

VERBAL SYNTAX AND MORPHOLOGY IN TYPICALLY DEVELOPING DUTCH CHILDREN AND CHILDREN WITH SLI: HOW DEVELOPMENTAL DATA CAN PLAY AN IMPORTANT ROLE IN MORPHOLOGICAL THEORY

Kenneth Wexler, Jeannette Schaeffer and Gerard Bol

Abstract. This paper is a study of normal and impaired (SLI) linguistic development, especially in verbal morphology and syntax. The paper studies both linguistic development and how developmental phenomena provide evidence for adult linguistic theory. We use extensive developmental data to test models of normal and impaired development that have been applied to other languages—in particular, the Agr/Tense Omission Model (ATOM). We develop detailed models of Dutch morphology that—together with ATOM—predict that Dutch-speaking children will produce more root infinitives than English-speaking children. Furthermore, the model predicts particular errors of tense and agreement will occur in Dutch but not English-speaking children. These predictions are confirmed. We also investigate how developmental data can help us to solve a problem concerning the interpretation of features in adult morphology.

1. Introduction

This paper is a study of normal and impaired linguistic (SLI) development in Dutch, especially verbal morphology and syntax. We use extensive developmental data to investigate a number of theoretical issues. In particular, we are concerned on the one hand with developmental issues. What is the nature of normal morphosyntactic development, and what is the relation of impaired to normal development? On the other hand, we use the developmental facts to investigate a number of issues in morphological theory. In particular, we wish to investigate whether features of a morpheme or features of its required context take precedence in determining which morphemes are inserted into a node in a syntactic tree and what this ordering says about the particular morphological analysis to be given to Dutch verbal morphology. The exact specification of morphological features often seems to have a nonunique solution. We propose that developmental analysis of the kind we undertake can help to provide the desired unique solution, thus advancing us toward explanatory adequacy in this domain. We will argue for a particular analysis of Dutch morphology and a particular view of the interpretation of features in morphological theory. At the same time we will investigate which parts of the

* We would like to thank Morris Halle for extensive discussion of the morphology in this paper and for making important suggestions to us. We thank Jan de Jong for his generous discussion of his research on Dutch SLI and for checking points in his data at our request.

linguistic system (syntax, features in the syntax, or features in the morphology?) develop slowly, in both normal and impaired language. We provide precise hypotheses as the result of our investigations and offer this paper as an example of how investigation of developmental and impaired developmental data can lead to a more adequate linguistic theory.

A phenomenon that has been studied intensively during the last 10 years in the field of first language acquisition is the optional occurrence of so-called root infinitives in early child language. Root infinitives (henceforth RIs) are infinitivals used as main clauses. Whereas RIs are prohibited by the adult grammar, early child grammar allows them freely, as exemplified in (1).

- (1) All examples below uttered before age 3;0.

Dutch (Weverink 1989)

pappa schoenen wassen	ik pak 't op
daddy shoes wash-INF	I pick it up
ik ook lezen	baby slaapt
I also read-INF	baby sleeps

German (Poeppel & Wexler 1993)

ich der Fos haben	mein Hubsabe had Tiere din
I the frog have-INF	my helicopter has animals in-it
Zahne pussen	Caesar tieg e nich ('Caesar kriegt er nicht')
teeth brush-INF	Caesar gets he not

French (Pierce 1989)

monsieur conduire	Patsy est pas la-bas
man drive-INF	Patsy is not down-there
pas attraper une fleur	marche pas
not catch a flower	walks not

English (Harris & Wexler 1996)

it only write on the pad	my finger hurts (Eve)
Patsy need a screw	this goes in there (Peter)

Notice that the RIs appear alongside finite clauses in the same stage of child language development, as illustrated in the second column in (1). This is the reason that Wexler (1990ff.)¹ referred to this phenomenon as optional infinitives (OIs) or optional root infinitives. The stage in which these optional infinitives occur also displays several other phenomena, such as correct use of agreement and verb placement, which Wexler took to be characteristics of the Optional Infinitive Stage. We refer to the developmental stage as the Optional

¹ For this paper, Wexler 1990ff. will be used instead of Wexler 1990, 1992, 1994, 1996.

Infinitive Stage (OIS) and to the actual infinitival sentences that the children produce as root infinitives (RIs).

This paper reports some results of a study of the OIS in the spontaneous speech of Dutch children with specific language impairment (SLI) and Dutch normally developing children. The term “specific language impairment” denotes the fact that language is the only cognitive function that is impaired; IQ and physiological skills fall within the normal ranges.

Our study is the first large (in terms of number of subjects) quantitative research on the OIS in Dutch normally developing children and in Dutch children with SLI.

We argue that, although verb placement and subject-verb agreement are close to adultlike from very early on in both the SLI and typically developing children, both groups proceed through a stage in which they optionally produce root infinitival main clauses. The only difference between the two groups is the age at which they leave this stage: the normally developing children no longer produce RIs at the age of 3;04 more or less; however, the SLI children studied show RIs as late as age 8. These results are similar to the findings by Rice and Wexler (1996) and Rice, Wexler, and Cleave (1995) for English SLI and normal child language and support the view that SLI children show a delay or a deficit in certain syntactic areas. In other words, the SLI children show an Extended Optional Infinitive (EOI) Stage. However, as has been noted by many investigators of child language, the rate of RIs in English child language is significantly higher than the RI rate in Dutch child language. We found the same puzzling discrepancy between the speech of English and Dutch children with SLI. We offer an analysis which explains a) the occurrence of RIs in normal and SLI child language, and b) the difference in rates of RIs between English and Dutch (SLI) child language. At the same time we derive quite specific predictions about the nature of agreement and tense in Dutch children and test these predictions, winding up with a natural model of Dutch morphology which, when coupled with a strongly supported model of child grammar, predicts a wide variety of specific behavior.

Section 2 briefly and generally describes our basic view of SLI. Section 3 reviews the Agr/Tense Omission Model of Schütze and Wexler (1996), which provides the basic model of difference between adult and early child grammar that we assume. In section 4 we provide a detailed discussion of Dutch verbal morphology, comparing alternatives and suggesting the most natural model. Section 5 uses this model of Dutch morphology to derive the prediction that there will be more RIs in English than in Dutch. Section 6 is a detailed discussion of agreement in Dutch, predicting particular types of correct or error patterns of agreement in children depending on exactly which of 2 different interpretations of features in morphology is chosen. At the same time, these alternative models have different implications concerning how inflectional morphemes are inserted into a phrase marker—in particular how negative “context” features are applied, an open question in morphological theory. Thus the predictions are dependent on alternative views of these context features. Section 7 applies the morphological

model to make predictions about surprising “tense” errors in Dutch-speaking children—in particular, that children will use what appear to be present tense forms instead of past tense forms, a phenomenon that does not occur in English-speaking children. Thus the model has the capacity to predict clear crosslinguistic variation in subtle aspects of linguistic behavior. Section 8 discusses V2 phenomena in Dutch and makes predictions concerning correlations between word order and verbal morphology in Dutch children. Section 9 summarizes the predictions, deriving detailed tables of what is predicted by the morphological model in conjunction with ATOM, as compared to the predictions for adult morphology. Section 10 describes our normal and SLI participants and our procedures of data collection and analysis.

Section 11 is a detailed discussion of our empirical results. Section 11.1 documents the existence of Optional Infinitives in Dutch-speaking normal and SLI children over different age groups and shows that our prediction that there are more OIs in English than in Dutch is true. The data is collected from a large group of children so that we begin to see in Dutch some sense of what the average rate of OI is for normal children, something which cannot be obtained from studies of very small numbers of children. Section 11.2 investigates the finiteness/word order correlation that is predicted, showing that it is almost without exception true over a very large set of data. Section 11.3 demonstrates that Dutch children, and especially Dutch SLI children, do make what appears to be a present tense for past tense error, as predicted, and there is further discussion of tense errors in general. Section 11.4 is a study of agreement, showing that both normal and SLI children do not make many errors on agreement. In section 11.5 we argue that one minor (statistically) agreement error that *does* occur is due to a phonological process of schwa-insertion. Section 11.6 considers the theoretical implications of our results on agreement, arguing for a particular natural model of Dutch morphology and for a particular view of how features are interpreted when inflectional morphemes are inserted into a phrase marker. Section 12 is the conclusion.

2. Hypotheses

Based on findings regarding English SLI by Rice and Wexler (1996) and Rice, Wexler, and Cleave (1995) we hypothesize that the grammar of children with SLI is very similar to the grammar of younger normal children, acquiring the same language. That is, the syntactic deficits shown by children with SLI are also found in the linguistic behavior of normally developing younger children, and, vice versa, grammatical mechanisms that even the youngest normal children master, SLI children are good at, too.² Against the background of this general hypothesis, we formulate the more specific hypotheses as in (2):

² For experimental studies of comprehension (grammaticality judgment tasks) showing that both normal and SLI development delays are not solely a production problem, see Rice, Wexler and Redmond 1999.

- (2) Hypotheses
- a. The English morphological system provides more possibilities for the occurrence of RIs than does the Dutch morphological system;
 - b. Like normally developing Dutch children, Dutch children with SLI know the principles of verbal syntax and morphology, but they do not know that both Agr(eement) and T(ense) are obligatorily specified.

3. Schütze and Wexler (1996)

Before discussing the Dutch data, we first give a brief outline of a morphological model for verbs in English child language proposed by Schütze and Wexler (1996), which provides the foundations for our present analysis.

On the basis of errors in subject case in English, Schütze and Wexler (1996) argue that the Optional Infinitive phenomenon in normal children results from the optional specification of Agr and/or T (the ATOM). In particular, they assume that the child essentially knows the principles of morphology as instantiated by Distributed Morphology, including the Elsewhere Principle and Subset Principle, as proposed by Halle and Marantz (1993), with many more examples, including relevant Germanic ones, in Halle 2000. Furthermore, they assume that children know the particular morphological specifications of verbal agreement and tense morphemes in the adult language that they are acquiring. However, the omission of Agr and/or Tense features from the syntactic representation of the sentence will, depending on the morphology of the language, in certain situations result in nonfinite rather than finite Spell-Out.

In Distributed Morphology, one specifies features for each of a set of “competing” morphemes for a particular “slot.” In our case, these “slots” are the Agr and Tense projections. In other words, the set of available morphemes must be correctly distributed over the relevant slots. This “matching” of morphemes and slots is done according to the specification of the morphemes and the specification of the slots: the specification of the morpheme must be the same (or as similar as possible) as the specification of the slot. From this it follows that a higher specified matching morpheme has priority over a lower specified matching morpheme. For example, in Schütze and Wexler’s analysis of English (as is schematized in (3)), the verbal inflectional morpheme /s/ has the features third person, +singular, in the context –PAST. Another morpheme is the (phonetically) empty morpheme /∅/, which has no agreement or tense features, thus operating as a kind of default, following the Elsewhere Principle.³

³ Schütze and Wexler follow Halle and Marantz (1993) in considering that in English, Agr and Tense “fuse” into one Agr/T category, so that person/number features and Tense features are in one category, as represented in (3). For the purposes of this paper, we could consider Agr and Tense as unfused and specify that /s/ is inserted in Agr when Agr is +third person, +singular, in the “context” of –PAST, in a way analogous to our presentation for the context feature for /t/ in Dutch in (7) below. So far as we can tell, this decision would have no consequences for the discussion in this paper.

- | | |
|-------------------------|----------------|
| (3) English | |
| Agreement | Tense |
| /s/ = [+3P, +SG, -PAST] | /ed/ = [+PAST] |
| /∅/ = [] | /∅/ = [] |

If the phrase marker (or the “slot”) should have third person singular –PAST features, as the Agr/Tense slot in (4), the /s/ morpheme is inserted, because the specification of this morpheme matches the specification of the phrase marker best, thus yielding *She walks every day*.

- (4) She walk_[Agr/T +3, +SG, -PAST] every day.

However, according to ATOM, children optionally omit the Agr and Tense features. In this case, following the Elsewhere Principle (Halle and Marantz’s “Subset Principle”), /s/ will be unable to be inserted, but the empty morpheme /∅/ will surface, since it is the maximally specified feature consistent with the representation. This yields one kind of Optional Infinitive in English, as illustrated in (5).

- (5) Eve sit floor (Brown 1973)

One of the major features of ATOM is that the particular effects that a language will show in the OI stage will depend on the particular morphology of the language. For example, many languages are predicted to show verbal forms that look like (morphologically, on the surface) finite forms, but are actually missing an underlying feature in the phrase marker. That is, these forms are not infinitives, but rather what would classically be called “finite” (because of the form of the verb). Yet their missing features (in the phrase marker which they help to spell out) predict many different phenomena. Wexler (2000) gives a quite detailed illustration of this, showing that what appears to be a finite present tense form in child Danish should be seen as a form missing a feature, so as to predict particular patterns of grammar in children.

These considerations lead to two conclusions. First, to predict child linguistic behavior we must develop a detailed and precise model of morphology in the language. Second, we are now in a position to predict specific crosslinguistic differences in linguistic behavior in children on the basis of crosslinguistic differences in the language.

4. Dutch Verbal Morphology

For these reasons, we are led to develop a model of the Dutch inflection system for main verbs. (6) shows the inflectional paradigm for Dutch main verbs in the PRESENT and the PAST as compared to English.

(6) a. PRESENT

Dutch			English		
ik	werk	1SG	I	work	
jij	werk-t	2SG	you	work	
hij/zij/het	werk-t	3SG	he/she/it	work-s	
wij	werk-en	1PL	we	work	
jullie	werk-en	2PL	you	work	
zij	werk-en	3PL	they	work	

b. PAST

ik	werk-te	1SG	I	work-ed	
jij	werk-te	2SG	you	work-ed	
hij/zij/het	werk-te	3SG	he/she/it	work-ed	
wij	werk-te-n	1PL	we	work-ed	
jullie	werk-te-n	2PL	you	work-ed	
zij	werk-te-n	3PL	they	work-ed	

Notice that the Dutch inflectional morphology is slightly richer than the English one is; Dutch distinguishes in number in both the present and the past, and in person in the present singular. The feature specifications in (7) seem to be the simplest specifications that will predict the forms in (6), given the morphological principles that we have assumed.

(7) Agr morphemes	Tense morphemes
$/t/ = [-1, +SG/-PAST]$	$/\emptyset/ = []$
$/\emptyset/ = [+SG]$	$/te/ = [+PAST]$
$/n/ = []$	

Let us see how (7) predicts the correct forms in the verb paradigm (6). First, notice that there are two projections, Agr and T, with different sets of competing morphemes; three for Agr, and two for T. This seems correct; there is no particular reason to assume that Agr and Tense have “fused” into one projection for morphological purposes. In the plural past, for example, there appears to be a PAST (T) morpheme $/te/$ and a nonsingular (Agr) morpheme $/n/$ yielding the suffix *ten*, as in *werkten*.

The least specified agreement morpheme is $/n/$, which is inserted whenever a more highly specified morpheme does not meet its featural conditions for insertion. Standard phonological rules in Dutch insure that schwa is phonologically inserted,⁴ thus the usual spelling as *en*. In the plural past,

⁴ In an earlier version of this manuscript (November 2000), we assumed a morphological model for Dutch (instead of (7)) in which there was an extra Agr morpheme, $/el/$. Singular PAST then was made up of a PAST morpheme $/t/$ and an Agr morpheme $/el/$. Various complications ensued. We thank Morris Halle for pointing out to us that standard phonological rules for Dutch would insert schwa before $/n/$ in the relevant contexts, so that we did not need to assume a separate $/el/$ morpheme and could simply take singular past as an unanalyzed morpheme $/te/$. This simplification eliminated a number of questions about morphological theory and moreover, turned out to be even more accurate, when combined with ATOM, in predictions for children. Thus we have only considered the simpler, more accurate model here.

when /n/ is added to /te/, the phonological result is *ten*, the double insertion of schwa not occurring, for phonological reasons.

