective contexts. We assume that the availability of a specific and appropriate form – the past participle – blocks the usage of infinitives.[12] Blocking mechanisms have repeatedly been proposed as crucial components of the language faculty, at various levels. They are known under various names, e.g. *Principle of Decreasing Specificity*, or *Elsewhere Principle* (Aronoff, 1976, Halle and Marantz, 1993, Kiparsky, 1973).

The underspecification of the infinitive is critical in explaining the changing meaning of root infinitives over time (the Modal Shift).[13] As soon as children add more specific, i.e., finite items to their verbal lexicon, such as the ones in (10), repeated below in (18), the blocking principle will prevent selection of infinitives in

contexts where these forms are more appropriate. As a consequence, the usage of root infinitives will decline.

(18) *-ø* → [PRES, SP]

-en → [PRES, PL]

-t → [PRES]

A prediction that can be derived from this scenario is that the modal shift correlates with an increasing use of finite verbs, which denote present tense (and, at a slightly later stage, also past tense). Such verbs come in three varieties: (1) simple finite (inflected) main verbs; (2) prepositional infinitival constructions *zijn aan het* V_{inf} 'be on the V_{inf}'; and (3) constructions with a finite 'dummy' auxiliary (*doen* 'do', *gaan* 'go') and a infinitival main verb (Jordens, 1990, Van Kampen, 1997, Zuckerman, 2001).

Overview

We begin our analysis by scrutinizing the No Overlap Hypothesis, attempting to supply it with a firmer empirical basis. Our analysis is longitudinal; it is therefore capable of pinpointing *changes* in lexical overlap. A gradual increase in overlap is indicative of a growing potential for the analysis of inflectional morphology. Verb inflection will be the second focus of our analysis. We take stock of the conditions necessary for the acquisition of verbal morphology: lexical and paradigmatic variation. Next, we look at the occurrence of errors in verbal inflection, taking these to be indicators of growing morphological productivity. Finally, we revisit the modal shift phenomenon, and relate this to the gradual rise of finite sentences.

On a methodological note, our proposal aims to provide a unified explanation for a number of correlated developmental phenomena during the OI stage. These phenomena pertain to spontaneous language production. Our proposal, however, is formulated in terms of linguistic competence. This raises the principled question whether spontaneous language production can be seen as a valid window onto developing linguistic competence. Comprehension studies suggest that children know more about grammar than their language output indicates. We will not go into this methodological issue in any serious measure, other than by stating that our proposal makes predictions for children's language comprehension, which can and should be tested. We will return to this issue in the Discussion section.

5. Method

We analyzed transcripts of spontaneous speech data of six monolingual Dutch-speaking children. All transcripts are available through the Child Language Data Exchange System (MacWhinney, 1995). Abel, Daan, Josse, Matthijs and Peter are included in the Groningen Corpus; Laura's data are in the Van Kampen Corpus. The transcriptions in these corpora are based on audio recordings made in the children's homes, in unstructured settings (e.g. playing, picture book reading, random conversations at the dinner table). The children's ages are given in Table 1.

--- insert Table 1 about here ---

Laura's sample contains files from an older age (over 3;0) than the samples from the other children (under 3;0). Laura suffered from recurrent ear-infections; her development is delayed but otherwise prototypical (Van Kampen, 1997). From each

child's corpus a number of files were selected. The data that were examined represent four *periods*, identified by the proportions of root infinitives and finite sentences (in the subsets of sentences containing a verb). In the files assigned to *period I*, finite sentences amount to (virtually) 0% (average MLU = 1.125). In the *period II* files, roughly 30% of all verb-containing utterances is finite (average MLU = 1.387). *Period III*: approximately 50% finite sentences (average MLU= 1.972); *period IV*: 80% finite sentences (average MLU = 2.607). Note that children do not jump from 0 to 30 to 50 to 80 percent finite sentences. Rather, the increase of finite sentences is gradual, and the periods are 'snapshots' taken from this gradual development. Appendix 1 gives the selected files for each child.

6. Results

6.1. Verb Overlap

In periods I/II there is hardly any overlap between verb types used in finite sentences and root infinitives. The finite verbs used are drawn from a small set, and are mostly modals, aspectual verbs and copulae (see Appendix 2), in agreement with previous observations by G. de Haan (1987), Jordens (1990), Schlichting (1996), Van Kampen (1997) and Wijnen (2000). As indicated in Table 2, the initial absence of overlap is followed by a steady increase from an average of 4.3 overlapping items in period III to an average 12.2 in period IV. These results are in conflict with the assumption that OI children freely combine verb stems with either finite or infinitival suffixes. However, before we draw this conclusion, we need to first deal with two methodological issues.

--- insert Table 2 about here ---

First, the initial absence of overlap may result from the statistical properties of the corpora. Since finite verbs occur very infrequently, the *a priori* probability of overlap is reduced. In order to test this account, we calculated the *expected* verb overlap on the basis of the distributions of finite sentences and root infinitives in each of the four stages. We assumed that the proportion of finite sentences in a set of relevant utterances, p_F, is an estimator of the probability that a verb from the child's verb vocabulary V will (on any occasion) be realized as a finite form (m.m. for the proportion of non-finite sentences, which equals 1 - p_F).[14] The estimated size of the verb vocabulary is taken to be the number of observed verb types (lemma's), i.e., the number of finite verb types added to the number of nonfinite verb types, minus the number of verbs that appear both as finite and nonfinite forms. Assuming that finite and nonfinite realization of a verb are independent events, the probability that a verb will occur *both* in finite and nonfinite forms is p_F * (1- p_F). The predicted overlap is obtained when we multiply this probability with the set size of the observed vocabulary n(V). In summary, the estimated overlap equals p_F * (1- p_F) * n(V). The hypothesis that verb stems can be freely linked to finite and nonfinite inflections will have to be rejected if expected overlap and predicted overlap are significantly different (i.e., observed overlap is lower).

--- insert Table 3 about here ---

Table 3 gives the totals for the six children per period. Binomial tests indicate that in period I/II, given the estimated probability of overlap, the probability of observing a cumulative overlap of 5 or fewer items is less than .0001. For period III,

the probability of the observed overlap or a smaller number is also less than .0001. Only in period IV, observed overlap is within the expected range (the probability of the observed overlap or a smaller number is .99). Thus, overlap is significantly smaller than predicted in periods I/II and III, but not in period IV. This can be taken to mean that a model in which all verbs in the children's output are assumed to be drawn from the same vocabulary, and the uneven likelihoods of finite or nonfinite realization are determined by some (unknown) external factor, does not apply to the early stages. Seeing that only in period IV the observed number of overlapping verbs exceeds the predicted number, we can conclude that at this point, the one-vocabulary (full-competence compatible) model is adequate. In summary, these results are in agreement with an account assuming that early in development, finite verb forms and nonfinite forms are drawn from separate sets.

