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## The Syntactic Representation of Degree and Quantity: Perspectives from Japanese and Child English\*

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### I. Introduction

Converging evidence from child language acquisition and cross-linguistic variation has the potential to provide important insights into the structure of Universal Grammar and the nature of language-specific knowledge. This paper examines the syntactic representation of degree and quantity in the English of children up to five years of age, and demonstrates that a variety of striking differences between adult and child English are paralleled by differences between (adult) English and Japanese. The proposed explanation is that children initially hypothesize a determiner system that is impoverished relative to that of adult English, and that in key respects resembles the 'impoverished' determiner system of adult Japanese (cf. Fukui 1986).

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Specifically, we take the adult English representation of degree in APs, and quantity in plural NPs, to be mediated by a null Deg<sup>0</sup> or plural D<sup>0</sup>, respectively, as argued by Abney (1987).<sup>1</sup> We take these types of D<sup>0</sup> to be absent from the inventory of determiners in both Japanese and child English, as suggested to us by Tom Roeper (p.c.). This gap in the determiner system has the character of a parametric property, in the sense that it has widespread syntactic consequences in Japanese and child English.<sup>2</sup>

We thus find that English-style 'subcomparatives', involving quantification over a degree- or quantity-type variable associated with an AP or plural NP, are disallowed in both Japanese and child English (§2). This pattern is not found with 'subequatives' in Japanese or child English, where we argue that the correct meaning is obtained through 'parallel distribution', rather than quantification over degree or quantity (§3). Our account directly explains the impossibility of overt degree phrases with adjectives in both Japanese and child English (§4), as well as the apparent Left Branch Constraint violations found with degree questions in child English (Hoekstra, Koster, & Roeper 1992) and Japanese (§5). Further supporting evidence comes from the optionality of plural marking on plural NPs both in Japanese (e.g. Miyagawa 1989) and (in specific environments) in child English (Cazden 1968) (§6).

## 2. Subcomparatives

English comparative constructions have been studied extensively in the syntax and semantics literature (e.g. Bresnan 1972, Cresswell 1976, Chomsky 1977, Pinkham 1982, Heim 1985, Grimshaw

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<sup>1</sup> We will henceforth refer to both Deg<sup>0</sup> and plural D<sup>0</sup> as types of determiners (D<sup>0</sup>). Modifying the proposals of Abney slightly, we will take a measure phrase in adult English to be the SPEC of a DP headed by Deg<sup>0</sup>, and a bare numeral modifier to be the SPEC of a DP headed by a null plural D<sup>0</sup>.

<sup>2</sup> Preliminary investigations suggest that the pattern we will report for Japanese and child English may be replicated, more or less exactly, in French, Russian, and Mandarin Chinese. If borne out by further research, the findings for French will be especially interesting, in that the determiner system of French is not systematically 'impoverished' in any sense, but may nonetheless differ from that of English along parametric lines.

1987, Corver 1990, Ishii 1991, Moltmann 1993 among others) but major issues raised by this work have not been addressed in previous studies of children's acquisition of comparatives. In this section we present and discuss the results of a study of children's comprehension of three types of English comparatives: Comparative deletion (1), subdeletion (2), and so-called 'subdeletion with ellipsis' (3).<sup>3</sup>

### (1) 'Comparative Deletion'

John reads more books than Mary reads.

### (2) 'Subdeletion'

John reads more books than Mary reads magazines.

### (3) (So-called) 'Subdeletion with Ellipsis'

John reads more books than magazines.

We began the present project by using Crain & McKee's (1985) Truth Value Judgement Task to examine preschool children's comprehension of comparative sentences as in (1-3). Two versions of this study were run in the course of an academic year. The first study included eight children (4;1 – 5;1 ; Mean Age 4;7), and the second included twelve children (4;2 - 5;4 ; Mean Age 4;9).

In contrast to earlier studies on children's comprehension of comparatives, our materials were designed so that a strategy of interpreting the comparative as a superlative, or a simple strategy of always guessing 'yes', would yield at best 'chance' performance (50% correct). Also in contrast to earlier studies, our comprehension task never depended on correct interpretation of pronouns, and our materials satisfied Crain & McKee's pragmatic condition of 'plausible denial'.

The first study examined comprehension of comparative deletion, subcomparatives, and subdeletion-with-ellipsis. The first study also checked for evidence of a 'more = most' strategy,

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<sup>3</sup> While (3) has often been treated as an elliptical form of 'John reads more books than he reads magazines', and while we shall adopt the term 'subdeletion with ellipsis' for (3), we use this terminology with the understanding that the acquisitional evidence, at least, casts some doubt on such an analysis, at least in children's English.

differences between noun versus adjective comparison, and differences between comparisons on mass versus count nouns.<sup>4</sup> The second study examined deletion and subdeletion in both comparatives and equatives. (Equatives will be discussed in §3.)