There are two T morphemes. When T is specified as +PAST, /te/ is inserted. Otherwise, the T morpheme is phonetically empty (i.e., \emptyset is inserted). Thus infinitives—which by syntactic principles lack Agr and T features—will have an Agr morpheme spelled out as /n/ and a T morpheme spelled out as / \emptyset /, yielding $\emptyset+n = en$. This is the correct form of the infinitive.

Moving to the Agr morphemes, suppose T is +PRESENT, thus nonpast. In this case, / \emptyset / is inserted for T. Suppose that the subject is first person singular. We cannot insert /t/ for Agr, because /t/ in (7) demands that the person features be non-first person. / \emptyset / demands only that the person features be +singular, so / \emptyset / is compatible with this situation. The other Agr morpheme, /n/ is also compatible, since it makes no demands on the features at all. But / \emptyset / is more highly specified than /n/, so that / \emptyset / must be inserted, the correct result.

Now suppose that T is +PRESENT, but the Agr features are third person singular. Again, / \emptyset / is inserted for T. For Agr, /t/ is compatible, since the subject is singular and is not first person, and the T feature is –past, all demands made by /t/. Of course, / \emptyset / is also compatible, since it only demands that the subject be singular, which it is. But /t/ demands that the subject be both singular *and* not first person, so that /t/ is more highly specified than / \emptyset /.⁵ Thus /t/ wins out over / \emptyset /. Of course, /n/, with no demands, is also compatible, but again /t/ is more highly specified than /n/. So /t/ is the most highly specified of the compatible morphemes. This means that (7) predicts that /t/ is inserted, the correct result.

When the subject is plural, neither / \emptyset / nor /t/ is compatible for insertion into Agr, because they both demand the [+SG] feature. Thus the only compatible morpheme is the “default” (i.e., the least specified) morpheme /n/, which is the correct result, whether T is PAST ($t + n = ten$) or –PAST ($\emptyset + n = en$).

The principles of morphology (insert the most highly specified compatible morpheme) together with the natural Dutch system in (7) yield just the right generalizations. We see that the “infinitival” morpheme /n/ and the “plural” morpheme /n/ are one and the same because all other Agr morphemes demand that the +singular feature be specified in the tree. For completely independent reasons, these two configurations do not have the +singular feature specified (in the case of the plural because a noncompatible feature [+PL] is specified on the subject and thus on Agr, and in the case of the infinitive because syntactic principles require that *no* phi features be spelled out in Agr). The generalization comes in not because of any *syntactic* similarity between the two configurations, but simply because both of them happen to miss the features demanded by the other morphemes in the Agr system. It is a

⁵ In (7) we can measure how highly specified a form is by using only the features before the “context” symbol; that is we can ignore the context feature –PAST in the specification of /t/. This is because this is the only context specification in the system (7), and we get the same result by ignoring the specification as by including it. Whether context is part of the calculation of how highly specified a form is in general goes beyond the topic of this paper.

morphological fact, not a syntactic fact, and it is captured beautifully in such a system.

Note the context feature /-PAST specified for /t/. This complication is necessary because if it were not stated, /t/ would be inserted as the Agr feature in non-first-person singular PAST contexts, incorrectly yielding *tet*, *werk-tet* instead of *werk-te* in these situations. It is a “context” specification because it is a specification on *another* inflectional node, not the node into which we are inserting the morpheme (the Agr node). Such specifications are often needed in morphology, so it is no surprise that it is needed here.

As an example, suppose that T is +PAST, and Agr is +singular, +third person. Tense is spelled out as /te/. If there were no “context” T feature in the Agr specification for /t/, then /t/ would be compatible. Since /t/ is more highly specified than the other Agr morphemes, it would be inserted, along with /te/ for the T node. But given the context T specification of /t/ in (7) as -PAST, /t/ is not compatible, and /∅/ is the most highly specified Agr morpheme. This latter is the correct result, as in (8).

- (8) a. Hij gaap-te-∅.
 he yawned
 b. *Hij gaap-te-t.

Thus we see that a contextual specification (-PAST) is necessary in the agreement slot for /t/.

There is, however, a major open question in morphological theory concerning negative features, in this case the context feature specification of /t/ as -PAST. Does -PAST mean that there exists a feature in the Tense node that is the opposite of -PAST, namely +PRESENT (call this *complete* specification)? Or does -PAST simply mean that the feature +Past does not exist in the T node (call this *incomplete* specification)? In other words, can /t/ be inserted when there is *no* feature specified for tense? The first option, complete specification, says *no* (since +PRESENT is not present in T), the second option (incomplete specification) says *yes*, (since PAST is *not* present in T).

The facts of Dutch adult morphology that we have considered ((6) plus the behavior of the infinitive) do not allow us to distinguish between complete and incomplete specification applied to (7). The only case we have of a T node with no features is the infinitive. But the infinitive also does not have any Agr features. So /t/ cannot be inserted in the Agr node of the infinitive anyway, even disregarding the context Tense specification, since /t/ demands +singular in Agr. Thus from the standpoint of the Dutch adult system, complete and incomplete specification are both empirically possible.

Whether complete or incomplete specification is correct however, is an important question. Morphologists often choose to take one pole of a feature as negative (e.g., should we consider +PRESENT or -PAST as the correct specification?). There is often little reason for such choice aside from some kind of intuition, without empirical consequences, so far as is known. If

complete specification is correct, then there *are* no empirical consequences in principle, since, for example, –PAST is totally equal to +PRESENT (always assuming here binary features). But if incomplete specification is correct then there are in principle empirical differences. But the adult language often does not give an empirical testing ground for such differences, since principles of grammar together with the morphological specifications (as in Dutch, as we have just seen) do not yield a testing ground for the predictions. We will see, however, that *child* grammar can give us an exact testing ground for the predictions, since it makes features complexes possible that are unattested in adult grammar. This will yield another case of how child grammar provides a testing ground for grammatical principle that is often impossible in the adult (see, for example, Schütze and Wexler 1996 on Case and its relation to Agr and Wexler 1998, 2000 for other cases).

5. Prediction Concerning Rates of Optional Infinitives

Note the particular assumption about the “infinitival” (or plural) /n/ morpheme in (7): /n/ is an Agr, not a T, morpheme, and it shows up whenever *singular* is not specified, i.e., either when plural is specified (as in some finite sentences) or when Agr is not specified at all in the syntactic representation (as in true infinitivals, which lack the agreement features). The empty sets of features, as for example the /n/ morpheme in the Agr slot mean that when there is no other consistent morpheme, this morpheme is inserted. This is where the Elsewhere Principle comes in. There is no “absolute” sense of default in Distributed Morphology; rather, the maximally specified morpheme that is consistent with the syntactic representation is inserted into a slot.

Using this model of Dutch morphology, we predict that Dutch child language will show a lower rate of OIs than English child language. Our hypothesis that children with SLI behave linguistically similar to younger children acquiring the same language, yields the same prediction for SLI Dutch versus SLI English. Let us assume that Dutch and English children omit (underspecify) Agr and T at the same rates, the unmarked assumption, so that the differing rates of RIs cannot be explained (stipulated) by differing rates of omission. We will show, rather, that it is the properties of the morphological systems of the language that force the prediction of different rates of RIs. We will illustrate here with a particular example. Schütze and Wexler showed that third-singular present /s/ will be “omitted”, yielding a RI (e.g., as in (5) **Eve sit floor*), when either Agr and/or Tense is omitted. When will a RI—that is, a root verb with the /en/ inflection with a singular subject as exemplified in (9)—appear in Dutch?

- (9) *mamma eten*
mommy eat-INF

Looking at the features for the Agr morphemes in (7) we see that according to the Elsewhere (Subset) Principle of Distributed Morphology, /n/ is inserted

if and only if the Agr node is not specified as +singular. Let us assume the subject actually is +singular. Also for simplicity (though the result generalizes) let us assume that Tense is +PRESENT (i.e., –PAST), so that the T morpheme is /∅/ whether or not T features are specified (cf. (7)). If the child omits the Agr features in the syntactic representation, then Agr is not specified +singular, and /en/ will surface.⁶ This is independent of whether or not T features are specified. On the other hand, if the child omits T, but *includes* Agr, then /en/ will not be inserted, given (7). We can now refine our hypothesis in (2a), as we do in the derived prediction in (10):⁷

- (10) a. English: RI in the contexts:
 i. [+Agr, –T]
 ii. [–Agr, +T]
 iii. [–Agr, –T]
 b. Dutch: RI in the contexts:
 i. [–Agr, +T]
 ii. [–Agr, –T]

From Schütze and Wexler's model of verbal morphology as presented in (3), we can infer that in English, underspecification of either Agreement or Tense yields the insertion of the /∅/ morpheme (i.e., an RI) by virtue of the Elsewhere Principle. In other words, if the English child underspecifies Tense, but not Agreement, as in (10ai), the only morpheme that is consistent is the /∅/ Agreement morpheme, because the /s/ morpheme requires that Tense be [–PAST]. However, since Tense is not specified, this contextual feature does not match the specification of the slot. Thus, the child will produce a RI. Similarly, if the English child underspecifies Agreement, but not Tense, as in (10aaii), there are two possible matching morphemes: the /ed/ morpheme if Tense is specified for [+PAST]; the /∅/ morpheme if Tense is not specified for [+PAST]. It is in this latter case that the result is a RI. As might be obvious by now, underspecification of both Agreement and Tense, as in (10aiii), always yields a RI in English.

The situation in Dutch is different: referring back to our model in (7) for Dutch we can see that if Agr is underspecified but not Tense, as in (10bi), the /en/ morpheme is inserted, by virtue of the Elsewhere Principle, since the other two Agr morphemes (/∅/ and /t/) both specify at least +singular. However, if Tense is underspecified, but not Agreement, the Elsewhere Principle dictates

⁶ As we discussed in section 4, /n/ is the inserted morpheme, and this becomes /en/ (spelling) via the phonological process that inserts schwa. Since this topic is not under discussion in this paper, and we can easily assume that the child knows the relevant phonology, we will often talk about inserting /en/ instead of the properly correct /n/.

⁷ If a version of ATOM is chosen in which either Agr or T may be omitted, but not both, we will derive the same result, that there will be more RIs in English than in Dutch. [–Agr, –T] will be omitted from the possible structures which will yield a RI in English and in Dutch in (10), but the structures in which RIs will be possible in English will still be a proper superset of the structures in which RIs will be possible in Dutch.

that the / \emptyset / morpheme be inserted in the Tense slot, and either / \emptyset / or /t/ (not /n/) for the Agr slot. Thus, in Dutch, underspecification of Tense does *not* yield a RI, contrary to English. If both Agreement and Tense are underspecified, as in (10bii), only the least specified morpheme, which is /en/ can be inserted, resulting in a RI.

Notice that the set of representations in which English has a RI strictly includes the set of representations in which Dutch has a RI. Thus the prediction follows:

- (11) Prediction: In a given developmental stage there are more RIs in English than in Dutch.

6. Predictions of ATOM Concerning Agreement

Ever since Wexler 1990 ff. and Poeppel and Wexler 1993, the prediction concerning the OI stage has been that children will produce correct agreement in the sense that a finite morpheme on the verb will have the same features as the subject. The situation is actually a bit more complicated once a formal model of morphology is constructed and ATOM applied to it. But it is clear that the Schütze and Wexler (1996) model for English predicts that when /s/ is inserted on the verb, the subject must be third person singular. This is empirically true, as Harris and Wexler (1996) demonstrated.

Now let us consider the consequences concerning agreement when ATOM is applied to Dutch morphology (7). Since /en/ often shows up as an OI, when Agr is omitted (as seen in the last section), we will not consider that morpheme. The two relevant Agr morphemes then are / \emptyset / and /en/. Given that, by far, most tokens in child language are singular, let's only consider the situation in which the subject is singular. Again, for simplicity we consider here only the situation in which Tense is –PAST.

When the subject is +first-person, +singular and Agr and T are both specified, the correct morpheme / \emptyset / is inserted on the verb. When Agr is specified and T is not specified, / \emptyset / is still inserted on the verb. Since the subject *is* first-person singular, this will appear as correct agreement. If Agr is missing, but T is specified, a RI will appear, as we saw in the last section. At any rate, the finite morpheme / \emptyset / will occur with its correct first-person subject in this situation.

The configuration is more interesting when the subject is third-person singular. If Agr and T are both specified, of course the correct morpheme /t/ will be inserted. If Agr is missing and T is specified (–PAST), an RI will appear.

The most interesting case is when Agr is specified as third-person singular and T is not specified. Since T is missing, / \emptyset / is inserted in the Tense node. But what is inserted in the Agr node?

It depends on whether we take the *complete* or *incomplete* notion of negative features, as discussed in section 4. If we accept the *complete*

interpretation, then the context specification of $-PAST$ for $/t/$ in (7) means that $/t/$ can only be inserted if Tense is specified as $-PAST$ (i.e., $+PRESENT$). Then, since $/t/$ is noncompatible (does not match), it cannot be inserted. Since the subject is $+singular$, $/\emptyset/$ is compatible (matches) and since $/\emptyset/$ is more highly specified than $/n/$, $/\emptyset/$ will be inserted. In this case we will have the possibility of what appears to be wrong agreement; a third person singular subject with $/\emptyset +\emptyset/$ on the verb. For example, the prediction is that children would utter nonagreeing forms like (12).

- (12) *Hij gaap- \emptyset - \emptyset .
he yawn

If the complete interpretation of negative features is correct, we thus predict that there will be agreement errors in which the stem ($/\emptyset/$ form will show up incorrectly with a third person singular subject.

Suppose, however, that the *incomplete* interpretation of negative features is correct. Then $/t/$ can be inserted when the Agr features are singular and non-first-person, *so long as* $-PAST$ is not specified in T . Thus in the $+Agr$, $-T$ situation, with Agr specified as $+third-person$, $+singular$, and no features at all in T , $/t/$ will be compatible, and thus, as the most highly specified compatible morpheme, $/t/$ will be inserted. The form will surface as (13), with “correct” agreement:

- (13) Hij gaap-t- \emptyset .
he yawns

In summary, we have the following predictions:

- (14) a. If incomplete agreement is correct, the child following ATOM and (7) will show no agreement errors; in particular, $/t/$ will be inserted for third-person singular even when Tense is unspecified, so that there will be no agreement errors such that $/\emptyset/$ is the agreement morpheme when the subject is third-person singular. (There will be no agreement errors on $/t/$).⁸
b. If complete agreement is correct, the child will insert $/\emptyset/$ when Agr is specified as second- or third-person singular and T is not specified, so that there will be agreement errors on $/\emptyset/$, which will appear with second- or third-singular verbs. (There will be no agreement errors on $/t/$).

It will thus be possible to use facts about agreement in child language to determine whether or not the complete or incomplete interpretation of negative

⁸ Of course, what we mean when we write that “there will be no agreement errors on $/t/$ ” is that when $/t/$ appears in a child production, the subject will be second- or third-person singular.

features in (7) is correct. What will be particularly interesting is that the different interpretations of completeness will yield different interpretations concerning tense errors also, as we will see in the next section, so that we will have two independent predictions concerning agreement and tense, and we will see if the results are consistent, yielding the same interpretation of completeness for negative features.