However, the observation that actual overlap between finite verbs and infinitives is significantly smaller than expectation in periods I and II need not be incompatible with a full competence approach if we take into account that the distribution of finite verbs and infinitives is modulated by semantic factors. Finite verbs and infinitives may occur in utterances that differ with regard to temporal, modal or aspectual properties. In adult language, simple finite verbs tend to be used in sentences that denote present and past tense, whereas infinitives occur in modal contexts, as the complement of a modal auxiliary. This asymmetry has effects on the distributions of event- and state-denoting predicates across finite and nonfinite forms (Barbiers, 1995, McDowell, 1987, Steedman, 1977). Schlichting (1996) and Blom (2003) provide relevant observations on adult Dutch, indicating that, indeed, particular classes of verbs (non-eventives) tend to surface as finite forms, while others (eventives) appear more often as infinitives.

Conceivably, the no-overlap phenomenon in Dutch child language is semantically conditioned in a way similar to adult Dutch. To test whether this is the case, we calculated the overlap of sets of finite verbs and infinitives in the children's input. The input data we took into account were the utterances delivered by eight adults.[15] We applied the usual criteria to determine finiteness of a verb, viz. morphology and position in the sentence. Since root infinitives amount to maximally 10% of all sentences with verbs in the input, we also included infinitives contained in complex verb phrases headed by finite auxiliaries. To control for the difference between children's and adult's vocabulary size, the overlap in adult Dutch is calculated on the basis of the children's lexicon of verbs, that is, the total lexicon of all six children in all periods. The verb types contained in this lexicon are listed in Appendix 3. Not all verb types used by the children were also used by the adults. We found 126 verbs (types) that were also used by the children. 36 items in this set occurred both as finite form and infinitive. Comparing these numbers to those in Table 3 indicates that the children's lexical overlap in each of the four periods is proportionally smaller than in the adults. The differences between children and adults are statistically reliable for all periods (period I/II: $\chi^2 = 25.8$, df = 1, $p < .0001$; period III: $\chi^2 = 15.7$, df = 1, $p < .0001$; period IV: $\chi^2 = 5.02$, df = 1, $p = .025$).

In conclusion, we find evidence for the No Overlap Hypothesis in the early stages of grammatical development. Our results show that there is less overlap than expected, given the proportions of finite sentences and root infinitives in the children's output. Also, the data show that there is less overlap than expected on the hypothesis that absence of overlap in child Dutch is due to the same factors that cause reduced overlap of finite verb and infinitive verb vocabularies in adult Dutch. Overlap increases during the phase that has been identified as the OI stage. By implication,

true, lexical optionality of finiteness as implied by the Optional Infinitive Hypothesis is only attained in a relatively late phase.

6.2. The acquisition of verbal inflection

The morphological learning procedure sketched in section 4 above provides us with criteria to determine if, at a given time point, a child's lexicon fulfills the conditions for the acquisition of verbal inflection – lexical and paradigmatic variation. It also specifies a criterion to pinpoint the onset of productivity with respect to verbal inflection, viz. the occurrence of errors of various types. Given the results on the overlap between finite verbs and infinitives, we do not expect to see paradigmatic and lexical variation, or morphological errors early in the OI stage (i.e., our periods I/II). As the child gets older, lexical and paradigmatic variation is predicted to increase and errors will begin to appear.[16]

--- insert Table 4 about here ---

Table 4 shows that lexical variation within the set of finite verb forms grows steadily from period I to IV. In periods I/II there is hardly any variation: 2-9 different verbs (types) with finite inflections, whereas period IV shows a considerable increase in this respect (range from 21-33 types). Paradigmatic variation refers to the combination of a particular verb stem with different inflectional suffixes. In period I/II, paradigmatic variation is absent. This is due to the fact that the earliest finite forms are characterized by absence of overt inflection, as most of these are either first person singular forms, or irregulars: *kan* 'can', *moet* 'must', *mag* 'may', *zit* 'sit'. The result is that the collapsed data of the six children give us a total of 116 finite verbs

(tokens) in periods I/II, and only 8 of these have an overt suffix (7%). As indicated by Table 5, all children begin to display some paradigmatic variation from period III onwards. They begin to use different inflectional endings with the same verbal stem as they start to vary number and distinguish between first and second/third person.

--- insert Table 5 about here ---

It can be concluded that in period I/II there is little lexical variation and no paradigmatic variation. From period III onwards both types of variation increase. Thus, from period III onwards, the minimal conditions for segmentation and mapping appear to be fulfilled, although we stress 'minimal' here since lexical and paradigmatic variation in finite verbs remain quite restricted.[17]

Errors

As explained above, we distinguish three kinds of verb inflection errors: incorrect mapping, segmentation errors and overregularizations. In exploring the occurrence and extent of such errors, we look at a subset of data, taken from four out of the six subjects of our study: Abel, Daan, Josse and Matthijs. The verb errors produced by these four children have been analyzed in a previous study by A. de Haan (1996). Since she used the complete corpora her data have greater density and precision than ours, and cover a larger age range as well.

Table 6 gives the onset of the two-word stage for the four children, lists the age at which the earliest agreement error was observed for each child, and relates the occurrence of errors to the periods in our study.[18] The first agreement errors were observed 4 to 7 months after the onset of the two-word stage. The number of errors

increases as a function of age. To give an impression of the increase: in the last files that are available (approximately age 3;5), third person number agreement was incorrect in 25% of the third person subject contexts (on average): children used either third person singular subjects with plural inflection (*-en*) or third person plural subjects with singular inflection (*-ø* or *–t*) in 25% of the third person contexts.[19]

--- insert Table 6 about here ---

For Daan as well as Josse some early errors are found. At the age of 2;01.21, Daan utters *haw lig koekie* 'here lie cookie' and uses *lig* instead of third person singular *ligt*. We assume that this is an outlier resulting from phonological processes (e.g. Beers, 1995). Of immediate relevance for this diagnosis is that Daan at the same age omits [t] in morphosyntactically different but phonologically comparable contexts, viz. *se ach* [= is ach**t**?] 'is eight' and *chiechui:ch* [= vlieg**t**uig] 'plane'.

At age 2;0.7, Josse produces in immediate succession *koms to* [= komt zo] 'comes soon', *kom to* [= idem] and *kom niet* [= komt niet] 'comes not' while referring to a third person singular subject. We interpret the first two examples as phoneme transitions rather than inflection errors, implying that Josse does express the –t ending, not at the end of the verb but in the onset of the following adverbial (cf. Wijnen, 1992). This leaves us with only one isolated early error.

By way of summarizing this section, the following observations can be made: Indices of lexical and paradigmatic variation suggest that it is unlikely that children are in a position to derive the rules of verbal inflection in the early phase of the OI stage. Only in the later periods (III and IV), the children's lexicons fulfill the minimal conditions for the acquisition of finite verbal morphology. This is in agreement with

the results from a longitudinal analysis of verb inflection errors in the data of four of the six children in our sample. The development of verb inflection errors indicates that children start acquiring finite verbal inflection some time during period III. In short, mastery of verbal morphology is a relatively late achievement.