	PERCENTAGES CORRECT		
	Adult-like Children	Other Children	
Comparative Deletion	100%	88%	
Subdeletion	100%	18%	( $p < .001$ )
Subdeletion with Ellipsis	100%	76%	
<hr/>			
Mass	100%	100%	(Not Significant)
Count	100%	100%	
<hr/>			
Noun	100%	54%	(Not Significant)
Adjective	100%	67%	

**Table 1. Results of first study of children's comprehension of comparatives.**

Our results were consistent with a largely forgotten observation made by Townsend (1975) and by Townsend and Erb (1976): A sizable percentage of four-to-six year olds exhibit a fairly specific comprehension deficit for subcomparatives. We found, in particular,

<sup>4</sup> Differences between noun and adjective comparison were, however, tested only with (full) comparative deletion. Other types of comparatives were evaluated exclusively with NPs. Work by Townsend & Erb (1976) indicates that our findings for NP subcomparatives also hold for AP subcomparatives.

that full subcomparatives contrasted sharply with both comparative deletion and so-called subdeletion-with-ellipsis. In the first version of the study, six of eight children exhibited specific and marked difficulty with subcomparatives, while the remaining two performed as adults. These findings are summarized in Table 1. Performance of each child was consistent across noun and adjective comparisons, as indicated at the bottom of the table.

Three of the six children exhibiting difficulty in subcomparatives also appeared to be using a 'superlative-like' interpretation of *more* and *-er*. Yet, this was not literally a 'superlative' interpretation, because the children were still sensitive to the first NP in the *than*-phrase. ('John has more silver than gold/Mary.') We will suggest an explanation for this finding below.

Thus far we have demonstrated that English-speaking children as old as four and five years of age often exhibit a specific comprehension deficit for subcomparatives as in (2), but perform at near-adult levels on (full) comparative deletion as in (1), as well as on so-called 'subdeletion with ellipsis' as in (3). These findings are summarized in (4).

(4) Child English (Comprehension)

Comparative Deletion	-	OK
Subdeletion	-	Impaired
Subdeletion with Ellipsis	-	OK

We observe that this pattern bears a striking resemblance to a point of cross-linguistic variation in adult languages: Japanese differs from English in that subcomparatives, insofar as they are possible at all, are far more restricted than in English (6). Yet, comparative deletion (5) and subdeletion-with-ellipsis (7) are fully grammatical.

(5) Comparative Deletion

John-wa [Mary-ga (\*hon-o) yomu yori-(mo)] hon-o takusan yomu  
 John-top Mary-nom book-acc read than book-acc many reads  
 'John reads more books than Mary reads (\*books).'

- (6) Subcomparative (Ungrammatical) .
- a. \* John-wa [Mary-ga zasshi-o yomu yori-(mo)] hon-o takusan  
       yomu  
       John-top Mary-nom book-acc read than magazine-acc many  
       reads  
       'John reads more books than Mary reads magazines' (NP)
- b. \* Heya-ga hiroi yori doa (-no-hoo)-ga ookii  
       window-nom wide than door (-gen direction)-nom is-big  
       'The door is bigger than the window is wide' (AP)
- (7) (So-called) Subdeletion with ellipsis  
       John-wa zasshi-yori hon-o takusan yomimasu  
       'John reads more books than magazines'

Our informants reject both (6a), a subcomparative involving two plural NPs, and (6b), a subcomparative involving two APs. As we shall discuss below, there does exist some variability in the judgements of Japanese NP subcomparatives, as in (6a), but to our knowledge Japanese speakers consistently reject AP subcomparatives as in (6b), and for all Japanese speakers NP subcomparatives, if possible at all, are a highly restricted option, as discussed by Ishii (1991).

Notice that *yori* 'than' can take a full clausal complement in Japanese comparative deletion, as illustrated in (5). Also, as noted by Kikuchi (1989), the gap in the *yori*-clause of (5) is obligatory, in contrast to the marked but grammatically possible English subcomparative, "John reads more books than Mary reads books." The main Japanese facts are schematically represented in (8), directly paralleling the pattern in (4).