7. Predicted Tense Errors in Children

Another immediate consequence for children of the morphological system in (7) concerns errors made when PAST forms should be produced. In English, the Schütze and Wexler ATOM models predicts that when Tense is omitted, an RI (e.g., *walk*) will be produced instead of the present form *walks* or the past tense *walked*. Schütze and Wexler (2000) reported an elicitation study on children in the OI stage, in which either past tense (*ed*) forms or present tense (third-person singular *habitual* forms, that should have *-s* inflections, *she walks every day*) would be correct. Their result was striking; even the youngest (age about 2;6) group produced either *ed* or an OI when the context was +PAST, and either *s* or an OI when the context was [+PRES]. Past tense forms were essentially never used when the context was [+PRES], and present tense forms were essentially never used when the context was [+PAST]. The children knew the difference between present and past, and produced either the correct form, or an OI, exactly as predicted by ATOM for English.

What are the predictions for Dutch? Let us start with (7). Suppose the correct structure is [+1, +SG, +PAST] (spelled out as *te*), but suppose that, under ATOM, Tense is omitted. Then \emptyset will be inserted for the Tense morpheme, and \emptyset will be inserted for the Agr morpheme. Thus the inserted morpheme will be \emptyset ; *gaap* will be uttered instead of *gaapte*. In other words, what will appear is what looks like the present tense instead of the past tense, in the situation where the subject is first-person singular.

The data we will be able to look at, however, concern third-person singular forms that should be past. So, it will be particularly important to derive what the predictions of ATOM and (7) are with respect to the situation where the subject is third-person singular and the context is PAST. Suppose that the child specifies Agr but omits Tense in this case. Since there are no Tense features, (7) predicts that \emptyset will be inserted in the Tense node.

But what will appear in the Agr node? It depends on the interpretation of negative features. Suppose that the incomplete interpretation is correct. Then we have third-person singular specified in Agr. There are no features in Tense. Since the context feature for */t/* specified that Tense be -PAST, the incomplete interpretation of negative features predicts that */t/* is compatible with this situation, since Tense in fact is not +PAST (there are no Tense features at all). Thus, since */t/* is the most highly specified compatible feature, */t/* will be inserted in Agr. (15) will be possible as a child production.

- (15) Hij gaap-t-Ø.
*he yawned/he yawns

The form in (15) is the same as in (13). What we mean by the notation on the translations is that this form is good when it means *he yawns*, but is incorrect when it means *he yawned*. But the prediction of the incomplete interpretation of negative features is that (15) can be used by a child (specifying Agr, omitting Tense) when the situation is +PAST. This will appear as a tense error; the child will be appearing to use present tense (since (15) is grammatical as a present tense form) in a past tense context.

This is a particularly interesting prediction, as Schütze and Wexler's model of English morphology (3) predicts no substitutions of present tense forms for past tense forms. Rice, Wexler and Cleave (1995) and Rice and Wexler (1996) found this result in English for both SLI children (age 5 and up) and for normal children (age 3 and up). Schütze and Wexler (2000) showed the same result for normally developing children age 2;6 and up. Thus we have an example of a crosslinguistic prediction of differences, depending on the morphological system of the language.

On the other hand, suppose that the complete interpretation of negative features is correct, and consider the case of third-person singular subjects, and the context is +PAST. We need to consider the case where Agr is specified and Tense is unspecified. As before, /Ø/ is inserted in Tense, since Tense has no features (cf. (7)). But in this case /t/ can *not* be inserted in Agr, because the complete interpretation of negative features means that /t/ can only be inserted in Agr if Tense is specified as -PAST (i.e., +PRESENT). But since Tense has no specified features at all, /t/ cannot be inserted. In fact, /Ø/ will be inserted in Agr, since it is the most highly specified compatible Agr morpheme.

- (16) *Hij gaap-Ø-Ø.
*he yawned/*he yawns

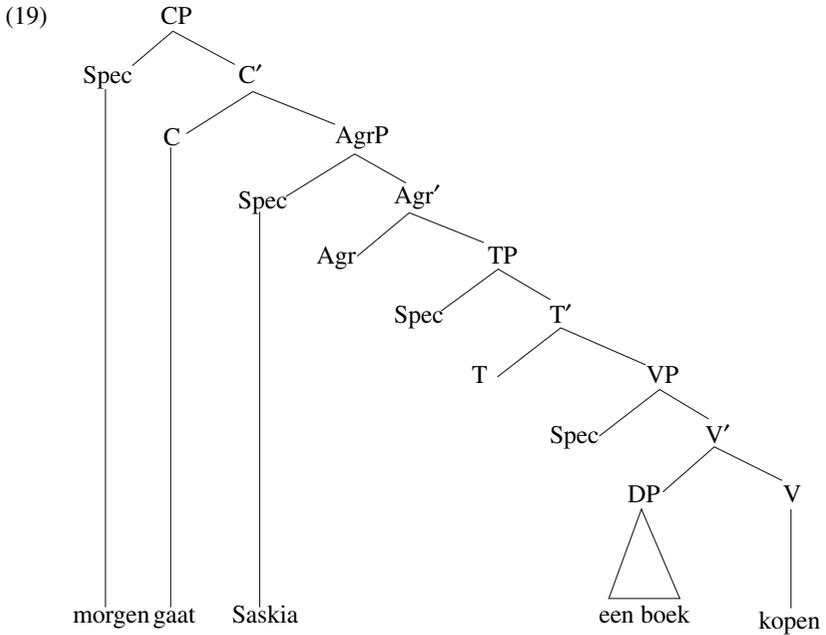
The form (16) is ungrammatical in both meanings, past and present. It is strictly ungrammatical. But the complete interpretation of negative features predicts that it will be used when Agr is present and Tense is omitted, whether the Tense context is PAST or PRESENT. This is the same form as the agreement error we saw in (12), but it will appear in PAST contexts as well, so long as Tense is omitted and Agr is present.

Thus there will a strong difference in what is expected as an error under the two different interpretations of negative features. Under the incomplete interpretation, we expect a clear "present tense" /t/ to appear sometimes in third-person singular PAST contexts. Under the complete interpretation, we predict that the error will look like a "stem" form; the Agr morpheme will be /Ø/, the form that appears to be only a first-person form, but that is predicted to appear even for third (or second) person when (PAST) Tense is missing, if the complete interpretation of negative features is correct.

Besten 1983, Koopman 1984, Haegeman & van Riemsdijk 1986). In subordinate clauses, this requirement is fulfilled by the complementizers (always overt in Dutch, as opposed to English); in root clauses the finite verb raises to C. Furthermore, nonfinite verbs remain in a lower position in the clause, probably V. This is illustrated in (19).

- (18) Morgen gaat Saskia een boek kopen.
 ADV V_{FIN} S O V_{NONFIN}
 tomorrow goes Saskia a book buy-INF
 ‘Saskia is going to buy a book tomorrow.’

A tree representation of this sentence is given in (19).



In certain pragmatic contexts, the XP in Spec, CP can be dropped, a phenomenon known as Topic-drop. This will render a sentence with the finite verb in initial position (V1).

To sum up, basically, Dutch finite verbs appear in the first or second position of the root sentence, nonfinite verbs occur sentence finally.

If children—both normal young children and older children with SLI—know the principles of syntax and morphology, as we hypothesize, we predict that they know finiteness—that is, that the finite verb appears in

second (or first) position in root clauses, and that infinitives are final. In other words, we make the following prediction:

- (20) Prediction: Normal Dutch children and Dutch children with SLI do not make errors with respect to the position of the verb; that is, finite verbs appear in second position and nonfinite verbs appear in final position.

The prediction (20) is expected to be true for the OI stage in V2 languages, as is well known (Weverink 1989 for Dutch, Poeppel & Wexler 1993 for German, Wexler 1990ff., among others). V2 was one of the structures that was used by Wexler (1990ff.) to argue for the basic properties of this stage—that although OI children could use nonfinite verbs in root position as well as finite verbs, nevertheless they knew syntactic principles of UG and the particular language (e.g., V2), and they therefore preserved the morphology/word order connection. It has been shown to be true for German SLI children by Rice, Noll, and Grimm (1997) and by Clahsen, Bartke, and Goellner (1997), although the number of subjects and amount of overall data were less in those studies than in our own.

Given our detailed analysis of the morphology of Dutch and the ATOM model applied to Dutch, in previous sections, we see that the situation is a bit more complicated in Dutch. Namely, there are some forms that appear to be “finite” (i.e., they have finite marking, not “infinitival” marking) that actually are not specified for some of the Agr/T features. In particular, we have seen that OIs (RIs) in Dutch children’s grammar are exactly some of the forms which are missing Agr features, although Tense is specified. Depending on which interpretation (complete or incomplete) of negative features that we take, there are various situations in which specifying Agr features, but omitting Tense features, leads to the insertion of a “finite” (i.e., non-*/n/*, namely either */∅/* or */t/*) morpheme into Agr. If raising the verb from its base position to C demands that both Agr and Tense be specified, then we would expect that some finite-appearing forms (namely those in which T was missing, but which nevertheless had a finite morpheme inserted) would fail to raise, and would be produced in final position.

On the other hand, we can maintain (20) even if the finite-appearing, but Tense-omitting, forms exist if we assume that main clause verbs move to C (the V2 position) if and only if they are specified for Agr.⁹ If a verb is specified for Agr but is missing T (+Agr, –T) then on our assumptions here, the verb

⁹ By being “specified for Agr”, we mean only that Agr features appear in the phrase marker. We assume that Agr features exist in all languages, even those which do not spell out agreement, for example the mainland Scandinavian languages.

will move to C, despite its lacking T. Conversely, a verb that is specified for T but is lacking Agr will not move to C.

For example, we showed in section 7 that in the OI stage, given the incomplete interpretation of negative features, a third-singular verb that has Agr but lacks T will nevertheless have the “finite” inflection *-t*. An example is (15) *Hij gaap-t-Ø/he yawns*, that can occur whether the context is PAST OR $-$ PAST, so long as the Tense features are omitted and the Agr features are not (i.e., [+Agr, $-$ T]). If, as we have assumed, verbs raise to C if and only if Agr is specified, then forms like (17) will show up only as V2 forms, as (20) asserts.

If the specification of T were necessary for movement to C, then such forms should not move to C. Note that to the extent that we can confirm that the predictions of the model concerning the existence of particular finite-appearing but missing-feature forms like (15) are upheld (for example, that */t/* appears on verbs in $+PAST$ contexts) and to the extent that the prediction in (20) (verb in second position) holds for such forms, it can be taken as evidence that Agr specifications are the triggers for movement to C in Dutch.¹⁰ This would then be another example of how analysis of child grammar can lead to conclusions that may not be derivable from the evidence available in adult grammar.

9. Summary of Predictions

Let us here summarize the assumptions and predictions we have made. We have assumed that normal and SLI children both obey ATOM. We have also proposed a morphological model for Dutch in (7). We showed that the model made slightly different predictions depending on which interpretation we took of negative features, complete or incomplete. Namely, the interaction of this model with ATOM predicted different empirical results on agreement and tense productions, so that the normal and SLI data could potentially distinguish the two models. The core predictions, however, were the same under both interpretations of negative features. A summary of the predictions appears in (21). All predictions apply to both normal (OI) children and SLI (EOI) children.

- (21) a. Children will place finite verbs in second position and nonfinite verbs in final position; see (20).
 b. At a given developmental stage normal English children will show more OIs than normal Dutch children, and SLI English children will show more OIs than SLI Dutch children, see (11).

¹⁰ Exactly where the verb will appear if it does not raise depends on the detailed syntax of Dutch that is assumed. Under traditional assumptions that Dutch Agr and T projections are right-headed, we would expect this $-T$ */t/* verb to appear in final position if it does not move to C.

- c. Under the complete interpretation of negative features, we expect to see a present tense agreement error (14b), in which first-person singular stem+Ø is substituted for stem+t (e.g., *gaap* for *gaapt*). Under the incomplete interpretation of negative features, we expect to not see such errors; see (14a).
- d. Aside from the one possible agreement error in (21c), we expect to see no agreement errors with a finite verb (which will appear in second position). That is, if a verb ends in /t/ or /Ø/, the subject will agree with it (except for the possible (21c) case, where there will be one kind of error on /Ø/, if the complete interpretation of negative features is correct). Of course, /en/ in final position—an OI which appears when Agr has been omitted—will appear with any kind of subject. Similarly for /ten/.
- e. In OI children, second- and third-person singular verbs used in past tense contexts will sometimes appear as singular “present tense” forms, if the incomplete interpretation of negative features is correct, (15). That is, /t/ will appear instead of /te/. If the complete interpretation of negative features is correct, this error will not occur, but an agreement error that looks like (21c) will be observed; see (16).

(21) provides a rather particular set of predictions, which is a sign of a precise, detailed model—the kind that we would like to see. Of course, precise predictions are hard to verify. To the extent that we verify the properties in (20) we will have provided a good deal of support for the model—both ATOM and the morphological model. In particular, a model which said only that SLI children had problems with morphology would not be able to make this particular set of predictions. For example, since /t/ is used for second- and third-person singular forms, why would not such a model predict that /t/ is overused a great deal?

In the study of the development of English, a traditional idea was that morphemes were “dropped” by normal and impaired children during development. This seemed like a natural idea in English because the typical produced error was the bare stem. As Wexler (1990 ff.) pointed out, results on other languages in the OI stage suggested that “dropping” of morphemes did not seem the appropriate characterization. Namely, infinitives that added a morpheme to the stem were often used. An interesting property of Dutch is that it has a common bare stem form, first-singular present tense. Note that (21) does not predict that any inflectional morphemes will be “dropped”, if the incomplete version of negative features is correct. That is, there is no prediction that the verb stem will show up as the full verb in present tense except when it correctly does, when the subject is first-person singular. Thus, despite the fact that Dutch has a bare stem form, first-person singular, which is used frequently, we do

not expect the “dropping” of morphemes. To the extent that this prediction is true, it provides further evidence that the “dropping” of morphemes on the surface level is not an adequate characterization of normal and impaired development.

To make sure that every prediction is quite clear, in (22) we list the predictions of (7) (the adult forms) in the first column, the predictions of ATOM applied to (7) for [+Agr, -T] in the second column, and the predictions of ATOM applied to (7) for [-Agr, +T] in the third column. We assume for this table the incomplete interpretation of negative features.

(22) The predictions of (7) combined with ATOM under the incomplete interpretation of negative features:¹¹

Context	Adult	+Agr,-T	-Agr,+T
1SG, PRESENT	∅	∅	<i>en</i>
2/3SG, PRESENT	<i>t</i>	<i>t</i>	<i>en</i>
PL, PRESENT	<i>en</i>	<i>en</i>	<i>en</i>
1SG, PAST	<i>te</i>	∅	<i>ten</i>
2/3SG, PAST	<i>te</i>	<i>t</i>	<i>ten</i>
PL, PAST	<i>ten</i>	<i>en</i>	<i>ten</i>
INFINITIVE	<i>en</i>	<i>en</i>	<i>en</i>

We have already seen why omitting Agr features results in /*en*/ for the PRESENT case. When Tense is PAST, the same argument holds, except that /*te*/ is inserted in the Tense node, so that /*ten*/ is predicted to result, even for singular subjects. We have derived the lack of agreement errors for +Agr,-T when Tense is PRESENT and the existence of errors for +Agr,-T when Tense is PAST. For the plural PAST, it should be obvious that omitting Tense will result in /*en*/ instead of /*ten*/.

The “infinitive” listing in the last row of (22) means the form that the infinitive should take in true (adult) infinitival contexts. The prediction is for no error; the child, like the adult, should use /*en*/ . This is a well-known property of the OI stage, universally attested, with extremely rare exception; in true infinitive contexts, the child produces the infinitival form. The prediction in our case follows from ATOM applied to (7), assuming as we do that true infinitives lack both Agr and T features, so that only /*en*/ may be inserted in Agr, and /∅/ in T, given the principles of morphology.