6.3. The modal shift revisited

It has been reported that children's root infinitives become more strongly associated with modal interpretations over time. In section 2, we summarized data confirming this observation. Conceivably, however, the modal shift in root infinitives is a corollary of an across-the-board increase in the use of modality.[20] Table 7 gives the proportions of modal interpretations of all sentences – finite as well as infinitive – that contain an eventive main verb. We restrict our test to eventive verbs, because, in contrast to non-eventive verbs, these occur both in finite sentences and root infinitives. It turns out that the proportion of sentences (finite and non-finite) with a modal interpretation remains stable in the first three periods and that it decreases after period III.[21] By contrast, as is shown by the rightmost column in Table 7, the average proportion of modal interpretations of root infinitives shows a monotonic increase from .57 to .77. Consequently, for these data, the modal shift in root infinitives cannot be ascribed to an across-the-board increase of modal denotations.

--- insert Table 7 about here ---

According to our hypothesis, the modal shift in root infinitives is an effect of infinitives being gradually replaced by verb forms that are semantically more specified than infinitives. We predict that root infinitives become more strongly

assoicated with modality when present tense finite verbs/sentences become available as a more specified alternative for denoting 'here-and-now'. A corollary is that such present-tense denoting finite constructions appear earlier than finite constructions with a *modal* interpretation, i.e., those containing a finite modal auxiliary with a infinitival complement, which are the grammatically more advanced (adult) counterparts of root infinitives with a modal interpretation.

We tested this prediction in the following way: We took all utterances with eventive predicates from the six children's corpora, and divided these sets into utterances denoting events that were ongoing at speech time (present), and events that were expected or desired to occur after speech time (modal). The children used three different sentence types in both contexts: root infinitives, sentences with a finite main verb, and sentences with a periphrastic verb (finite auxiliary with infinitival main verb complement). Figures 1.*a-l* show the relative frequencies of these three construction types in the subsets of utterances with present-tense (ongoing) and modal interpretations respectively, as a function of period. (The corresponding raw data can be found in Appendix 4.) Because past events are infrequent, we excluded them from the analysis. States have been excluded because of the infrequency of state-denoting root infinitives: state-denoting simple finite verbs are therefore not an alternative for root infinitives.

--- insert Figures 1*a-l* about here ---

Recall that all six children show an increasing modal use of root infinitives. If root infinitives are indeed gradually replaced by specified finite alternatives, as we propose, and if this "replacement" causes the modal shift, then we expect that in all

six children root infinitives are first replaced in the ongoing domain before being replaced in the modal domain. The individual data (Figure 1) as well as the average patterns depicted in Figures 2 and 3 clearly demonstrate that between periods II and III, the proportion of sentences with a finite main verb, used to describe an event that is ongoing, increases at the expense of root infinitives (Fig. 2). This increase takes place before periphrastic constructions begin to be used: these constructions increase in number between periods III and IV, and, as indicated by Figure 3, they are predominantly associated with *modality*.

--- insert Figure 2 about here ---

--- insert Figure 3 about here ---

In period III, most (69%) utterances describing ongoing events contain a finite verb (either a single main verb or a periphrastic verb). At the same time, sentences with a modal interpretation contain finite predicates in only 21% of the cases. Thus, in period III, finite forms have replaced root infinitives for the description of *ongoing* events, while *modality* is still predominantly expressed by means of root infinitives. In period IV, periphrastic verbs outnumber root infinitives in sentences with a modal interpretation. Thus, we see that root infinitives are replaced by finite constructions with more specific semantics in a more or less step-wise fashion. The modal shift in root infinitives comes about particularly as finite verbs with present tense denotation are acquired and used.[22]

Turning now to the periphrastic structures, we observe that in period III the proportion of periphrastic verbs referring to ongoing events (12%) is close to the proportion of periphrastic verbs with a modal interpretation (17%). Between periods

III and IV, the proportion of modal periphrastic verbs goes up from 17% to approximately 60% of all verb-containing utterances with a modal interpretation (Fig. 3). By contrast, the proportion of periphrastic verbs with an 'ongoing' denotation stabilizes at roughly 14% (Fig. 2). This pattern (slight increase at Period III, subsequent leveling off) agrees with previous suggestions of an intermediate developmental step preceding the grammatical marking of finiteness by means of verb movement (Hollebrandse and Roeper, 1996, Jordens, 1990, Van Kampen, 1997, Zuckerman, 2001). This intermediate step is characterized by the use of 'dummy' or 'placeholder' finite auxiliaries such as *ga(at)* 'go(es)' or *doe(t)* 'do(es)' (examples 19), as well as *zijn* + *infinitive* as a precursor of the prepositional infinitival construction *zijn aan het* + *infinitive* 'be on the + infinitive' (examples 20).

(19) a. koe gaat rijden Matthijs 2;04.24
Cow go (FIN) drive (INF)
'The cow is driving'

b. lamp gaat branden Peter 2;00.28
lamp goes (FIN) burn (INF)
'The lamp is burning'

c. doet Paulien huisje maken Daan 2;04.28
do(FIN) Paulien house (DIM) make (INF)
'Paulien is building a house'

(20) a. sijn de soep ete Laura 2;04.01
are (FIN) the soup eat (INF)
'They are eating the soup'

b. is takelen Matthijs 2;05.01

is (FIN) hoist (INF)

'(it) is hoisting'

b. Peter is (ver)schonen Peter 2;00.28

Peter is (FIN) wash (INF)

'Peter is washing'

7. Discussion

The results of our longitudinal analysis of verbal constructions produced by Dutch-speaking children in the OI stage confirm that (a) at the onset of the OI stage virtually all verbs are infinitives; the proportion of root infinitives decreases gradually over age. (We made use of this phenomenon to create an independent variable, viz. 'period', defined in terms of average proportion of root infinitives.) (b) Early in the OI stage, finite and nonfinite verbs constitute non-overlapping sets. The overlap increases until, in what we called period IV, the statistics are similar to what is expected for adult speakers. (c) In parallel with the increasing overlap, we see a growth of both lexical and paradigmatic variation in the verb lexicon: the number of verbs increases and different verb stems come to be combined with different inflectional suffixes. (d) Approximately in period III, morphological errors begin to appear that are suggestive of emerging productivity of verb inflection. (e) Whereas early in the OI stage root infinitives are associated with a variety of temporal and aspectual/modal denotations, over time they become more strongly, and eventually virtually exclusively, associated with a modal interpretation. This so-called modal shift in root infinitives is correlated

in time with the increase of finite utterances that do *not* have modal (but rather, in most cases 'here-and-now') interpretations.

These observations, together with the previously reported U-shaped development of subject realization in root infinitives (Blom and Van Geert, 2004) are difficult to reconcile with theoretical approaches that assume the Optional Infinitive stage is a uniform phase in language acquisition. Nonetheless, the results reported here do not necessarily contradict the hypothesis that the syntactic matrix is mastered early. In fact, we adopted this as a working hypothesis. The way in which this can be made to work is by separating out morphology (inflection) and syntax, and acknowledging (i) the asymmetry between syntax and morphology in language acquisition (see 9 above), and (ii) the influence of productive morphology on syntactic performance as stated in (14) below:

(14) SYNTAX-MORPHOLOGY DEPENDENCY: Syntactic performance depends on morphological competence.

What this boils down to is, in fact, a relatively straightforward story. Following Pinker and Jackendoff (2005), it can be assumed that particular architectural properties of language are innately given and remain constant throughout development. These properties may include the functional categories and their structural ordering, as well syntactic principles such as the Extended Projection Principle and a specificity or blocking principle at the lexicon-syntax interface (e.g. the Principle of Decreasing Specificity). Thus, language learning children do not need to learn that the structural position of finiteness features is high in the syntactic tree. What they do need to learn

is which elements belong to the class of V(erbs) and which verbs are finite and non-finite.