¹¹ For ease of comparing to child productions, in (22) we have listed /*en*/ instead of /*n*/, assuming phonological insertion of schwa, as we have already discussed.

In (23) we list the predictions of ATOM applied to (7) under the complete interpretation of negative features.

- (23) The predictions of (7) combined with ATOM under the complete interpretation of negative features:

Context	Adult	+Agr,-T	-Agr,+T
1SG, PRESENT	∅	∅	<i>en</i>
2/3SG, PRESENT	<i>t</i>	∅	<i>en</i>
PL, PRESENT	<i>en</i>	<i>en</i>	<i>en</i>
1SG, PAST	<i>te</i>	∅	<i>ten</i>
2/3SG, PAST	<i>te</i>	∅	<i>ten</i>
PL, PAST	<i>ten</i>	<i>en</i>	<i>ten</i>
INFINITIVE	<i>en</i>	<i>en</i>	<i>en</i>

The forms in (23) differ from those in (22) in exactly two cells—namely, the second- and third-person singular contexts, for both PRESENT and PAST. These are the two differing predictions that we have already discussed. That is, since +PRESENT is not specified in the +Agr,-T configuration, the complete interpretation of negative features does not allow /t/ to be inserted. Instead, /∅/ is inserted. This accounts for the two differences between (22) and (23).

10. Subjects and Methods

We coded and analyzed the spontaneous speech of 20 Dutch children with SLI between the ages of 4;2 and 8;2, and 47 normally developing Dutch children of age 1;7–3;7. The details of the SLI and the normal children are provided in (24) and (25), respectively (MLU means “mean length of utterance”):

- (24) Details for children with SLI

ID	Sex	Age	MLU	ID	Sex	Age	MLU
01	M	6;00.24	2.1	11	F	5;01.02	3.7
02	F	4;09.08	2.2	12	F	5;01.04	3.9
03	F	4;01.16	2.4	13	M	8;01.17	4.2
04	M	6;02.10	2.5	14	M	4;07.20	4.4
05	M	6;07.22	2.8	15	M	5;04.28	4.4
06	F	5;03.07	3.2	16	M	5;11.22	4.4
07	M	6;00.10	3.3	17	M	6;01.13	4.4
08	M	6;00.13	3.4	18	M	7;00.18	4.6
09	M	6;01.26	3.5	19	M	7;01.26	4.8
10	M	4;08.21	3.7	20	M	7;04.19	5.7

(25) Details for typically developing children

ID	Sex	Age	MLU	ID	Sex	Age	MLU
01	M	1;10.05	1.0	24	M	2;03.16	3.2
02	F	1;08.23	1.1	25	F	2;06.20	3.2
03	M	1;11.16	1.1	26	F	2;04.20	3.5
04	M	1;07.16	1.1	27	M	2;10.09	3.5
05	M	1;07.20	1.2	28	F	2;07.27	3.5
06	F	1;08.06	1.3	29	M	3;05.28	3.5
07	M	1;07.11	1.3	30	M	3;00.02	3.7
08	F	1;11.12	1.4	31	M	3;00.12	3.8
09	M	2;02.05	1.6	32	M	3;04.16	3.9
10	F	1;10.17	1.7	33	F	3;04.20	4.1
11	M	1;10.02	1.8	34	F	3;01.24	4.1
12	F	2;01.09	1.8	35	F	2;08.05	4.1
13	F	1;10.12	2.1	36	F	2;11.20	4.2
14	F	2;02.29	2.2	37	M	3;06.06	4.2
15	M	2;01.22	2.3	38	M	3;00.06	4.3
16	F	2;06.24	2.4	39	F	3;03.24	4.3
17	M	2;05.02	2.4	40	F	3;05.10	4.5
18	F	2;06.10	2.5	41	F	3;00.25	4.5
19	F	2;00.12	2.7	42	M	3;06.23	4.6
20	M	2;11.09	2.7	43	F	3;00.15	4.7
21	M	2;05.11	2.8	44	M	3;05.00	4.8
22	M	2;11.18	2.8	45	M	3;05.00	4.8
23	F	2;05.07	2.9	46	M	3;07.05	5.2
				47	F	3;02.18	5.3

All children with SLI lack sufficient intellectual or obvious physiological impairment to account for their difficulties in language production. The IQ of the children has been tested and falls within normal ranges.

For both the children with language problems, and the normally developing children, the transcripts on which we based the analysis come from the GRAMAT research of Bol and Kuiken (1990). The data in both groups consist of spontaneous speech samples. The speech of the children with SLI was recorded at their schools, while the children were playing with their speech therapist. The normally developing children were audio recorded for one hour in everyday situations at their homes in the presence of at least one of the parents and the observers. Only a subset of the recordings was used for transcription. Each transcript contained 100 analyzable utterances, and it was these transcripts that we analyzed. The MLU results we report were measured in morphemes.

The data were coded for several syntactic and morphological phenomena, including subject-verb agreement and the position of the verb. This was done according to a coding scheme developed by the authors, and based on the coding conventions of the CHILDES database system (MacWhinney & Snow

1985). After one author coded the transcripts, another author checked for accuracy and, where necessary, added or improved codes, consulting the first coding author.

11. Results and Discussion

11.1 Rate of Optional Infinitives

As the subject details in (25) show, the normally developing children show a correlation between age and MLU: the increase of age is paralleled by an increase in MLU. However, the SLI children do not display such an obvious correlation, as can be seen in (24). This suggests that a comparison by MLU between the SLI and the normal children is more valid than a comparison by age.¹² However, previous studies of language acquisition have pointed out that MLU by itself is not always a satisfactory indicator of development. Because of this and in order to be able to compare the results with English (which are presented by age in Rice and Wexler 1997 [though with comparison to an MLU-matched control group]), we will present our results regarding OIs both ways: by MLU and by age. As for MLU, we divided the subjects into the MLU groups in (26). # = Number of children.

(26) MLU groups

MLU	# SLI	Average MLU	# Typically developing	Average MLU
1	0		12	1.4
2	5	2.4	11	2.5
3	7	3.5	9	3.5
4	7	4.5	12	4.4
5	1	5.7	3	5.2

As for age, we defined the age groups as in (27) and (28) for the SLI and the normally developing children, respectively:

(27) Age groups for children with SLI

Age group	# of children	Average age
4;02–5;05	8	4;09
6;00–8;02	12	6;06

¹² Rice, Wexler, and Hershberger (1998) found a clear and systematic increase in MLU as well as a decrease in the rate of OIs in SLI English as a function of age, from 5 to 9 years, both findings that we do not show. However, their study was longitudinal; the same 20 SLI children were tested over these years. It is possible that our cross-sectional study randomly chose SLI children at different ages who had a different “degree” of SLI, as measured by rate of OIs. We would expect the rate of OIs to decrease with age in SLI children if we studied the same children over different ages since at the very least children learn strategies to overcome many of the behavioral manifestations of SLI. Similarly we would expect MLU to increase with age.

(28) Age groups for typically developing children

Age group	# of children	Average age
1;07–2;00	12	1;08
2;01–2;06	10	2;03
2;07–3;00	12	2;08
3;01–3;07	13	3;04

To count the rate of root infinitives, we counted the number of finite main verbs and infinitival root main verbs. We excluded from the counts of finite verbs auxiliaries, modals and copulas. This is because it is well known that these forms only show up as finite verbs in child main clauses, so it has become standard to only count main verbs. We excluded from the nonfinite forms anything but a root nonfinite main verb that does not sound grammatical to an adult. Thus we excluded adult root infinitives, all independent infinitives (e.g., an infinitive following another finite verb, which is good in some adult constructions) and past participles with the auxiliary omitted. These criteria match the criteria for the English comparison (main verb stem +s produced by the child as verb stem).

The results in (29) and in (30) indicate that the production of root infinitives decreases as a function of MLU in both SLI and normally developing children, and as a function of age only in normally developing children:

(29) Proportions of root infinitives by MLU

MLU	Root infinitives	
	SLI	Typically developing
1		84% (93/111)
2	30% (27/89)	62% (172/276)
3	19% (38/196)	19% (35/180)
4	6% (12/209)	9% (32/375)
5	3% (1/29)	8% (6/76)

(30) Proportions of root infinitives by age

Children with SLI		Typically developing children	
Age group	% RIs	Age group	% RIs
4;02–5;05	15% (28/189)	1;07–2;00	83% (126/152)
6;00–8;02	15% (50/334)	2;01–2;06	64% (126/198)
		2;07–3;00	23% (57/253)
		3;01–3;07	7% (29/415)

First, the table in (29) shows that the RI rates of the children with SLI are comparable to the RI rates of their MLU matched normal controls. Especially for MLU groups 3, 4 and 5 the similarity is striking: both SLI and normal children produce 19% RIs in MLU group 3, 8% and 9% in MLU group 4,

respectively and in MLU group 5 the RI rate is 3% for the SLI children and 8% for the normally developing children.

Second, as we can see in the table in (30), arranged by age, the SLI children still produce RIs by the time normally developing children have pretty much left the OI stage. The oldest child in the last age group of the normally developing children is 3;07, whose age group only produces 7% RIs, whereas the youngest child in the first age group of the SLI children is 4;02, whose age group produces an average of 15% RIs. These two results provide support for our hypothesis that children with SLI display language deficits similar to errors made by younger, normally developing children, and that the only difference lies in the fact that normally developing children grow out of this stage, whereas SLI children might not.

We should also point out that the fact that we have a relatively large number of normal subjects means that we are going some way toward obtaining the kind of mean group estimates for OI rates in younger Dutch children at different ages that are available for older English children from 3;0 on (cf.: Rice and Wexler 1996, Rice, Wexler and Hershberger 1998). In fact we have these estimates in (30) for approximately 6-month age groups from 1;7 to 3;7, with a minimum of 10 children in each group. Most OI studies investigate a few children; there are not many with a large enough group of children to provide more accurate statistical results for the population as a whole.

From 1;7 to 2;0 there is an 83% rate of OIs over children. This lends support to Wexler's (1990ff.) hypothesis that the rate of OIs tends toward 100% as children become very young, and might be consistent with the claim of Wijnen (1997) that at the youngest ages in Dutch there is a 100% rate of OIs.

The third result concerns the rate of RIs as compared to English. The RI rate is large for young normal Dutch children with a low MLU, decreasing radically when the MLU becomes higher than 4, or in the beginning of the third year. To make an age comparison to English children with a mean age of 3;0 in Rice and Wexler (their youngest group), we selected in (31) the 11 Dutch children around the same mean age.¹³ The rate of RIs (OIs) is much lower, as predicted (11, 21b), than in English. Rice and Wexler (1996) show that RIs (/s/ omission) in spontaneous speech for children with an average age of 2;11 (they did not study younger children) occurs 35% of the time, whereas our results show that 11 normal Dutch children in the same age range with an average age of 3;0 produce RIs 16% of the time.¹⁴

¹³ Rice and Wexler's Table 1 gives the mean age of this group as 35 months, but in Rice, Wexler, and Hershberger 1998 (p. 1419), the mean age of this same group is given as 36 months. Likely the small discrepancy is due to decisions about rounding. Since the other English data we discuss is from this same study in Rice, Wexler, and Hershberger, we have chosen their figures.

¹⁴ The 35% figure is from Rice and Wexler's Group 2. Their Group 1 (also 20 participants, also mean age 3;00) had a 44% rate of RIs (OIs) in spontaneous speech in obligatory -s contexts. The mean over both groups was 39%. We chose the smaller figure to report in (31) to error on the side of conservatism, given our hypothesis that this number is large compared to Dutch. The raw frequencies were not reported for Group 1.

- (31) Proportions of root infinitives at age 3;00: Dutch compared to English for typically developing children

Language	Age group	# of children	Average age	% RIs
Dutch	2;10–3;02	11	3;00	16% (42/265)
English	2;06–3.08	20	3;00	35% (196/540)

Comparison of SLI Dutch and English children confirms the same result, although the comparison is slightly more complicated, since the ages of the English SLI children that Rice and Wexler studied and our Dutch SLI children do not completely overlap. However, (32) gives an indication of the RI proportions in SLI Dutch as compared to SLI English. We took the English data in (32) from Rice, Wexler and Hershberger (1998). We selected their “round 3” of measurement because the children then had mean age 5;08, which was the closest match to our Dutch SLI group in mean age.¹⁵ The 34% rate of RIs for English children at this age was read off from the graph in Rice, Wexler and Hershberger’s figure 1 (third-singular *-s* [spontaneous data]), since this comes closest in methodology (naturalistic data, coded for inflection) to our study. The rate of OIs in Dutch is 15% compared to the 34% rate for English.¹⁶

- (32) Proportions of root infinitives: Dutch compared to English for children with SLI

Language	Age group	# of children	Average age	% of RIs
Dutch	4;02–8;02	20	5;11	15% (78/523)
English	5.04–6.02	19	5;08	34%

In summary, both sets of results confirm our prediction that the rate of RIs in Dutch SLI and normal child language is smaller than the rate of RIs in child and SLI English, respectively, thus providing support to the Agr/Tense Deletion model of Schütze and Wexler (1996) together with our model of Dutch verbal morphology (7). ATOM’s robustness in predicting not only particular correlations in errors (e.g., nonnominative subject case only in OIs in child English) but also in predicting quantitative differences in crosslinguistic variation is difficult for less technically precise models to match. An advantage of using a clear linguistic model is that it can make these precise predictions of differences.

¹⁵ We calculated the mean age and age range of participants by adding 12 months to the means and range given in Rice and Wexler for the Study 2 SLI participants, since these were the same children studied at later time periods in Rice, Wexler, and Hershberger. Since there might have been “minor adjustments for children who dropped out after the first round of testing and for children added after the first round” (p. 1418), the figures we report for mean age and age range may be very slightly different from the real ones.

¹⁶ Rice, Wexler, and Hershberger to do not give frequencies of obligatory contexts and uses of *-s*, but they report “mean frequencies of obligatory contexts at or exceeding 10 uses for each of the target morphemes, per group...per round, except past *-ed*” (p. 1420). Since there were 19 participants in the SLI group, this means that there were at least $10 \times 19 = 190$ obligatory contexts for *-s*; given other information the authors provide, the number was probably considerably higher. For example, note the 540 contexts for Round 1, reported in (31).

11.2 Finiteness/Verb Position Contingency

The most prominent feature of the OI stage in V2 SOV languages like Dutch is that there is a strong contingency between finiteness and verb position: finite verbs occur in second position and nonfinite verbs occur in final position. In (20) we predicted that SLI children would obey this contingency as well. We analyzed all verbs in the children’s utterances as to their morphology (finite/nonfinite) and the position of the verb, V1/V2. Following the standard methodology introduced in Poeppel and Wexler (1993), we only included utterances in the final analysis if there were at least 3 constituents, so that the position of the verb could be unambiguously determined as V second or V final. As we showed earlier in the paper, the first constituent (in Spec,CP) can often be omitted in Dutch, so that we treated an omitted first constituent as a constituent.

Thus we call the V2 position “V1/V2,” by which we mean that the verb sometimes appears in first position, following a null constituent. In every V1/V2 case, there is a constituent (at least) which follows the first or second position verb.

We wanted to count *all* the verb forms the children used, so that we could test the morphology/word order correlation generally. That is, the counts include (for the finite verbs) not only the finite main verbs, but also finite auxiliaries, modals and copulas. The nonfinite forms include not only the child RIs but also RIs that appear to be good for adults, all dependent infinitives (i.e., following a finite aux or modal) and past participles.¹⁷

In (33) and (34) we report the total number of number of finite and nonfinite verbs in V1/V2 versus V-final position, for normal and SLI children, respectively. The percentage is the percentage that the cell makes up in the column, such as the percentage of V-final verbs that are nonfinite.