The gradual increase of 'normal' (i.e., adult-like) finite constructions over time, and the correlated change in predominant interpretation of the gradually declining root infinitives (modal shift) are the result of the gradual, piecemeal growth of the verb vocabulary, and the accompanying processes by which verbal inflectional paradigms are created. The developmental scenario we think is most likely is one in which, firstly, verb forms are gradually accrued. The majority of the earliest verb forms of children who acquire Dutch are infinitives (see Wijnen et al., 2001); finite forms – in particular of lexical verbs – come in slightly later. As a result of the gradual expansion of the verb lexicon, it comes to contain an increasing number of minimally different items. This is reflected in the increasing overlap of the sets of finite and nonfinite verbs (in terms of lemma's). Lexical and paradigmatic variation in the verb lexicon (i.e., the availability of minimally different elements) sets the stage for word form segmentation, and the mapping of resulting word parts (morphemes) onto syntactic features. The relatively abrupt onset of inflectional errors pays testimony to these processes. As the finite-infinitive opposition becomes productive, i.e., as finite and infinitival inflections become associated with their target syntactic features, the pattern of subject omission becomes target-like as well, such that infinitival verbs are associated with null subjects, and finite verbs with overt subjects.

The upshot is that the gradual changes in children's linguistic output during the OI stage are the result of lexical learning. We are not the first to suggest that lexical learning and syntactic development are interrelated (see e.g. Bates et al., 1988). In the generative tradition, Clahsen (1988) was one of the first to argue that full productivity of verbal agreement morphology is a crucial factor in the transition

from a root infinitive type grammar to adult competence, and that attaining productivity depends on lexical learning.

The developmental relation between lexical learning and morphological analysis has been the focus of various theoretical proposals. Locke (1997) argued that the build-up of a repository of unanalyzed, 'idiomatic', words and phrases in long term memory is a necessary condition for the onset of a process of 'analysis and computation', in which the stored elements are analyzed and segmented, leading to the emergence of phonological, morphological and eventually syntactic representations and rules. According to Locke, what initiates the analysis and computation phase could either be the intrinsic storage limitations of the mental lexicon, or the detection of recurring elements and regularities. Ann Peters's work (1982) contains valuable suggestions regarding the process of detecting and analyzing elements stored in long term memory that have linguistically relevant structural similarities. As far as we know, there is no fully explicit theory on this process as yet, but, for instance, Bybee's network model of morphology (Bybee, 1995) would seem to provide adequate analytical tools for studying the development of morphology in child language. A particularly interesting feature of Bybee's model is that the emergence of (regular) morphological paradigms depends on type frequency, i.e., the number of different elements (lemma's) that share a morphological pattern – lexical variation in our terminology. Thus, the relatively late attainment of morphological productivity observed in this study (correlated with the accrual of different verb types) seems to conform to this model's predictions. Other proposals that relate to our ideas in that they stress the role of lexical development, and hence, the influence of learning based on input distributions, can be found in recent work of Tomasello (2003), Mintz (2003), and Freudenthal, Pine, Aguado-Orea & Gobet (in press).

An alternative to our proposal with regard to the role of morpological learning in the escape from the root infinitive stage can be found in a recent contribution by Legate and Yang (subm.). The authors assume a selectional model of the acquisition of syntax. The language learner is equipped with a prespecified (i.e., innate, universal) 'population' of grammars, and is assumed to converge on a target grammar by means of a probabilistic algorithm taking parsing successes as primary data. Grammars that fit the input well gradually become stronger, whereas non-fitting grammars (i.e., inappropriate parameter settings) are gradually suppressed, in proportion to the amount of parsing failure. According to Legate and Yang, the root infinitive phase results from a relative dominance of a grammar (one from the given set) that does not contain Tense (as in, e.g., Mandarin Chinese). The speed with which such a grammar is suppressed is proportional to the amount of evidence for Tense in the input, i.e., the frequency of verb forms that explicitly and unambiguously mark Tense. This would explain the common observation that the root infinitive stage is much shorter or even virtually absent in children acquiring for instance Spanish or Italian, while it is relatively extended in the acquisition of e.g. Dutch or English: Unequivocal evidence for the presence of Tense is many times stronger in Spanish and Italian than in Dutch or English.

What seems to be lacking in Legate and Yang's hypothesis is an account of *how* children will know what the relevant morphemes are, i.e., those that mark tense. Clearly, tense morphemes do not flag their identity in the input speech. In our approach, learning which parts of words are morphemic is a function of the comparison of similar, partly overlapping forms. Correlating morphological overlap with similarities and differences in meaning or usage is assumed to bring about the discovery of Tense morphemes (as well as other inflections). Note that an abundance

of evidence for the presence of Tense in the target grammar, as observed by Legate and Yang, means that the child perceives many, and many different verb forms that are morphological marked for tense (in many variations). This can be argued to lead to a fast build-up of sufficient paradigmatic and lexical variation in the child's lexicon, which we argued to be crucial for attaining productivity in verbal morphology. Hence, the observation of a correlation between the amount of evidence for Tense present in the input, and the rapidity with which root infinitive properties of child language disappear can be fit within our approach as well.

To summarize, we demonstrated that children's linguistic behavior in the Optional Infinitive stage is not uniform, but shows several patterns of change over time. We argued that these developmental patterns can be linked together by assuming that they are, directly or indirectly, the result of a gradually expanding verb vocabulary, and the resulting morphological sophistication resulting from it. This has an impact on the realization of the syntactic matrix, which we assume to be in place from a very early stage onward. As is clear from the foregoing, our explanation of the observed developmental changes in language production refers to changes in underlying competence. It has been questioned if language production is a valid window onto competence; experiments making use of infant testing procedures (e.g. the head-turn preference paradigm) appear to demonstrate that children at every stage of development know more about grammar than their spontaneous utterances reveal (see e.g. Gerken, 2002 for an overview). However, as repeatedly emphasized by scientists using these methods, infant testing procedures show children's early ability to recognize the difference between patterns that are familiar and unfamiliar, which is an outcome that does not necessarily tell us something about children's early grammatical competence, but may, just as well, reflect children's giftedness with

respect to pattern recognition. Soderstrom, Wexler and Jusczyk (2002), for instance, conducted a preferential listening experiment that directly relates to our claims: they found that English toddlers (aged 1;6) are able to distinguish bare verb forms from third person singular forms. Showing their awareness of the ambiguity of this finding, Soderstrom et al. remark that "[t]he nature of the sensitivity to agreement morphology is yet to be determined. It is unclear, based solely on these findings, whether it reflects a deep grammatical knowledge of the agreement properties of English, or a more surface sensitivity to statistical patterns of the language." (p. 650). In this contribution, we hope to have shown that production data are highly informative with respect to children's ability to make use of grammatical competence, especially if these data allow for longitudinal analyses. In our view, the observation that several morphosyntactic and semantic changes take place at the same time does support an explanation in terms of grammatical competence.

Notes

1. This may well be just the property of recursivity (Hauser et al., 2002); see Jackendoff and Pinker (2005) for a response and a broader definition of innate knowledge of language.
2. That is, finite sentences in non pro-drop languages.
3. Studies differ in how they formulate the role of pragmatics: they refer either to pragmatic rules (Hyams, 1999, Lasser, 1997), or to processing capacities needed for discourse integration (Avrutin, 1999).
4. Note that the early bare verbs are presumably truncated infinitives (Taelman et al., 2005).
5. This corresponds to what we will call periods I and II below.
6. Haegeman (1996) looked at subject drop in Dutch child language and argued that the longitudinal pattern – she found a decrease – is in line with full competence. We will not go into the details of Haegeman's analysis, except for pointing out that she did not distinguish between finite sentences and root infinitives, but looked at the overall rate of subject drop at successive time points.
7. More generally, U-shaped behavioral patterns have been interpreted as reflective of restructuring the knowledge base underlying linguistic performance (e.g. Marcus et al., 1992, e.g. Strauss, 1982).
8. There is an alternative explanation for the modal meaning of root infinitives, proposed by Hoekstra and Hyams (1998). Blom and Wijnen (2000) point out that a modal shift is compatible with this explanation. However, a number of issues remain unresolved; see Blom (2003).

9. Naturally, ‘early’ and ‘late’ are relative notions that may differ from language to language, and from child to child.

10. We do not exclude the possibility that older children, who are able to use grammar, and even adults, still make use of two resources in the production of structured utterances: memorization and computation.

11. Or in terms of Schütze (1997) infinitival verb forms properly license the empty category PRO.

12. See also Lasser (1997) for data showing the absence of German root infinitives in perfective contexts.

13. In earlier work (Blom and Wijnen, 2000, Blom, 2002), we proposed a different explanation, based on Hoekstra and Hyams’s(1998) model. According to this model, infinitives in Dutch receive a modal reading because infinitival morphology carries the feature [−realized]. It was hypothesized that the modal shift reflects children's discovery of the infinitival suffix and its semantic feature. The revised hypothesis presented in this paper has a broader empirical coverage. It fits the disappearance of root infinitives as a function of the appearance of finite forms, and the underspecified semantic nature of the infinitives is in accordance with children’s use of root infinitives in non-modal contexts and with the marginal and context-dependent acceptability of root infinitives in adult Dutch.

14. Keep in mind that this model assumes that the child’s verb lexicon consists of verb stems that can be freely combined with both finite and infinitival suffixes.

15. Selected main tiers were *JEA (Abel), *JOS (Daan), *ROB (Daan), *ABB (Josse), *HAN (Josse), *JAC (Laura), *MAR (Matthijs) and *LEI (Peter). The data include only child-directed speech.

16. The observations from Clahsen and Penke (1992) and Guasti (1994) that young children do not make agreement errors need not indicate that children have mastered inflection. In the absence of a longitudinal analysis, it cannot be decided whether their findings reflect lexical storage or the application of inflection rules.

17. For infinitives, Gillis (2003) reports a similar development. In the longitudinal data of Jolien, he first finds little lexical variation. This is followed by a marked increase of the number of lemma's that appear with infinitival morphology.

18. We examined data from Laura as well as Peter. These two children may deviate form the other four in different ways. Laura had a delayed development and may have started acquiring inflection relatively late. Peter, on the other hand, was a quick learner, and may thus have been earlier than the other children.

19. Due to a limitation in the results presented by De Haan (1996), we can only calculate this for third person agreement.

20. Halliday (1975) conducted a detailed investigation of the early development of language functions in the spontaneous speech of his son, Nigel. He pointed out that use of the modal functions, such as the regulating ('Do as I tell you' or 'You must') and instrumental ('I want') function, clearly increase over time. This increase, however, takes place *before* the age at which root infinitives come in (between 16½ and 18 months) and clearly before the modal shift takes

place. Thus, Halliday's observations provide no further insight into the modal shift. Except for this study, we do not know of any studies examining the quantitative development of modality in child language.

21. Interpretations were assigned on the basis of available cues in the transcripts, i.e., extra-linguistic information, preceding and following utterances of the child and his/her caretaker. Interpretations have been assigned independently by two analysts. A conservative strategy was applied: in case of disagreement or uncertainty, an utterance was not included in further analyses.

22. This analysis presupposes that the relative numbers of ongoing and modal utterances do not change much throughout the four stages. However, this does not mean that the specific meanings remain constant over time as well. In fact, we cannot assume that the children use the newly acquired modal auxiliary + infinitive only to replace root infinitives, as the acquisition of the modal auxiliary plus infinitive makes new modal meanings available. Modal root infinitives nearly always express intentions, dynamic necessity (i.e., wishes and desires), or deontic necessity (commands). When the modal auxiliary + infinitive construction enters the repertoire, children begin to express dynamic and deontic possibility, which denote ability and permission, respectively. Thus, from a semantic point of view, only a part of the increasing number of modal auxiliary + infinitive constructions *replaces* root infinitives. An analogous semantic expansion does not take place in the case of present tense sentences, because (i) the temporal domain does not have as much semantic differentiation as the modal domain, and (ii) the forms that are used to mark the present-past tense distinction come in after period IV. At the same time, all of this does not imply that sentences containing finite main verbs simply

replace root infinitives. The rise of finite main verbs is clearly an effect of lexical growth. With the newly acquired finite main verbs, children begin to refer to ongoing activities that they did not speak about before, when their repertoire consisted largely of root infinitives.

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Table 1.

Children's age ranges (years;months.days) and the total numbers of utterances in the selected files used for the analyses.

CHILD	Age Range	Number of Utterances
Abel	1;10.03 - 2;07.29	2890
Daan	1;08.21 - 2;09.10	4859
Josse	2;00.07 - 2;08.18	3340
Laura	1;09.04 - 3;04.06	4241
Matthijs	1;09.30 - 2;11.19	4624
Peter	1;07.18 - 2;03.21	2349

Table 2.

The increase of lexical overlap between the verbal predicates in root infinitives and sentences with a finite main verb (types).

CHILD	period I/II		period III		period IV	
	$N_{OVERLAP}$ (N_{INF}/N_{FIN})		$N_{OVERLAP}$ (N_{INF}/N_{FIN})		$N_{OVERLAP}$ (N_{INF}/N_{FIN})	
Abel	0	(13/2)	3	(34/15)	10	(46/24)
Daan	2	(24/9)	6	(36/21)	13	(53/35)
Josse	0	(20/5)	1	(38/11)	8	(53/21)
Laura	2	(14/8)	6	(45/17)	8	(55/24)
Matthijs	0	(36/2)	7	(63/14)	16	(73/35)
Peter	1	(21/3)	9	(31/18)	18	(33/33)

Table 3.

Predicted overlap between finite and nonfinite verb sets on the basis of proportions of finite sentences and (p_F) and root infinitives (1- p_F) and observed verb lexicon size (n(V)), and actually observed overlap numbers (totals for the six children).

Period	1- p_F	p_F	n(V)	Predicted overlap	Observed overlap
I/II	0.83	0.17	152	21.7	5
III	0.41	0.59	311	75.2	32
IV	0.1	0.9	424	38.9	73

Table 4.