(33) Finiteness/position contingency typically developing children

	V1/V2	V-final
Finite	1953 (99%)	11 (2%)
Nonfinite	20 (1%)	606 (98%)

(34) Finiteness/position contingency children with SLI

	V1/V2	V-final
Finite	1071 (99.8%)	16 (5%)
Nonfinite	2 (0.2%)	335 (95%)

¹⁷ To save space we do not report the correlation tables of just the main finite verbs and the child root infinitives. But because (33) and (34) show such a small number of counterexamples to the predicted correlation, we straightforwardly see that there could not have been many counterexamples in that subset of the items of the table.

Both SLI children and normally developing children show adult like knowledge of verb placement from the earliest MLU level and age studied.¹⁸ Overall in (33) we see that there are 626 nonfinite verbs and 1,964 finite verbs; thus about 24% of the verbs are morphologically nonfinite. But 98% of the verbs in final position are nonfinite and only 1% of the verbs in V2 position are nonfinite. For the SLI children in (34), there are 337 nonfinite verbs and 1,087 finite verbs, for a rate of 24% morphologically nonfinite verbs, identical to the rate for the normal, younger children. But the SLI children have final verbs which are 95% nonfinite and V2 verbs which are 0.2% nonfinite.

Thus, our results confirm the hypothesis we formulated in (2b) and (20) for SLI children: just like normally developing children, they know the principles of finite morphology, and they know the syntax of the language with respect to obligatory processes of verb movement, in particular V2. However, as we saw in (29), (30), and (32), they do produce RIs, which shows that they do not know that Agr and Tense are obligatorily specified.

As we pointed out in section 8, our prediction that “finite” verbs must appear in second position depends on the assumption that Agr is the motivator for movement to C. Since we observed almost no finite-appearing verbs in final position, we have provided evidence that in fact Agr is the motivator for movement to C.

It is worth remarking that this strong knowledge of the finiteness/verb position in SLI children shows how well they know the syntax of their language and also the morphology of their language. They distinguish almost categorically between finite morphology and infinitival morphology, as measured by verb placement. If the SLI children had any “trouble” with verb morphology, such that they could not properly enter the inflectional forms into a “paradigm” (as suggested by the “Surface Hypothesis” of Leonard 1998), then we would not expect this strong correlation of verbal morphology and word order. In a language in which the verb shows up in different positions depending on the inflectional morphology, we would expect a far from perfect behavior by SLI children if they did not have the forms entered into their lexicons (in the “paradigms” in Leonard’s terms) or if they had the forms entered, but with incorrect or weak specifications of some kind. At least for these Dutch SLI children, we can conclude that the verbal inflectional forms are completely and well specified in the lexicon, at least as regards the finite/nonfinite distinction.

11.3 The Use of “Present Tense” Forms for Past Tense

As shown in (21e), (22), and (23), ATOM together with the morphological model in (7) and the incomplete interpretation of negative features predicts that past tense contexts will show up in what appear to be “present tense” forms in the OI

¹⁸ There are such an extremely small number of counterexamples in (33) and (34) to the finiteness/position correlation that there could not be any effect differentiating age or MLU groups, and inspection of these shows that there is not. Thus we do not break down the information in (33) and (34) by age or MLU groups.

stage, and thus in the EOI (SLI) stage. This error is predicted to not occur under the complete interpretation of negative features. Given the contexts of the spontaneous data that we collected, there were extremely few contexts in which past tense is appropriate. Thus our own data will just yield a quite tentative result. But we will then discuss data from another study that used a method that elicited many more past tense contexts and we will be able to determine with a larger amount of relevant data whether the prediction of (7) is correct.

(35) Past-tense contexts, *-t* and other errors

	Contexts	<i>-t</i>	<i>-∅</i>	<i>-en</i>
Normal	53	4	4	1
SLI	84	6	4	1

It was not easy to decide when a past tense context occurred, and we likely missed many. In (35), for normal children, we see that 44 of 53 past contexts received an appropriate past inflection (*te/ten*). So, the error that we predicted—the substitution of what look like present tense forms for past tense forms, (slightly different for the complete and incomplete interpretations; see (22) and (23)) does occur. The overall rate of error is $9/53 = .17$. It is quite possible that we have seriously underestimated the amount of this error, because it is much easier to spot a past tense context if the past tense form were actually used. Thus we may have missed many past contexts in which the verb was produced as a present (or nonfinite) verb. Nevertheless, the fact that the error *does* occur is consistent with the model. Both forms of error occur (*/t/* as predicted by the incomplete interpretation and */∅/* as predicted by the complete interpretation), so it is difficult to decide between the two models on the basis of the very limited numbers in (35).

SLI children show 73 correct past forms out of 83 past contexts for an error rate of $11/84 = .13$. Again, the error that we predicted does occur, and we may have missed a good number.

There may be other reasons why the present for past error frequency is small in the data besides the difficulty in coding past tense contexts when the past inflection does not exist. Children tend to talk mostly in the “here and now,” the present tense, when they are young, for cognitive reasons presumably. Thus past tense contexts will increase as they get older. But as they get older T omission will become smaller. Thus many/most of the past tense contexts would be expected to occur in the older normal children. Bol and Kuiken (1988) showed that 75–90% of the normal Dutch children in their study first used past tense forms between the ages of 3;0 to 3;6. We saw in (27) that these children produced only 7% RIs. Thus their Agr omission rate was only about .07. Similarly, their T omission rate may also have been small at this age. Given that these children mostly produce [+Agr, +T] verbs, we would not expect a large number of this type of substitution. Thus the rate of present for past tense substitutions that we have observed is probably meaningful despite the fact that it is not large, particularly as the same error is virtually nonexistent for English-speaking children.

Looking at the particular forms of present tense that are used, there are extremely few substitutions of *-en*; for example, *gaapen*, for a past-tense form (only 1 each for each the normal and SLI children). These *-en* forms here are forms that occur in finite (V2) position. The fact that they hardly exist supports the analysis, because such forms are not predicted to occur for singular PAST subjects. They might occur if both Agr and T were omitted, but in that case, raising to V2 cannot occur.¹⁹

Over all the data might be thought of as consistent with the predictions of (7). The set of errors of the predicted kind is large enough to encourage the search for more and clearer data.

Fortunately, de Jong (1999) is a study of SLI development that—because of the experimental method used—contains a larger amount of appropriate past-tense data. De Jong asked Dutch children with SLI (and controls) to tell a story they just witnessed and asked the children what happened using the past tense (thus hoping to elicit the past tense in many contexts), and he reports the verbal forms that the children use. He says that they often use the “dramatic present” in the storytelling (a well-known phenomenon among normal children), so that it is often not appropriate to decide that a story context is an obligatory context for past tense. De Jong thus decided to count as obligatory contexts for past tense only those utterances by the child in which an “adverbial phrase indicating pastness” was used.” (p. 61) This phrase was

¹⁹ As (22) and (23) show, only substitutions of /t/ and /∅/ (stem) forms are predicted to occur. The incomplete interpretation of negative features predicts that stem forms will be substituted only for first-singular past forms (*gaap* for *gaapte*). The complete interpretation of negative features predicts that stem forms will be substituted for first-, second-, and third-singular past forms. The data are consistent with this prediction, although the small number of relevant contexts makes it difficult to draw a strong inference.

For the normal children, the four stem forms all have third-singular subjects, appearing at first glance to contradict the predictions of the incomplete interpretation, which only predicts stem form substitution for first-singular past forms. However, it turns out that all 4 of these forms are ones in which *-t* may in fact be omitted (with some dialectal variation) from present tense, verbs like *heb/ have* and *moet/must*. The natural assumption is that for these forms, Agr is spelled out as *-∅*. In terms of our model (7) we might think that /t/ has exceptions stated for this very small class of verbs (or there is some device making /∅/ more specific than /t/ for this class of verbs). That is, /∅/ is inserted in present tense singular forms in this small class of verbs, at least optionally, no matter what the person feature. So in fact, these 4 stem forms *are* the forms that we would expect when T is omitted (and thus spelled out as *-∅*). Thus the existence of these forms supports (7) and is not necessarily inconsistent with the incomplete interpretation of negative features.

Turning to *-t* for the normal children, three of the four *-t* errors have a third-person singular subject, as predicted by the incomplete interpretation of negative features. There is only one unaccounted for case: a third-person plural subject.

For the SLI children, of the four *-∅* errors, one had a first-singular subject, predicted by (7), under either interpretation of negative features. The other three (third-singular or -plural subjects) are unaccounted for by the incomplete interpretation of negative features, but the singular cases are predicted by the complete interpretation. Perhaps the nonpredicted cases are rare instances of surface inflection omission. Four of the six SLI *-t* errors have a third-person singular subject, as predicted by the incomplete interpretation of negative features. (The other two have a first-singular subject, not predicted by (7)). Overall, there seems to be support for (7) and, given the productions of /t/ for third-singular PAST, a bit more support for the incomplete interpretation of negative features than for the complete interpretation. But the numbers are overall low, given our method, so that the further evidence from de Jong's experiment will be more telling.

always the adverb *toen/then*, which—despite its translation in English—can only refer to past events. Thus, although some past contexts were undoubtedly missed, we can be certain that all the contexts under discussion were intended as past tense by the children.²⁰

First, let's consider the normal children. De Jong's Table 4.3 shows that the 20 younger normal children had .98 correct use of past tense in these obligatory contexts; the 35 older normal children had .99 correct use. Thus there were virtually no errors in the normal children. Note that the 20 younger normal children have mean age 59.6 months, with standard deviation 7.4. Although we cannot find a statement of the range of ages for this group, given the mean and SD, it is unlikely that any of them (or at most, say, one) are younger than 45 months.²¹ Thus we expect them to be out of the OI (ATOM) stage (our example (30) shows a rate of 7% OI for much younger children; age 3;0–3;7). And in fact, de Jong's finding (Table 4.6) is that the group of 20 younger normal children only produces a mean number of 0.10 OIs (his "Agreement error 3") per child compared to 2.85 mean OIs per SLI children, who are much older²² (he does not report overall rates of OIs in obligatory tensed contexts). In other words, de Jong agrees that the normal children are out of the OI stage. It follows that the nonoccurrence of past tense forms as present tense forms in these children is predicted by our model.

Now let us turn to de Jong's SLI children ($n = 29$, mean age = 93.7 months). Here the situation is quite different. In obligatory past tense contexts, de Jong's Table 4.3 shows that they use past tense forms in only .77 of the obligatory contexts (compared to .98 for the younger normals, as already discussed).²³ Thus the SLI children definitely make a reasonably large number of morphological errors in past tense contexts, supporting (7) and ATOM.²⁴

What forms actually appear instead of the past tense form? For brevity and simplicity let us concentrate on the regular verbs, though essentially the same results hold for irregular verbs. For regular verbs, de Jong's Table 4.5 shows that there are 6 stem forms, 7 infinitival forms and 23 present-tense forms.

²⁰ De Jong is assuming that children know the meaning of *toen* and use it appropriately, as a past adverb; his discussion of the data seems quite consistent with this assumption.

²¹ On p. 73, de Jong writes that a slightly differently selected group of 15 of these younger controls are all "over 3;11," which would be consistent with our conclusion.

²² There are slight more analyzed utterances ("T-units") for the SLI children; nevertheless the ratio of RIs per T-unit for the SLI children is almost 20 times greater than for the younger normally developing children.

²³ De Jong's Table 4.3 shows $p = .0000$ for this normal/SLI comparison.

²⁴ In fact, the error rate might, in a relevant sense, be even larger than the .77 figure suggests. A very large number of the past tense forms are *ging* + infinitive, where *ging* is the past tense form of *gaan/go*. These are counted as correct uses of past tense in obligatory contexts although they are nonadult as simple descriptions of past events. Since auxiliaries are never produced as infinitives in the OI stage (de Haan 1987 for Dutch, Wexler 1990ff. for the general OI case), we would not see *gaan* appear in the infinitive form in these contexts, where *gaan* is an auxiliary appearing together with an infinitive. Pending an exact analysis of what happens to *gaan* when Tense is omitted from the representation (is it omitted? or is the construction impossible?), we would expect that the true error rate in past tense is even greater than .23. In fact, as we will discuss, de Jong (p. 66) writes: "When counted by obligatory contexts only .33 of the contexts were properly filled for regular verb contexts."

To know what ATOM and (7) predicts, we have to know what the forms of the subjects were. De Jong (1999) does not say but de Jong informs us that essentially the subjects were all third person because of the nature of the elicitation task, telling a narrative. He writes (p.c.), “there was no instance in the past tense data where a singular subject required first person form.” It seems reasonable to infer that essentially all the forms listed in Table 4.6 had third-person subjects. Most of them must be singular, though it’s not clear how many plural subjects there are, if any.

A look at (22) and (23) shows that infinitival /en/ forms are only predicted by (7) and ATOM in the past tense if the subject is plural, and ATOM chooses +Agr,–T. If Tense features are included, of course, /t/ must be inserted in this PAST context, and /en/ is impossible. So this use of /en/ is consistent with ATOM and (7) under both interpretations of negative features if the subject is plural. It is possible that these subjects *are* plural, and this result would then be predicted. The same /en/ would also be predicted even if the subject were singular and Agr and Tense were omitted, a possibility that might be allowed, as we have discussed, although we did not list it in (22) and (23). Thus it seems that the infinitival /en/ forms are consistent with (7) and ATOM.

By far the largest error category is the use of “present tense” forms in past contexts. There are 23 of these. Although de Jong (1999) does not explicitly say, these are presumably uses of /t/ since \emptyset (stems) and *-en* (infinitives) were counted separately.²⁵ Moreover, de Jong (personal communication) confirms that these were essentially uses of /t/. Thus there are a good number of /t/ (present tense) forms used instead of past tense (/te/) forms in third singular PAST contexts, as predicted by the incomplete interpretation of negative features (see (21e) and (22)) for ATOM (+Agr,–T) but not by the complete interpretation of negative features (see (21e) and (23)). De Jong does not give the percentage of use of present tense forms in obligatory past tense contexts, but we can in fact estimate this percentage.

Many of the past tense forms were *ging* ‘go’ + infinitive and many were irregular verbs, which could have somewhat different morphological properties (see fn. 24). So let us concentrate on regular main verbs. De Jong reports (p. 66) that “only 33% of the contexts were properly filled for regular verb contexts.” That is, correct past-tense forms were used only one-third of the time when the verb produced was a regular main verb. We have seen that there were 36 errors on produced regular verbs; thus we can

²⁵ Possibly *-en* forms with singular subjects used in verb-second (finite) position were also counted as “present tense” errors in past contexts, although from other comments in de Jong there were unlikely to be many (if any) of these. There were only 18 *-en* substitutions for a singular verb in finite contexts over *all* the groups and *all* the utterances (p. 76). Since the utterances with obligatory past tense contexts (those with *toen*) were only a very small proportion of all these utterances, it is likely that none of the finite *-en* with singular subject errors were in the obligatory past tense set. Model (7) predicts these do not exist (aside from performance errors) because for *en* to be inserted in a past tense context both Agr and T must be omitted and in this case the verb could not raise to C (second position).

conclude (de Jong does not give the numbers) that there were about 54 obligatory past tense contexts for regular main verbs, that in 18 of them the correct past tense forms was used and that in the remaining 36 cases an error was made. 23 of these errors were to substitute the present tense for the past tense. Thus of 54 past tense contexts, 23 appeared as present tense. This is a rate of $23/54 = 43\%$ of present-tense substitution²⁶—that is, of substitution of /t/ for third-person PAST /te/. This is quite a strong confirmation of the predicted error.

This is quite different from results in English, where ATOM predicts that past tense forms will show up only as correct past tense forms (not considering overregularizations for irregular verbs²⁷) or as OIs (stem forms in English). Present tense -s will never show up for past tense contexts. And Rice and Wexler (1996) have shown this to be true for SLI children 5 and older and for normal children 3;0 and older. Schütze and Wexler (2000) reported an experimental elicitation study where past tense contexts were set up, thus being similar in this respect to de Jong's study. For the youngest group of 2;2–2;10 normal children, out of 81 third person singular past tense contexts elicited, 35 of the responses were past tense (-ed), 46 were OIs (the bare stem) and none were present tense -s. These children are clearly still in the OI stage ($46/81 = 57\%$ OIs for past tense contexts), but they never substitute present tense for past tense. The Dutch children who are still in the OI stage, however, very often (43%) substitute present tense for past tense. The difference in the rates of present tense substitution for Dutch (43%) and English (0%) is huge, and provides quite striking confirmation of ATOM together with the natural models of morphology given for Dutch and for English. Furthermore, since the error is predicted only be the incomplete interpretation of negative features, the evidence provides clear confirmation for this interpretation, at least for the Dutch case under consideration.

ATOM thus predicts a major difference in Dutch and English development, and this is empirically confirmed. In English there will be no substitutions of present for past and in Dutch there *will* be such substitutions. It is worth observing that the predicted differences in this regard show that the traditional distinction between errors of "commission" and errors of "omission" is not precise enough, and cannot be used in the most simple and obvious way. It is often said that children make errors of omission but not of

²⁶ If we include the 6 stem forms as present tense also (they should be so counted, according to (7) and ATOM (and the incomplete interpretation of negative features) if and only if they have first-person singular subjects (22)), the rate goes up to $29/54 = .54$. Thus someplace between .43 and .54 past tense regular verbs show up as present tense. On the other hand, as we pointed out in the text, de Jong (p.c.) says none of the PAST forms had first-person singular subjects, so that we should not count these forms. Thus .43 seems the most accurate estimate for use of /t/ when third-person PAST /te/ was required.

²⁷ For empirical results on overregularizations in English SLI, see Rice, Wexler, Marquis, and Hershberger 2000.

commission. For example, it is often said (e.g., Bishop 1994) that children (and SLI children) in English do not substitute present tense for past tense because this is an error of commission; they leave off past tense, however, (producing what we call a RI), because this is an error of omission. We see instead that the developmental facts show that errors of commission *can* be made (and often) if the underlying child deficit produces what *appear* to be such errors. On our model, the child knows the agreement features, but wrong forms can surface nevertheless because the child has omitted features from the syntactic representation. The errors of commission that do *not* exist—on our view—are ones in which the child inserts the wrong morpheme in the syntactic structure that she has actually chosen.²⁸ She follows the rules of morphology. In our view, this is the correct generalization about both normal and SLI children.

There are also 6 stem forms used in past tense contexts. (7) and ATOM predict that the stem form (stem + \emptyset + \emptyset) is possible for OI children in third-singular PAST contexts (+Agr, -T), but only if the complete interpretation of negative features is assumed. Note that the stem form is only predicted to be possible in first-person singular contexts by the incomplete interpretation of negative features. Since De Jong (p.c.) says that only third-person singular subjects are used in the PAST contexts, the 6 stem forms must be assumed to be consistent with the complete interpretation of negative features and not with the incomplete interpretation. But there are about 4 times as many forms (/t/) that are predicted by the incomplete interpretation and not by the complete interpretation. Thus we have to conclude that the data most strongly supports the incomplete interpretation.

One possibility is that UG (morphological theory) does not determine whether the complete or incomplete interpretation of negative features is correct, and that the learner is free to choose whichever form is consistent with the data (input). Given the Dutch data that we have discussed, both interpretations are consistent; we have had to go to analysis of child grammar to find a difference. Thus it is possible that children are free to choose either interpretation and the production of the 23 /t/ forms and 6 / \emptyset / forms in third-singular PAST contexts results from the fact that either is consistent with the input data, and the child's choice is not determined.

But there are so many more /t/ forms than stem forms in this context, that we will tentatively take the data as supporting the incomplete interpretation, in which case we will have to count the 6 stem forms as performance errors.

At any rate, note the significance of the errors for learnability and UG considerations. Children produce forms that they have never heard in the particular context; namely 43% of the forms used in third-singular PAST

²⁸ Schütze and Wexler (1996) leave open the possibility that at a particular stage the child may not have learned all the morphemes completely (in the case of morphological case)—that is, has not inserted them in her mental lexicon. But for the most part empirical results in the OI stage show that the verbal agreement and tense paradigms do exist in the lexicon from a fairly early age. Certainly this is true for the Dutch children that we and de Jong studied.

contexts are /t/, and these forms have never been heard in this context. We have to account for these forms. If children know every aspect of grammar perfectly, we cannot account for these forms. This is what Borer and Wexler (1987) call the Triggering Problem and what Babyonyshev, Ganger, Pesetsky, and Wexler (2001) refer to as the “Problem of the Abundance of the Stimulus.” Children must have heard the correct /te/ form many times. Why is there still an error? As these authors argue, the only explanation is maturation of the linguistic faculty, in our case withering away of ATOM (or the Unique Checking Constraint of Wexler (1998) which is taken to cause ATOM). For further arguments concerning maturation, see Wexler (2002).

ATOM also expects infinitival forms in Dutch to be used instead of past tense forms—this occurs when Agr has been omitted *and* T has been omitted.²⁹ Thus the use of these forms is understood. Moreover, the fact that there are many more present tense forms than infinitival forms is explainable if T is omitted much more often than Agr, because the infinitival form demands that Agr be omitted. Wexler, Schütze and Rice (1998) argue that T is omitted more often than Agr in the English data (for normals and SLI) because the nonnominative subject stage, which depends on Agr omission, ends before the OI stage, which in English depends on either Agr or T omission. Another observation consistent with the claim that T is omitted more often than Agr in English children is that the null subject stage (which Bromberg and Wexler (1995) and Schütze and Wexler (1996) assume depends on T omission) lasts beyond the nonnominative subject stage (which depends on Agr omission in Schütze and Wexler’s analysis). If Dutch behaves like English in the relative probability of dropping Agr or T—the unmarked assumption—then we understand why there are many more present tense forms used in past contexts than infinitivals.

At any rate, the fact that the largest number of Past Tense errors are present tense forms, a phenomenon quite distinct from the results in OI and EOI (SLI) English, constitutes striking support for ATOM and for the morphological model of Dutch that we have assumed. Clearly, the surprising prediction (21e) (surprising because on the surface it is different from the result for English) is confirmed. Without a detailed linguistic theory, there would have been no way to make this prediction of particular crosslinguistic differences. On the other hand, the developmental theory and data help us to pick out the correct linguistic model, as we will see again in the next section.

²⁹ If Tense (=PAST) is present and Agr is missing, then /te/ will be inserted for PAST, and /n/ will be inserted for Agr, resulting in *-ten* (see (22) and (23)). DeJong does not discuss whether *-ten* occurs with a singular subject in the obligatory past contexts although his discussion of counting past tense forms that do not show concord as *past* (p. 61) seems to indicate that they do exist but that he did not count them as errors from the standpoint of tense. These forms would follow from our analysis, as we just argued. If in fact the “infinitival” errors are only *en* and not *ten*, then we would have to conclude that it is unlikely for T to be present when Agr is missing. Perhaps, as discussed in the text, T is omitted much more often than Agr and the result would follow.

11.4 *The Development of Agreement*

For each verbal inflectional morpheme of Dutch,³⁰ \emptyset , *t*, and *en*, we looked at each utterance in which it appeared on the verb and determined whether the subject agreed with it—for example, for */t/*, second- and third-person singular subjects agree with it; any other subject does *not* agree with it. The results for both SLI and normal subjects are displayed in (36), by MLU group. See (26) for numbers of subjects and ages for each MLU group. In each cell of (36), *x/y* means that *y* is the total number of tokens of the morpheme (both agreeing and nonagreeing) that were used over all the children in that MLU group, and *x* is the number of nonagreeing uses of the morpheme. Above this fraction is the percentage of errors for that cell. For example, for MLU 2, SLI subjects used the morpheme */t/* 19 times. Three of these 19 uses did not agree with their subjects, and thus the error rate is 16%. The total morpheme use, errors, and error rate across inflectional endings are given in the last two columns.

(36) Agreement errors: Given inflectional ending, how many wrong subjects?

MLU	% error \emptyset		% error <i>-t</i>		% error <i>-en</i>		Total errors	
	SLI	Normal	SLI	Normal	SLI	Normal	SLI	Normal
1		15% 4/27		0% 0/9		5% 1/22		9% 5/58
2	10% 8/79	5% 10/185	16% 3/19	4% 2/54	20% 2/10	53% 9/17	12% 13/108	8% 21/256
3	10% 18/179	2% 6/273	8% 6/76	3% 2/73	31% 9/29	13% 4/32	12% 33/284	3% 12/378
4	7% 16/224	2% 11/449	7% 8/120	6% 7/114	15% 4/26	2% 1/52	8% 28/370	3% 19/615
5	5% 1/20	3% 3/97	0% 0/4	15% 4/26	0% 0/5	7% 1/14	3% 1/29	6% 8/137

³⁰ In (36) we only counted morphologically finite present tense verbs (i.e., verbs with \emptyset , *t*, or *en* inflections) that occurred in first or second position. (There were extremely few past tense verbs in the corpus, given the setting in which data were collected). There were a very few number of verbs ending in a finite present inflection that we could clearly determine were intended by the child as past tense. Since we predicted in (22,23) that these could occur, we excluded them from the count of present tense agreement forms in (36).

The column “% error *-en*” deserves some further explanation. As we described above (see (18)), Dutch infinitives appear in final position, whereas finite verbs occupy the first or the second position of the sentence. Moreover, the children produce *-en* mostly in final position and almost all of the final position verbs are *-en* verbs (see (33) and (34)). In other words, finiteness can be diagnosed by means of position, a standard method in the study of early morphosyntax. However, morphologically, not all finite and nonfinite verbs are distinct. For example, present plural verbs (first, second, or third person) have the same morphological ending as the infinitive, namely *-en*. For the calculation of the percentage of agreement errors with verbs ending in *-en* we first needed to decide which ones were finite and which ones nonfinite. To do this, we distinguished the verbs ending in *-en* in first/second position from the ones in final position. Then we excluded the *-en* verbs in final position from our counts. Thus, we only counted *-en* verbs which were clearly in first or second position and therefore considered to be finite plural verbs.

Starting with the normal children, we observe that the agreement error rate is quite low in almost all the cells. There is one large rate—53% for *-en* at MLU 2, based on 17 contexts. We will return to a discussion of this one cell with a large error rate. The next highest rate is 15% for stem \emptyset at MLU 1. But mostly the rates are quite small. Over all morphemes, the total error rates range from 9% for MLU 1 to 3% for MLU 3 and 4. Given that the grammatical subjects for each inflection have to have different features, this is a rather striking degree of good performance, in keeping with the general result in the OI stage that agreement performance when measured in this way is excellent (e.g., Poeppel and Wexler 1993 for German).

Turning to the SLI subjects, we see that agreement performance is again very good, although overall rates are slightly higher than for MLU-matched normal subjects. But the error rate over all morphemes is never higher than 12% (for MLU 2 and 3) and is as low as 3% (for MLU 5). The two largest error rates in any cell are for *-en*—31% for MLU 3 and 20% for MLU 2. This is similar to the large *en* error rate for MLU 2 of the normals, and we will return to this error. But overall, we can say that for the SLI subjects, as for the normal subjects, performance on agreement is quite good, which is especially striking since the subject features must change with the verbal inflectional features.

This result is also in keeping with our model's prediction that agreement errors (using a finite agreement morpheme with the wrong subject) do not occur often, because children know the featural specification of agreement morphemes, as we predicted in (21d). This result is contra to suggestions (Clahsen, Bartke & Goellner 1997) that SLI children have strong troubles with agreement. Other German data (Grimm's) shows that there are only small numbers of agreement errors in German (cf. Rice et al., 1997). It is possible that Clahsen et al.'s subjects had other problems besides SLI.

11.5 Schwa-Insertion as Cause of *-en* Errors

Let us consider *-en*—the one morpheme that showed a somewhat larger error rate in (36). We encountered several verbal forms ending in a schwa [ə], with a singular subject (both in the normally developing children and in the children with SLI). Since the dialect of the children studied allows *n*-deletion at the end of a word if it is preceded by a schwa, these were initially considered number agreement errors—namely, an *-en* (plural) ending with a singular subject. However, it has been argued that this is a phonological phenomenon, rather than a syntactic agreement error. In her study of the acquisition of prosodic structure by Dutch children, Fikkert (1994) observes that disyllabic words with final stress and stressed monosyllabic words often receive an extra (nonstressed) syllable in final position. Some of her examples are repeated in (37).

(37) Disyllabic words

- | | | | |
|---------------------|---|------------------|----------|
| a. konijn /ko:'n n/ | → | ['n nə] | (1;5.14) |
| b. ballon /b 'l n/ | → | ['m mə], ['b mə] | (1;7.13) |

Monosyllabic words

e.	aap	/a:p/	→	['a:pə]	(1;4.14)
f.	trein	/tr in/	→	['t inə]	(2;5.23)
g.	dik	/d k/	→	['k kə]	(2;6.5)

Fikkert argues that this phenomenon is due to the trochaic template of Dutch. An optimal (quantity-insensitive) trochaic foot consists of a strong syllable followed by a weak one, and therefore in the cases illustrated in (37) an extra syllable is added to fill the weak branch of the foot. This analysis is further confirmed by the fact that disyllabic words with initial stress never display an addition of a weak syllable in Dutch child language: there is no weak branch to fill in disyllabic words with initial stress, since this is already filled.

Our data show that many of the verbs ending in schwa with a singular subject are indeed monosyllabic, and precede another strong syllable, implying that the trochaic template is violated. Some examples are given in (38) and in (39) for the SLI and the normally developing children, respectively:

- (38) Children with SLI
- a. ik moete achter toon (=tafel) (01; age 6;01, MLU 2.1)
I must behind table
'I have to be behind the table.'
 - b. die-SG magge wel hoor (06; age 5;03, MLU 3.2)
that-SG may yes 'hoor'
'That's OK/allowed.'
 - c. lepel kanne inne vrachtwage (07; age 6;00, MLU 3.3)
spoon can in truck
'The spoon can go in the truck.'
 - d. hebbe mij opgegeten-3SG (09; age 6;02, MLU 3.5)
has me up-eaten
'He ate me up.'
 - e. oh, hondje bijte niet, he? (12; age 5;01, MLU 3.9)
oh doggie bite not huh
'Oh, the doggie doesn't bite, does it?'
- (39) Typically developing children
- a. Minne moete paard (13; age 1;10, MLU 2.1)
Minne must horse
'Minne has to be on the horse.'
 - b. kanne open-3SG (22; age 2;05, MLU 2.8)
can open
'It can be opened.'
 - c. wille zo lopen-1SG (23; age 2;05, MLU 2.9)
want this-way walk-INF
'I want to walk this way.'

- d. ja, hij heppe wel klaan, heleboel (29; age 2;10, MLU 3.5)
 yes he has yes crane many
 'Yes, he does have a crane, many.'
- e. je moete die hebbe (30; age 3;00, MLU 3.7)
 you must that have-INF
 'You should have that one.'