Accumulation of finite verb (i.e. verbal root with -ø, -t or –en suffix in first or second sentence position) types in the periods I/II, III and IV.

CHILD	I/II $N_{FIN\ (TYPES)}$	III $N_{FIN\ (TYPES)}$	IV $N_{FIN\ (TYPES)}$
Abel	2	15	24
Daan	9	21	35
Josse	5	11	21
Laura	8	17	23
Matthijs	2	14	35
Peter	3	18	33

Table 5.

Number of verb types that appear with more than one finite affix in periods III and IV.

CHILD	III	IV
Abel	4	6
Daan	4	6
Josse	2	5
Laura	3	5
Matthijs	1	6
Peter	3	5

Table 6.

Onset of the two-word stage, occurrence of first agreement errors and periods in this study.

CHILD	ONSET 2-WORD STAGE	1st AGREEMENT ERROR	ONSET ERROR ~ period
Abel	1;10.30	2;03.02	end period III
Daan	1;08.21	2;04.01	begin period III
Josse	2;00.07	2;03.28	begin period III
Matthijs	1;09.30	2;05.01	end period III

Note: For Daan as well as Josse, some very early errors are found (around 2;1). We assume that these are "outliers" due to phonological difficulties; see main text for an explanation. The ages given in the Table 6 are taken as the onset not only because they seem to be the first real agreement errors but also since they mark the begin of an error-phase: after this age, the number of errors increases.

Table 7.

Frequencies and proportions of utterances (finite and infinitive) containing eventive verbs that have modal denotations, and frequencies and proportions of RIs containing eventive verbs that have modal denotations.

Period	$N_{EVENTIVE}$	N_{MODAL} (%)		$N_{EVENTIVE\text{-}RI}$	$N_{EVENTIVE\text{-}MODAL\text{-}RI}$ (%)	
I	80	46	(57 %)	75	43	(57 %)
II	436	268	(62 %)	383	256	(67 %)
III	999	552	(55 %)	518	402	(78 %)
IV	2621	767	(29 %)	271	210	(77 %)

Figure captions

Figure 1.

Proportions of root infinitives (RI), sentences with single finite main verbs (SF), and sentences with periphrastic verbs consisting of a finite auxiliary and a lexical main verb (PV), either denoting ongoing events or modality, as a function of Period (I to IV). Individual data.

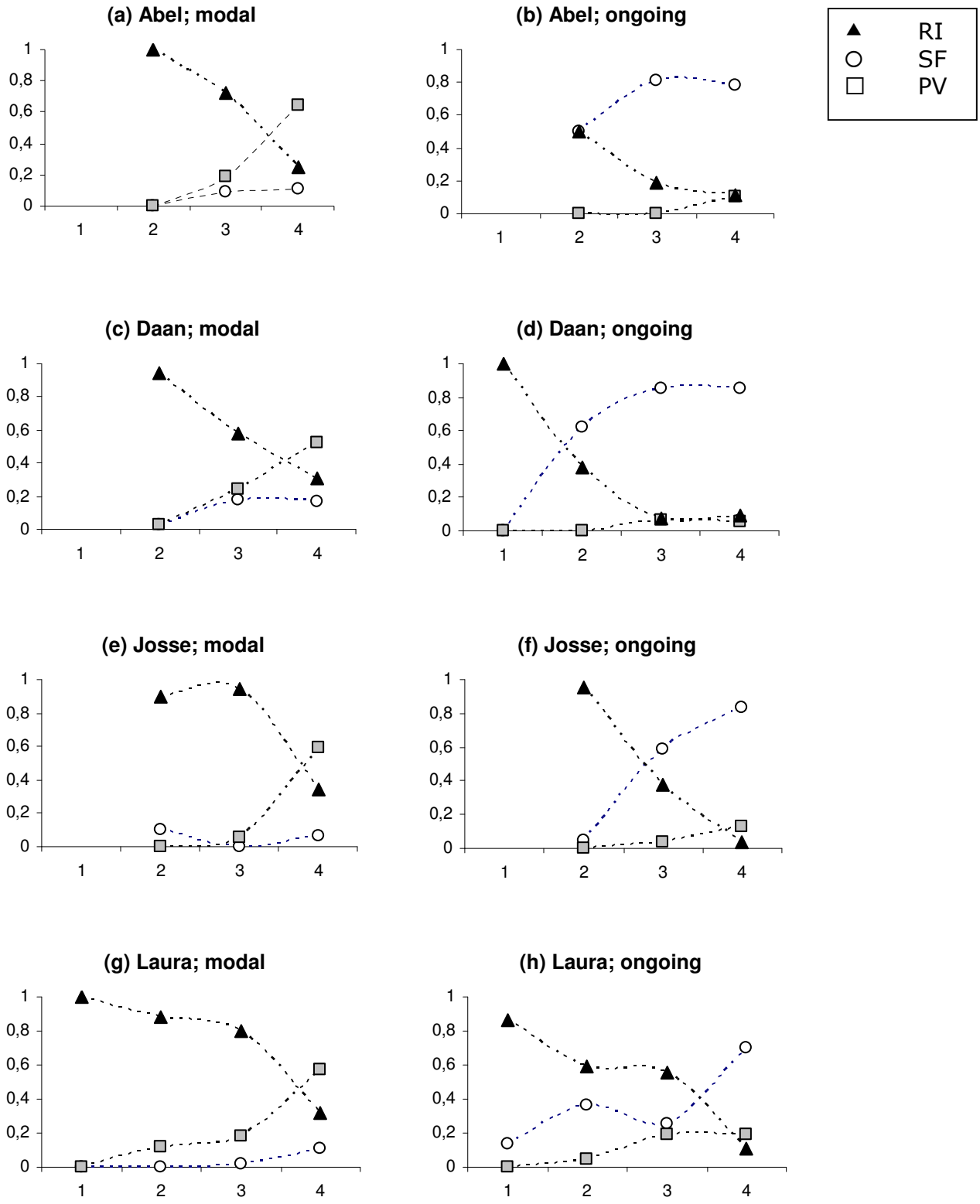
Figure 2.

Proportions of root infinitives (RI), sentences with a finite main verb (SF), and with a periphrastic verb (PV) denoting ongoing events, in the four periods; data from all six children collapsed.

Figure 3.

Proportions of root infinitives (RI), sentences with a finite main verb (SF) and with a periphrastic verb (PV) denoting modal events, in the four periods; data from all six children collapsed.