Notice that each verb in the examples in (38) and (39) consists of a stem +schwa. In each case, the stem would have been the appropriate form of the verb. Furthermore, it is interesting that several of the verbs in the above examples have a different vowel when they are used as plural or as an infinitive. For example, the plural or infinitival counterpart of the verb *magge* ([magə]) used in (38b) is *mogen* ([mo:gə]), and the plural or infinitival counterpart of *kanne* ([kanə]) in (38c) and (39b) is *kunnen* ([kənə]). This suggests that they should not be considered plural forms or even infinitives. This provides further support for the hypothesis that verbal forms such as the ones exemplified in (38) and (39) are stems with an added schwa for metrical reasons, rather than number agreement errors.

Finally, schwa-addition does not only occur with verbs, but also with nouns and prepositions. Example (38c) above shows a schwa-addition to a preposition, namely *inne* (in + schwa). We also found examples such as *poppe* (pop 'doll' + schwa).

In summary, verbs ending in a schwa with a singular subject should not be counted as number agreement errors for *-en*, but given a phonological explanation. In (40) we took the examples with schwa out of the counted *-en forms*, modifying (36).

(40) Schwa errors taken out of *-en* errors: % of agreement errors

MLU	% error -∅		% error -t		% error -en		Total errors	
	SLI	Normal	SLI	Normal	SLI	Normal	SLI	Normal
1		15%		0%		5%		9%
		4/27		0/9		1/22		5/58
2	10%	5%	16%	4%	0%	0%	11%	5%
	8/79	10/185	3/19	2/54	1/10	0/17	12/108	12/256
3	10%	2%	8%	3%	3%	0%	9%	2%
	18/179	6/273	6/76	2/73	1/29	0/32	25/284	8/378
4	7%	2%	7%	6%	4%	0%	7%	3%
	16/224	11/449	8/120	7/114	1/26	0/52	25/370	18/615
5	5%	3%	0%	15%	0%	0%	3%	5%
	1/20	3/97	0/4	4/26	0/5	0/14	1/29	7/137

We see in (40) that the rate of *en* errors has dropped dramatically, being 0% in most cells. The largest rate is 5% (1 error out of 22) for the normal MLU 1 children. In other words, *-en* in second position occurs almost exclusively with

plural subjects—the impression of agreement errors we had seen in (36) was almost exclusively the result of counting schwa as *en*, which we have seen is much more likely to be a phonological process in the children.³¹

The largest rate of agreement errors over all morphemes is now 11%, for SLI MLU 2 children. The largest cell error rate is 16% for *-t* for SLI MLU 2 children (3/19). Mostly the error rates are much less than this. The consideration of the phonology of Dutch children has shown that morphological agreement is even more exact than we had previously seen. Thus our large amount of data for Dutch clearly confirm the hypothesis of the OI and ATOM models that children (and SLI children, given the Extended Optional Infinitive [EOI] model) know the featural specifications for major inflectional verbal morphemes, namely the agreement morphemes. Furthermore, they know how to insert these morphemes in syntactic structures. Neither morphological features (learned) nor morphological principles (universal, presumably innate) seem to be a problem for children; everything is in place quite early, at least for the features and principles that we have studied.

11.6 Agreement Patterns in Children and the Choice of Interpretation of Negative Features in Morphological Theory

In (21c), we predicted whether or not a particular agreement error would exist in the OI stage, depending on which interpretation of negative features was chosen. We wrote, “Under the complete interpretation of negative features, we expect to see a present tense agreement error (14b), in which first-person singular stem + \emptyset is substituted for stem + *t* (e.g., *gaap* for *gaapt*). Under the incomplete interpretation of negative features, we expect to not see such errors (14a).”

In fact, for singular subjects, this error is the *only* predicted agreement error, as a glance at (22, 23) confirms. Thus it is crucial to look to see whether this error occurs.

Consider, for example, the MLU 3 normal group of children in (40). They produce overall 6 stem ($/\emptyset/$) forms that are errors, that is, that are other than first-person singular PRESENT. Let’s assume for the sake of building the strongest case for the predicted agreement error that all 6 of these errors are produced when the subject is second- or third-person singular. (Of course, it is quite possible that some of them are for plural subjects; they could, for example, be performance errors. But we’ll assume for calculational purposes that all 6 should be $/t/$.)

Now look at the $/t/$ column in (40) for the MLU 3 normal group. They produce 2 errors on $/t/$ out of 73 contexts in which $/t/$ is required. Thus they

³¹ We have no particular reason to think that the schwa-insertion child error is more prevalent in SLI children than in normal children. Note that the largest *-en* error rate (53%) in (36) is in normal children at MLU 2, and this rate is reduced to 0% in (40). Thus the MLU 2 normal children display the process to a large extent. Thus there is nothing to suggest that the schwa-insertion process, resulting from the attempt to match a trochaic template, lasts longer in SLI children.

produce 71 instances of /t/ where /t/ in fact should be inserted, second- and third-person PRESENT forms.

So we can calculate that the MLU 3 normal group has $6 + 73 = 79$ contexts in which /t/ is required, and of these /t/ is produced in 73 of these and /Ø/ is produced in 6 of these.³² The rate of use of the stem /Ø/ instead of /t/ thus has a maximum value of $6/79 = 7.6\%$. This is a quite small number, especially since it is a maximum value; it is unlikely that there are no performance errors, and that *all* mistaken uses of /Ø/ are substitutes for /t/. Likely some uses of /Ø/ are substitutes for plural /en/, in which case the predicted (by the complete analysis) agreement error of /Ø/ being used in second- and third-person contexts is less than 7.6%.

We can carry out this calculation for each cell, but let's just consider the total values. For normal children overall, we can calculate from (40) that the maximum rate of substitution of /Ø/ when /t/ is required is $4 + 10 + 6 + 11 + 3 = 43$ (the total errors on /Ø/) divided by $9 + 52 + 71 + 107 + 22 = 261$ (the total correct uses of /t/) + $43 = 43/304 = 14.1\%$. Again, this is a small number, and it is only a maximum. The normal children do not make the expected /Ø/ for /t/ mistake very much. They should make this mistake whenever they choose +Agr,-T in the third singular case, if they are following the complete interpretation of negative features.

Since we have argued in section 11.3 that very young children in the OI stage omit Tense quite often, we would expect (assuming the complete interpretation of negative features, i.e., the predictions in (23)) that there would be a large number of the predicted /t/ → /Ø/ agreement errors. We have seen that these young children have large proportions of OIs. But they only have quite small numbers of the agreement error. It does not appear as if the predicted error of the complete interpretation of negative features occurs very often for normal children.

Returning to (40), we calculate that for SLI children the maximum rate of the predicted /t/ → /Ø/ agreement error is $8 + 18 + 16 + 1 = 43$ (total number of errors on /Ø/) divided by $16 + 70 + 112 + 4 = 202$ (total contexts in which /t/ is used correctly) + 43, that is, $43/245 = 17.6\%$. Again, this is a quite small number, since we expect these children (especially the younger children) to omit Tense from the representation quite often, as we argued in section 11.3.

Overall, then, the predicted agreement error in (23) does occur, but not very often. In particular, it occurs much less frequently than the /te/ → /t/ "Tense" error that (22) (the incomplete interpretation of negative features) predicts. This latter error occurs at a rate of 43% for de Jong's experiment, in which the error can be clearly determined, as we saw in section 4.3.

³² Of course, we are ignoring OIs here; the relevant cases are the finite forms, that is, we are only considering forms in second position in the sentence, as we should.

We can conclude that the incomplete interpretation of negative features seems to be more empirically consistent with the data than the complete interpretation. (22) predicts both that the “tense” error /te/ → /t/ will occur and that the “agreement” error /t/ → /∅/ will not occur. (23) makes the opposite predictions for the two points. On both issues, (22), the prediction from the incomplete interpretation of negative features, wins out, and is thus to be taken as empirically superior, and thus likely more correct.

It is possible, as we discussed earlier, that UG does not determine which of the two interpretations is correct, and that the child is free to assume either one, neither being determined by the data available to the child in a Dutch environment. In this case, both types of errors could occur. But we would have no explanation of the much greater appearance of the Tense error. Therefore we conclude that the incomplete interpretation of negative features is correct for Dutch. This raises the explanatory adequacy question: Is this a universal property of morphology? We cannot pursue such a question here, but the research program for morphological theory and acquisition is clear.

This question of whether (22) or (23) is correct (i.e., which interpretation of the meaning of negative context features) should not obscure the very important larger point that (7) together with ATOM makes the correct predictions concerning agreement as well as tense. None of the possible agreement errors that are licensed by neither interpretation (that is by neither (22) nor (23)) occurs at more than negligible rates, either for normal or SLI children.

Consider, for example, the substitution of /t/ for /∅/, which should be quite possible intuitively, since /t/ is used in a wider variety of contexts than is /∅/. Let us look at errors on the use of /t/, then. Starting with the normal children we see that there are extremely few *t* errors in (40), ranging from 0% to 6% for MLU 1–4, and for some reason getting as large as 15% for MLU 5 (though based on only 26 contexts). There is not much room for the error to occur. Moreover, we see that there are many more first person singular subjects (-∅ required) than second- and third-person singular subjects (-*t* required), as can be seen by the fact that the total contexts for ∅ are at least 3 times as high as the total contexts for -*t* at every MLU level. Consider, for example, MLU 2. There are 175 ∅ contexts and 54 *t* contexts. That means that there are 175 chances for the required -∅ to show up as *t*. But there are only 2 errors total on *t*, so that at most 2 of the required -∅ forms show up as *t*. The error hardly occurs, at most it occurs 2/175, 1% of the time.

Turning to the SLI children, again we see that there are not large percentages of -*t* errors. Except for 16% at MLU 2 (3/19), the error rates are 7 or 8% (MLU 5 has only 4 contexts). Consider, for example, MLU 3, where there are 179 ∅ (stem) verb forms, but only 2 agreement errors on -*t*, so that at *most*, there are 2 -*t* for -∅ errors out of 179 possible ones, again at most a 1% rate. There are simply extremely few errors of the /t/ for /∅/ type, an error that both (22) and (23) say cannot occur. The children, both normal and SLI, treat -∅ as if it *must* appear when the subject is first-person singular. This is

categorical knowledge, and the child's behavior shows it. Omission of Agr or T features from the representation will not result in the use of /t/ instead of /∅/, as we have seen in (22) and (23). Thus there is extremely little unpredicted randomness or noise in the child's behavior. (7) together with ATOM captures the child's behavior quite nicely, both for normal and SLI children. It is clear that these children are in an ATOM stage, and that they know the morphemes, the features that define the morphemes, that is (7), and the universal principles of morphology that determine how these features get spelled out (22,23). The preciseness of the results is almost startling. If the rather precise properties that we have assumed are not true, why do we find these extremely precise nonrandom patterns?

Let us look at errors on /t/ in a bit more detail. If -t shows an agreement error, it can be with either a subject which requires -∅ (a first-singular subject) or a subject which requires en (a plural subject). In (41) we count the number of t errors which are made in each of these contexts.

(41) Agreement errors with -t by subject features

MLU	SLI		Normal	
	1SG subject	PL subject	1SG subject	PL subject
1			0	0
2	1	2	2	0
3	3	3	0	2
4	3	5	3	2
5	0	0	2	2

Overall, normals made 7 -t errors with first-person singular subjects and 6 -t errors with plural subjects, Since (40) shows that there were about 7 times as many first-person singular subjects as plural subjects, we see that there was a much larger tendency to use t given a plural subject than given a first-person singular subject (though even for plurals the rate is quite small).³³ As the footnote shows, the use of t given a plural subject is about .04 and given a first-person singular subject it is about .01. Thus the agreement error /∅/ → /t/ essentially does not exist for normal subjects.

For SLI subjects, in (41) there are 7 -t errors with first-person singular subjects and 10 with plural subjects. With plural subjects in (40) there are 67 correct -en, so the rate of -t with plural subjects is less than

³³ We cannot determine an exact rate from this table (40) because it shows the number of uses of -en, not the number of plural subjects. But given the overall low rate of agreement errors, the number of plural subjects would approximate the number of uses of -en; it would be just a little bit larger than the number of correct uses of -en, which is 136 for normal subjects in (40). Thus the use of -t for plural subjects rate is less than 6/(136 + 7) which is approximately .04. There are 799 correct uses of -∅ by normals. The use of -t for first-singular subjects is less than 7/799 which is less than .01.

10/(67 + 10) = .13. In (40) there are 459 correct first-person singular (-Ø) subjects so the rate of -*t* use with first-person singular subjects is less than 7/(459 + 7) = .015. For SLI subjects too, the rate of -*t* instead of -Ø is extremely small.³⁴

Thus for both normal and SLI subjects the rate of substitution of -*t* for -Ø is about .01, which seems reasonable to count as virtually nonexistent, determined by an extremely small number of performance errors. The low rate holds at every MLU level. Clearly, the prediction in (22) and (23) holds. Thus we can conclude that model (7) is the correct model of Dutch morphology, and that ATOM predicts the errors that children make when it is applied to (7), so that ATOM correctly describes the features that children omit from representations. This appears to be a good result, since (7) seems to be something like a minimal specification of the model for Dutch, what we can call the “natural” model. It also seems that a child learning Dutch would find it natural to fill in [+1, +SG] for -Ø, since that is the context in which it always occurs. The extremely categorical specification of /Ø/’s features in the child may be due to the extremely clear set of circumstances in which it occurs by itself. This is similar in many ways to the situation for /s/ in English. On /s/, too, we know that there are almost no agreement errors (see Harris and Wexler 1996).

The important point is that a set of “errors” is predicted by ATOM, and only these particular errors occur at more than extremely marginal rates. The precise interworking of the principles of morphology (the Elsewhere condition, consistency, features, etc.), the particular morphological system of Dutch (7) and syntactic constraints on the child’s representations (ATOM and the principles that motivate it) have a highly specific set of empirical consequences, and these consequences seem to be precisely fit. UG and child constraints are at work in the child in a highly abstract, noncommonsensical way, but a way that follows beautifully from theory. The interaction of massive quantitative data with abstract theory has worked out in a highly satisfactory way, lending great credence to the suspicion that the field is on the right track.

ATOM is necessary if we are to explain the OI stage in Dutch and other languages, and its properties. It has been a somewhat long deductive process for the study of morphology, requiring that we explain in a consistent system the facts of both adult and child use, and take crosslinguistic phenomena into

³⁴ There is no direct way within ATOM and the morphological model in (7) to explain why a singular form -*t* is used instead of the plural form -*en*. If Agr is omitted, *en* should result. Thus it is supportive of ATOM that the rate of such forms is so small. Nevertheless, since the rate for SLI subjects is about .13 (.04 for normal subjects) and since it is larger than the use of -*t* for first-person singular subjects and since this small rate of singular for plural seems to occur in many languages, it would be good to have an account. It might be that the children sometimes have not quite learned the number specification for a morpheme, thus -*t* would be missing its number specification (which in our model is its only specification). To closely study this issue would demand that we look at responses by individual subjects and have a much larger number of plural contexts than actually occurred. At any rate, the phenomenon is a second-order one (e.g., we are trying to explain a difference of .04 versus .015 for normal subjects).

consideration (since ATOM receives independent support both from other languages and from the comparison between OI rates in Dutch and English). Although it requires a somewhat complex chain of reasoning, we believe that each step is tight. In some cases (perhaps especially in fields like morphology, where the data are bounded) it may be possible to determine the correct analysis only by entertaining a scope of empirical phenomena wide enough to include both adult and child (and impaired language) data. In our opinion, it should be looked upon as an advance for the field that such tight deductive connections can be drawn between what previously appeared to be separate fields.

12. Conclusion

We specified a model for the development of normal language which assumes that children in the OI stage (in Dutch and English):³⁵

- (42) a. have UG principles
- b. have set relevant parameters correctly: Very Early Parameter-Setting (Wexler 1990ff., 1996, 1998; see also Hyams 1996, Schaeffer 1997)
- c. know the features of the relevant inflectional morphemes, which are specified in (7): Very Early Knowledge of Inflection (Wexler 1998)
- d. are subject to ATOM (Schütze & Wexler 1996, Wexler 1998)

Furthermore, we assumed (43) about SLI children:

- (43) SLI children are subject to the assumptions of (42), but their ATOM stage (42d) lasts until they are much older (if it ever stops).³⁶ This is the *Extended Optional Infinitive Stage* (EOI).

We showed that (42) makes a large number of specific predictions (21), repeated here for easy reference.

- (21) a. Children will place finite verbs in second position and nonfinite verbs in final position; see (20).

³⁵ SLI children in languages in which normal children do not go through the EOI stage are predicted to not go through the OI stage. This is empirically confirmed, for example, for Italian. See Wexler 2002 and references there. Essentially, languages that do not go through the OI stage are the Infl-licensed null-subject languages (Wexler 1998).

³⁶ Evidence from English (Rice, Wexler & Hershberger 1998) indicates that the OI stage lasts at least through the 8-year age range as measured by use of RIs. Ongoing work suggests that it continues past that, though a different methodology has to be used given training effects. In Dutch, Bol (2000) has studied a boy with SLI who had 5–10% RIs in the 9;4–9;9 age range.

- b. At a given developmental stage normal English children will show more OIs than normal Dutch children, and SLI English children will show more OIs than SLI Dutch children; see (11).
- c. Under the complete interpretation of negative features, we expect to see a present tense agreement error (14b), in which first-person singular stem + \emptyset is substituted for stem + *t* (e.g., *gaap* for *gaapt*). Under the incomplete interpretation of negative features, we expect to not see such errors; see (14a).
- d. Aside from the one possible agreement error in (21c), we expect to see no agreement errors with a finite verb (which will appear in second position). That is, if a verb ends in /*t*/ or / \emptyset /, the subject will agree with it (except for the possible (21c) case, where there will be one kind of error on / \emptyset /, if the complete interpretation of negative features is correct). Of course, /*en*/ in final position—an OI which appears when Agr has been omitted—will appear with any kind of subject. Similarly for /*ten*/.
- e. In OI children, second- and third-person singular verbs used in past tense contexts will sometimes appear as singular “present tense” forms, if the incomplete interpretation of negative features is correct, (15). That is, /*t*/ will appear instead of /*te*/ . If the complete interpretation of negative features is correct, this error will not occur, but an agreement error that looks like (21c) will be observed; see (16).

Each of the assumptions (21a) and (21d) are standard predictions of the OI stage in V2 SOV languages. We confirmed them by detailed analysis of a large set of Dutch child data, for both normal and SLI children. We showed that (21b) holds by comparing the Dutch data to English data, both for normal and SLI children. We found that the agreement error predicted in (21c) by the complete interpretation of negative features does *not* get produced very much, so that the incomplete interpretation of negative features is more correct. We also showed that the tense error in (21e) holds quite strongly, with SLI children in particular making a large number of substitutions of present for past tense, in contrast to English children, where ATOM does not predict the same result. (We discussed why we expected the result to be smaller in normal children, who were mostly out of the OI stage when they were using sufficient number of past contexts). Thus the incomplete interpretation of negative features was once again seen to be more accurate than the complete interpretation.

Thus all the predictions of the model were confirmed by quantitative analysis of production data. Moreover, the result that the incomplete interpretation of negative features is the superior morphological model for Dutch is satisfying because it provides support for one particular alternative in morphological theory, the incomplete interpretation of negative features. Adult data have been insufficient to determine which interpretation is correct in that domain, so it is a hopeful sign that developmental data and analysis might be

able to contribute to the determination of the correct theory. Unification of different domains in this way is a sign of progress in a field.

It is important to state that child language has been useful not in an obvious, simple way, by simply looking at the child's language, without theoretical analysis. The child's productions do not wear their analysis on their sleeve, anymore than do adult judgments. We could use the child grammar data to help us determine what is correct in morphological theory only because we had a theoretical analysis of child grammar (ATOM, correct specification of features (7), etc.). This is to be expected in any complex scientific field. Child grammar needs theoretical analysis just as does adult grammar, and the more (good) theory about child grammar, the more it can help adult grammar. One example is our V2 result showing that Agr, not T, motivates V-to-C.

In summary, in the adult grammar of Dutch, root infinitival constructions are prohibited because both Agreement and Tense are obligatorily present. To check its agreement/tense features, the verb needs to raise to the functional projections Agr and T. Furthermore, to satisfy the V2 requirement, the finite verb moves up to C. We propose that, just like typically developing children, children with SLI enter a stage in which either Agr or T is optional. When Agr is missing, the verb does not raise to C, but stays in the basic V position (or possibly in Agr or T, as we discussed). The fact that such verbs are realized as infinitives (with an *-en* inflection) is explained by our model of Dutch verbal morphology, based on Halle and Marantz's Distributed Morphology ideas.

The lower rate of RIs in Dutch child language as compared to English is accounted for by our application of Schütze and Wexler's Agr/Tense deletion model to a detailed morphological model of Dutch. In Dutch, only underspecification of Agr yields RIs; in English, underspecification of either Agr or Tense (or both) gives rise to RIs. Thus, Dutch provides fewer contexts for RIs than English.

Dutch children with SLI make "apparent" substitutions of present tense for past tense; this too follows from the application of ATOM to the same morphological model, but applied in this case to the tense morpheme.

Finally, we saw that Dutch children with and without SLI perform well at subject-verb agreement and V2, which follows from our assumption that both groups enter a stage in which they essentially know the principles of syntax and morphology, given the hypothesis that SLI children do not differ syntactically from younger normal children.

Thus a complex array of data—both correct behavior and error behavior—follows from a particular natural model of Dutch morphology coupled with a model of child behavior (ATOM) for which there is extensive evidence in other languages. The model of morphology must incorporate a particular view of how properties of features are utilized in the insertion of morphemes. The fact that such a complex array of different data follows from the same simple model provides a good deal of support for the model.

Concluding, the Dutch results strongly confirm Schütze and Wexler's Agr/Tense Deletion theory of Optional Infinitives together with our model of Dutch verbal morphology, in fact, testing subtle predictions concerning the rate of root infinitives between Dutch and English and supporting a unique morphological model for Dutch verbal inflection. Furthermore, ideas such as that of Wexler's (1998) *Unique Checking Constraint*, which derive ATOM and also the conditions (non-null-subject languages) under which ATOM applies, are also supported, as Dutch is not a null-subject language, so that ATOM should apply. We can conclude that early child language—including SLI language—shows a remarkable possession of universal principles of grammar and detailed language-particular properties of morphology and parameter values, along with a highly specific way of being different from adult language. Both normal and language-impaired children know universal properties of grammar and learn subtle and detailed properties of their own grammars and inflectional (morphological) systems at an early age. Not only is this a very important fact to know about children, but it has proven very useful in learning more about the nature of language, for example the nature of morphological systems, even in the adult.

References

- BABYONYSHEV, M., J. GANGER, D. PESETSKY & K. WEXLER. 2001. The maturation of grammatical principles: Evidence from Russian unaccusatives. *Linguistic Inquiry* 32:1–44.
- BESTEN, H. DEN. 1983. On the interaction of root transformations and lexical deletion rules. In *On the Formal Syntax of the Westgermania*, ed. W. Abraham, 47–31. Also published in *Groninger Arbeiten zur Germanistischen Linguistik* 1–3:1–78.
- BISHOP, D. V. M. 1994. Grammatical errors in specific language impairment: competence or performance limitations? *Applied Psycholinguistics* 15:507–549.
- BOL, G. W. 2000. The Escape from the Extended Optional Infinitive Stage? Evidence from a Longitudinal Dutch Case Study on SLI. Poster presented at the sixth meeting of the European Group of Child Language Disorders, Konstanz, 22–25 June.
- BOL, G. W. & F. KUIKEN. 1988. Grammaticale analyse van taal-ontwikkelingsstoornissen. Ph.D. dissertation, University of Amsterdam.
- BOL, G. W. & F. KUIKEN. 1990. Grammatical analysis of developmental language disorders: a study of the morphosyntax of children with specific language disorders, with hearing impairment and with Down's syndrome. *Clinical Linguistics and Phonetics* 4:77–86.
- BORER, H. & K. WEXLER. 1987. The maturation of syntax. In *Parameter setting*, ed. T. Roeper & E. Williams, 123–172. Amsterdam: Reidel.
- BROMBERG, H. S. & K. WEXLER. 1995. Null subjects in child *wh*-questions. *MIT Working Papers in Linguistics* 26:221–247.
- BROWN, R. 1973. *A first language; the early stages*. Cambridge, MA, Harvard University Press.
- CLAHSEN, H., S. BARTKE & S. GOELLNER. 1997. Formal features in impaired grammars: A comparison of English and German SLI children. *Journal of Neurolinguistics* 10(2/3):151–171.
- FIKKERT, P. 1994. *On the acquisition of prosodic structure*. Dordrecht: Institute of Generative Linguistics.

- GRIMM, H. 1993. Syntax and morphological difficulties in German-speaking children with specific language impairment: Implications for diagnosis and intervention. In *Language acquisition problems and reading disorders: Aspects of diagnosis and intervention*, ed. H. Grimm & H. Skowronek, 25–63. Berlin: Walter de Gruyter.
- HAAN, G. J. DE. 1987. A theory-bound approach to the acquisition of verb placement in Dutch. In *Formal parameters of generative grammar, Yearbook*, ed. G. de Haan & W. Zonneveld, 15–30. University of Utrecht.
- HAEGEMAN, L. & H. VAN RIEMSDIJK. 1986. Verb projection raising, scope and the typology of rules affecting verbs. *Linguistic Inquiry* 17:417–466.
- HALLE, M. 2000. Distributed morphology: Impoverishment and fission. In *Research in Afroasiatic grammar: Papers from the third conference on Afroasiatic Languages, Sophia Antipolis, 1996*, ed. J. Lecarme, J. Lowenstamm & U. Shlonsky, 125–149. Published as Volume 202 of the series *Current issues in linguistic theory*.
- HALLE, M. & A. MARANTZ. 1993. Distributed morphology and the pieces of inflection. In *The view from Building 20: Essays in linguistics in honor of Sylvain Bromberger*, ed. K. Hale & S. J. Keyser. Cambridge, MA: MIT Press.
- HARRIS, T. & K. WEXLER. 1996. The optional infinitive stage in child English. In *Generative perspectives in language acquisition*, ed. H. Clahsen, 1–42. Amsterdam: John Benjamins.
- HYAMS, N. 1996. The underspecification of functional categories in early grammar. In *Generative perspectives on language acquisition*, ed. H. Clahsen, 91–128. Amsterdam: John Benjamins.
- JONG, J. DE. 1999. *Specific language impairment in Dutch: Inflectional morphology and argument structure*. Groningen, the Netherlands, Groningen Dissertations in Linguistics 28.
- KOOPMAN, H. 1984. *The syntax of verbs*. Dordrecht: Foris.
- KOSTER, J. 1975. Dutch as an SOV language. *Linguistic Analysis* 1:111–136.
- LEONARD, L. 1998. Children with specific language impairment. Cambridge, MA, MIT Press.
- MACWHINNEY, B. & C. SNOW. 1985. The Child Language Data Exchange System. *Journal of Child Language* 12:271–296.
- PIERCE, A. 1989. *On the emergence of syntax: A cross-linguistic study*. Ph.D. dissertation. MIT, Cambridge, Mass.
- POEPPEL, D. & K. WEXLER. 1993. The Full Competence Hypothesis of clause structure in early German. *Language* 69:1–33.
- RICE, M., K.R. NOLL & H. GRIMM. 1997. An extended optional infinitive stage in German-speaking children with specific language impairment. *Language Acquisition* 6:255–295.
- RICE, M. & K. WEXLER. 1996. Toward tense as a clinical marker of specific language impairment in English speaking children. *Journal of Speech and Hearing Research* 39:1239–1257.
- RICE, M., K. WEXLER & P. CLEAVE 1995. Specific language impairment as a period of extended optional infinitive. *Journal of Speech and Hearing Research* 38:850–863.
- RICE, M., K. WEXLER & S. HERSHBERGER. 1998. Tense over time: The longitudinal course of tense acquisition in children with specific language impairment. *Journal of Speech, Language, and Hearing Research* 41:1412–1431.
- SCHAEFFER, J. 1997. Direct object scrambling in Dutch and Italian child language. Ph.D. dissertation, University of California, Los Angeles.
- SCHÜTZE, C. & K. WEXLER. 1996. Subject case licensing and English root infinitives. In *Proceedings of the 20th annual Boston University Conference on Language Development* 1:670–681. Somerville, Mass.: Cascadilla Press.
- SCHÜTZE, C. & K. WEXLER. 2000. An elicitation study of young English children's knowledge of tense: Semantic and syntactic properties of optional infinitives. In

- Proceedings of the 24th annual Boston University Conference on Language Development*. Somerville, Mass.: Cascadilla Press.
- WEVERINK, M. 1989. The subject in relation to inflection in child language. Master's thesis, University of Utrecht, the Netherlands.
- WEXLER, K. 1990. Optional infinitives, head movement and the economy of derivation in child grammar. Paper presented at the annual meeting of the Society of Cognitive Science, MIT, Cambridge, Mass.
- WEXLER, K. 1992. Optional infinitives, head movement and the economy of derivation in child grammar. *Occasional Paper 45*. Center for Cognitive Science, MIT, Cambridge, Mass.
- WEXLER, K. 1994. Optional infinitives, head movement, and economy of derivation. In *Verb movement*, ed. N. Hornstein & D. Lightfoot, 305–350. New York: Cambridge University Press.
- WEXLER, K. 1996. The development of inflection in a biologically based theory of language acquisition. In *Toward a genetics of language*, ed. M. L. Rice, 113–144. Mahwah, N. J.: Erlbaum.
- WEXLER, K. 1998. Very early parameter setting and the unique checking constraint: A new explanation of the optional infinitive stage. *Lingua* 106:23–79.
- WEXLER, K. 2000. Three problems in the theory of the optional infinitive stage: stage/individual predicates, eventive verbs and finite null-subjects. In *Proceedings of the 19th West Coast Conference on Formal Linguistics* 560–573. Somerville, Mass.: Cascadilla Press.
- WEXLER, K. 2002. Lenneberg's dream: Learning, normal language development, and Specific Language Impairment. In *Language competence across populations: Toward a definition of Specific Language Impairment*, ed. Y. Levy & J. Schaeffer, 11–61. Mahwah, N.J.: Erlbaum.
- WEXLER, K., C. SCHÜTZE & M. RICE. 1998. Subject Case in children with SLI and unaffected controls: Evidence for the Agr/Tns Omission Model. *Language Acquisition* 7:317–344.
- WIJNEN, F. 1997. Temporal reference and eventivity in root infinitives. *MIT Occasional Papers in Linguistics* 12:1–25. Cambridge, Mass.: MITWPL.

Ken Wexler
MIT

Department of Brain and Cognitive Sciences
Department of Linguistics and Philosophy
77 Massachusetts Ave., NE20-409
Cambridge, MA 02139
USA

wexler@mit.edu

Jeannette Schaeffer
Ben-Gurion University of the Negev

Gerard Bol
University of Groningen