Figure 1


(a) Abel; modal
(b) Abel; ongoing
(c) Daan; modal
(d) Daan; ongoing
(e) Josse; modal
(f) Josse; ongoing
(g) Laura; modal
(h) Laura; ongoing
RI
SF
PV
0
0,2
0,4
0,6
0,8
1
1
2
3
4

(Figure 1, continued)

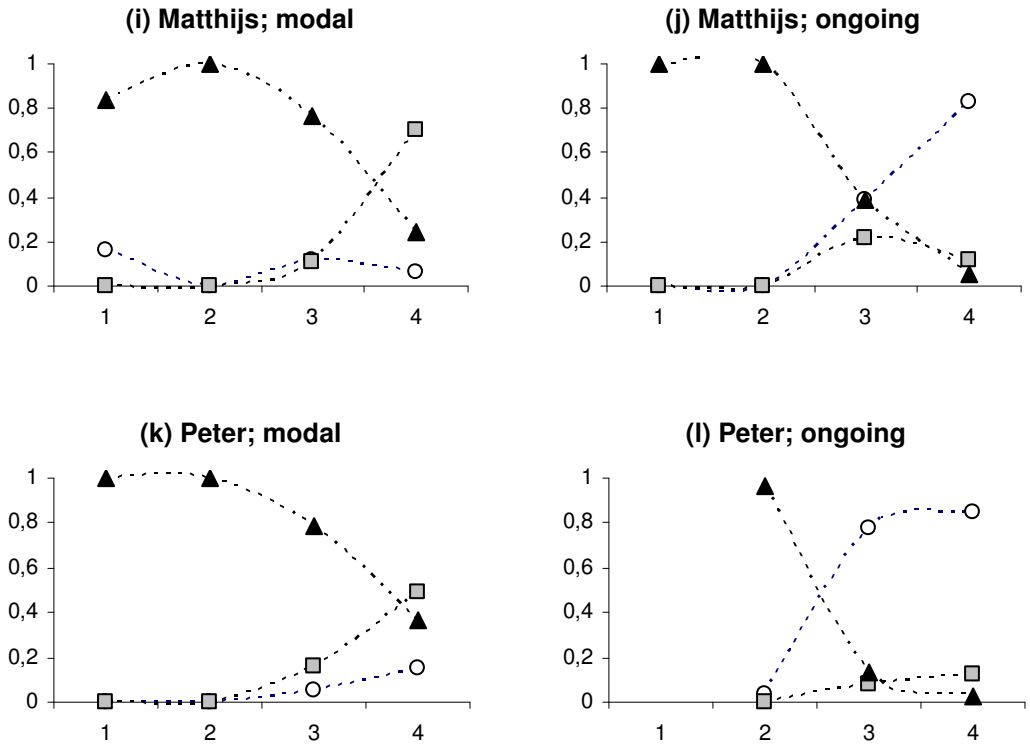


Figure 2

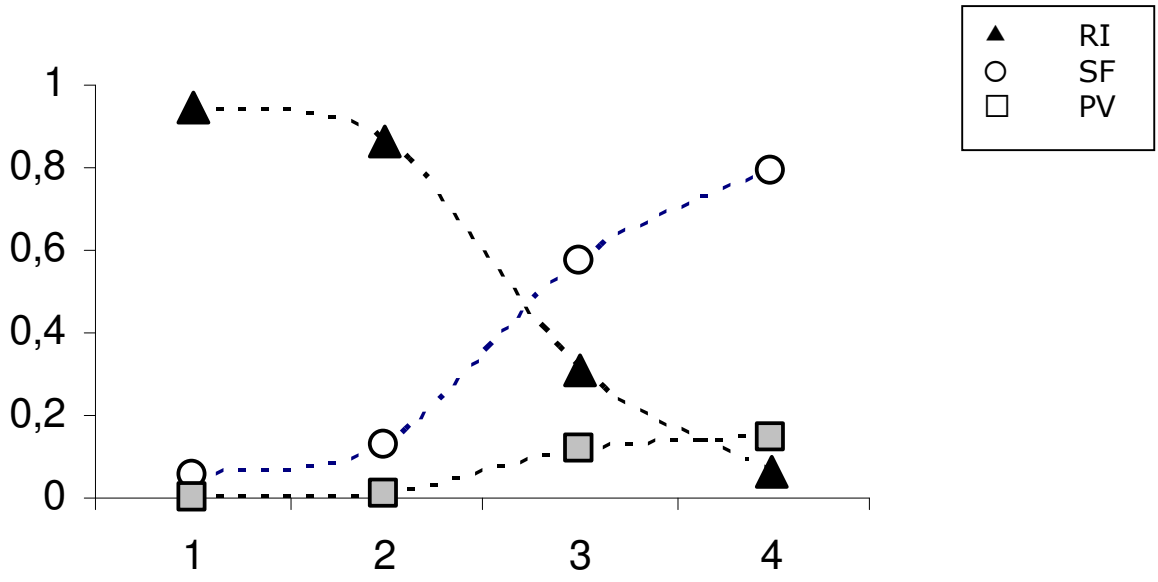
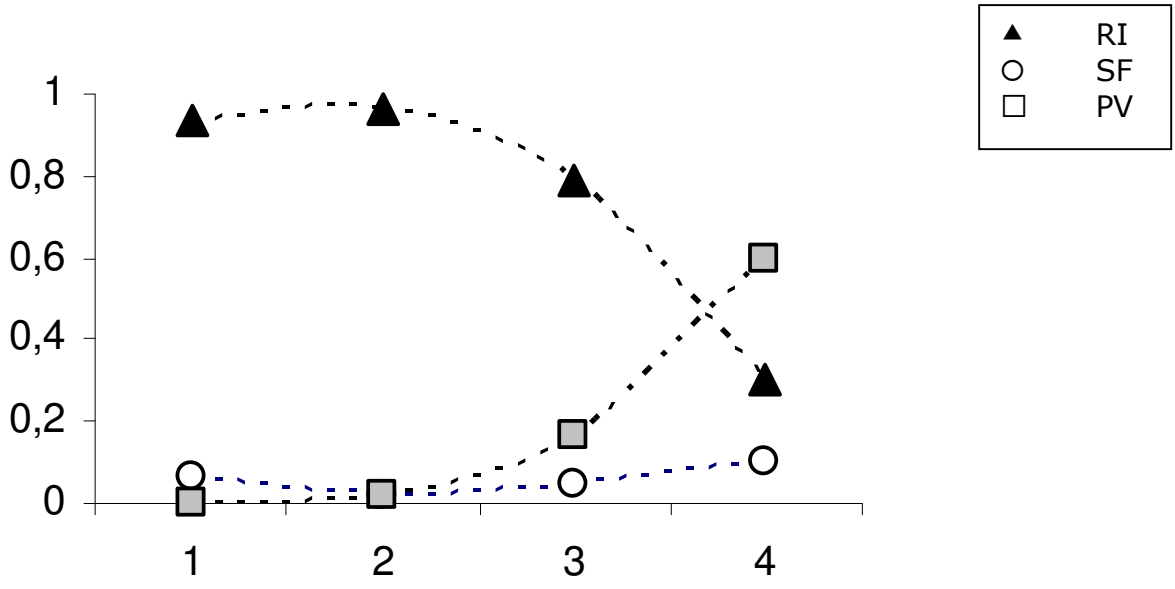


Figure 3



Appendix 1

Selected files (age of recording in years; months.days).

	I	II	III	IV
Abel	Not available	1;10.30 1;11.12 1;11.26	2;01.02 2;01.16 2;02.19 2;03.02	2;05.17 2;07.15 2;07.29
Daan	1;08.21 1;09.09 1;10.16	2;00.22 2;00.19 2;01.21	2;04.14 2;04.28 2;05.11	2;08.13 2;08.27 2;09.10
Josse	Not available	2;00.07 2;00.21	2;03.28 2;04.11	2;07.20 2;08.04 2;08.18
Laura	1;09.04 (01) 1;09.18 (02)	2;00.05 (08) 2;00.19 (09) 2;01.02 (10)	2;04.01 (17) 2;04.15 (18) 2;05.00 (19) 2;05.17 (20) 2;06.10 (21)	3;02.09 (34) 3;03.00 (35) 3;03.02 (36) 3;04.06 (37)
Matthijs	1:09.30 1;10.13	1;11.10 1;11.24 2;00.09	2;04.24 2;05.01	2;10.22 2;11.03 2;11.19
Peter	1;07.18	1;09.20 1;10.03	2;00.28 2;01.26	2;03.07 2;03.21

Appendix 2

Finite verbs in stage I/II (types)

States	
(auxiliaries and other non-thematic verbs)	
Modal:	Kan ‘can’, mag ‘may’, moet ‘must’, wil ‘wants’
Prospective:	Gaat ‘go’, komt ‘comes’
Position:	Lig ‘lie’, zit ‘sit’
Perception:	Hoor ‘hear’, zie ‘see’
Copula:	Is ‘is’
Other:	Heet ‘is called’, past ‘fit’
Events	
(thematic verbs)	
-	Eet ‘eat’, springt ‘jump’, zingt ‘sings’

Appendix 3

Verb vocabulary (finite and non-finite) of six children during OI stage

aaien ‘stroke’
bakken ‘bake, fry’
ballen ‘play w/ ball’
bedoelen ‘mean’
bellen ‘call, ring’
bewaren ‘keep’
bijten ‘bite’
blaffen ‘bark’
blazen ‘blow’
blijven ‘stay’
boeren ‘burp’
boksen ‘box’
botsen ‘hit, collide’
bouwen ‘build’
branden ‘burn’
brengen ‘bring’
dansen ‘dance’
denken ‘think’
doen ‘do’
douchen ‘shower’
draaien ‘turn’
dragen ‘carry’
drijven ‘float’
drinken ‘drink’
drukken ‘push, excrete’
duikelen ‘tumble’
durven ‘dare’
duwen ‘push’
eten ‘eat’
fietsen ‘bike, cycle’
fluiten ‘whistle’
gaan ‘go’
geven ‘give’
glijden ‘slide’
gooien ‘throw’
halen ‘fetch’
hangen ‘hang’
hebben ‘have’
helpen ‘help’
heten ‘are called’
hijsen ‘hoist, pull’
hikken ‘hiccup’
hoesten ‘cough’
hoeven ‘need’
horen ‘hear’
huilen ‘cry’
kammen ‘comb’
kauwen ‘chew’
kijken ‘look’
kleien ‘work clay’
kletsen ‘chat’
klimmen ‘climb’
kneden ‘knead, mold’
knippen ‘cut’
knoeien ‘spill’
koken ‘cook’
komen ‘come’
kopen ‘buy’
krijgen ‘get, receive’
kruipen ‘crawl’
kunnen ‘can’
lachen ‘laugh’
laten ‘let’
leggen ‘lay’
lezen ‘read’
liggen ‘lie’
lopen ‘walk’
lukken ‘succeed’
lusten ‘like’
maaien ‘mow’
maken ‘make’
moeten ‘must’
mogen ‘may’
naaien ‘sew’
natspatten ‘splatter, sprinkle’
nemen ‘take’
omdoen ‘put on’
opbeuren ‘lift’
opruimen ‘clear [up]’
opschieten ‘hurry’
pakken ‘take, grab’
passen ‘fit’
plakken ‘stick, glue’
plassen ‘pee’
poepen ‘poo[p]’
poetsen ‘polish’
praten ‘talk’
prikken ‘prick, sting’
proeven ‘taste’

rammelen ‘rattle’
regenen ‘rain’
rijden ‘ride’
roeren ‘stir’
rollen ‘roll’
ruilen ‘swap’
schaatsen ‘skate’
schommelen ‘swing’
schrijven ‘write’
schuiven ‘shove, push’
slaan ‘hit, strike’
slapen ‘sleep’
slopen ‘pull down, demolish’
smeren ‘spread’
spelen ‘play’
springen ‘jump’
spugen ‘spit’
staan ‘stand’
stampen ‘stomp’
stappen ‘trot’
stoppen ‘stop’
strijken ‘iron’
sturen ‘send, drive’
takelen ‘hoist’
tanken ‘tank’
tekenen ‘draw’
tikken ‘tap’
tillen ‘lift’
timmeren ‘hammer’
trekken ‘pull’
vallen ‘fall’
vangen ‘catch’
varen ‘sail’
vegen ‘swipe’
verstoppen ‘hide’
verven ‘paint’
vinden ‘find’
voeden ‘feed’
voelen ‘feel’
voetballen ‘play soccer’
vragen ‘ask’
wachten ‘wait’
wassen ‘wash’
weten ‘know’
willen ‘want’
worden ‘become’
zagen ‘saw’
zeggen ‘say’
zetten ‘put’
zien ‘see’
zijn ‘be’
zingen ‘sing’
zitten ‘sit’
zoeken ‘search’
zuigen ‘suck’
zullen ‘will, shall’
zwemmen ‘swim’

Appendix 4

Numbers of root infinitives, sentences with simple finite (main) verbs, and finite sentences with periphrastic verbs used to describe ongoing and modal events, in the four periods. Individual data (corresponding to Figures 1*a*-*l*).

(a) Abel

	Root infinitive		Simple finite verb		Periphrastic verb	
period	modal	ongoing	modal	ongoing	modal	ongoing
I	n.a.	n.a	n.a	n.a.	n.a.	n.a.
II	14	10	0	10	0	0
III	57	7	7	31	15	0
IV	20	12	9	82	53	11

(b) Daan

	Root infinitive		Simple finite verb		Periphrastic verb	
period	modal	ongoing	modal	ongoing	modal	ongoing
I	0	4	0	0	0	0
II	31	14	1	23	1	0
III	40	7	12	76	17	6
IV	44	17	24	153	74	10

(Appendix 4, continued)

(c) Josse

	Root infinitive		Simple finite verb		Periphrastic verb	
period	modal	ongoing	modal	ongoing	modal	ongoing
I	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
II	44	40	5	2	0	0
III	55	11	0	17	3	1
IV	51	5	9	108	87	17

(d) Laura

	Root infinitive		Simple finite verb		Periphrastic verb	
period	modal	ongoing	modal	ongoing	modal	ongoing
I	2	13	0	2	0	0
II	31	13	0	8	4	1
III	129	72	3	33	30	25
IV	38	16	13	101	68	28

(e) Matthijs

	Root infinitive		Simple finite verb		Periphrastic verb	
period	modal	ongoing	modal	ongoing	modal	ongoing
I	16	15	3	0	0	0
II	66	23	0	0	0	0
III	77	9	12	9	11	5
IV	40	8	10	116	117	16

(Appendix 4, continued)

(f) Peter

	Root infinitive		Simple finite verb		Periphrastic verb	
period	modal	ongoing	modal	ongoing	modal	ongoing
I	26	0	0	0	0	0
II	70	27	0	1	0	0
III	44	10	3	57	9	6
IV	17	12	7	361	23	53