(8) Japanese:

Comparative Deletion	-	OK
Subdeletion	-	Ungrammatical
Subdeletion with Ellipsis	-	OK

The leading idea of this paper is that in both Japanese and child English, expressions denoting quantity or degree can never serve as syntactic arguments within an AP or plural NP. We will now briefly examine two types of analysis that have been proposed for English subcomparatives, and we will point out that both types of analysis

crucially depend on the presence of syntactic positions corresponding to degree or quantity. Our conclusion will be that a difficulty in syntactically licensing variables (such as the trace of a null operator) ranging over degree or quantity, can account for the observed restrictions on subcomparatives in Japanese and child English.

Two broad types of analysis for English subcomparatives have been advanced in the literature. Both types of analysis, in order to provide the full range of English subcomparatives, depend crucially on the availability of a syntactic argument position, denoting degree or quantity, within the DP. Bresnan (1972) argued that in a subcomparative such as (2) (repeated as 2' below), there is a covert quantification over possible numbers of magazines (denoted in 2' by the phonologically null expression 'x-many').

(2') John reads more books than Mary reads (x-many) magazines.

Thus, the truth conditions for (2') are (roughly) that John reads more than x books, where x is the number of magazines that Mary reads.

Cresswell (1976) formalized Bresnan's analysis in terms of the semantic type 'degree/ quantity'; x in (2') is then taken as ranging over this special semantic type. Chomsky (1977) suggested (albeit with some hesitation) that the x in (2') should be identified with the trace of a null *wh*-operator. A now fairly standard approach to subcomparatives involves extraction of a null operator from a degree/quantity position in the plural DP (*magazines* in 2') up to the head of the *than*-phrase. Lambda-abstraction causes the *than*-phrase to be interpreted as a predicate over quantities (<Q,t>): 'Lambda x: Mary reads x-many magazines'. Similarly, *more* can be taken as a generalized quantifier that undergoes LF extraction, and creates the lambda-abstract, 'Lambda x: John reads x-many books'. Following the analysis of (Bresnan 1972), the *than*-phrase is taken as an extraposed argument of *more*. At LF the comparative morpheme takes two arguments of type <Q,t>. The sentence is then true if and only if the (maximum) quantity  $x_1$  such that John reads  $x_1$  books, is greater than the (maximum) quantity  $x_2$  such that Mary reads  $x_2$  magazines.

Crucially, the standard approach to subcomparatives in terms of null operator movement assumes that the operator originates in a syntactic position inside the DP, and leaves behind a variable that

ranges over quantities (for an NP) or degrees (for an AP). That the operator should be able to extract from the DP without violating the Left Branch Constraint is a bit surprising, and has often been taken as an argument against this approach to subcomparatives (e.g. in Grimshaw 1987), but a variety of technical solutions to this problem are available. One might, for example, argue that LBC effects are exclusively a PF phenomenon, tied to cliticization of a (null or overt) determiner onto its specifier; LBC effects would then not be expected in LF movement operations.

A second, slightly different approach to English subcomparatives has been suggested by Ishii (1991). This approach is motivated by the results of a variety of tests for *wh*-movement (see Pinkam 1982, Grimshaw 1987, Corver 1990), suggesting that English subcomparatives do not (necessarily) involve movement of a *wh*-operator denoting degree or quantity.

The main idea of Ishii's approach, as we interpret it, is to allow an abstract comparison operator to unselectively bind two lower positions, one in the matrix clause and one in the *than*-clause. Following a suggestion of Pinkam (1982), Ishii argues that there are two types of *more* in English: A quantificational form of *more*, as in standard accounts of comparative deletion, and also a non-quantificational form that marks a variable position. The abstract comparison operator MORE unselectively binds a non-quantificational instance of *more* and a gap parallel to *more*. The cases of 'multiple subcomparison' discussed by Corver (1990) can be readily handled by the unselective binding approach, if more than one abstract comparison operator is present, as in (9).

- (9) a. Santa Claus gave more girls more dolls than he gave boys trucks. (Corver 1990)
- b. S.C. gave more girls dolls than he gave boys trucks, and S.C. gave more dolls to girls than he gave trucks to boys. (von Stechow 1984)
- c. MORE(1,2) MORE(3,4) S.C. gave more(1) girls more(3) dolls than he gave e(2) boys e(4) trucks

In our view, to obtain the correct semantic interpretation in the unselective binding approach to subcomparatives, the two positions

bound by the abstract comparison operator must both denote expressions of degree or quantity. The unselective binding approach will then be ruled out in (full) comparative deletion, because the gap in the *than*-clause denotes an individual rather than a degree or quantity. Thus, an analysis with movement of *wh*-operators will be forced in comparative deletion, as indicated by the standard diagnostics for *wh*-movement (Chomsky 1977).

Ishii discusses a number of possibilities for comparative deletion with quantification over semantic types other than degree or quantity, notably quantification over event variables. Such possibilities can create the illusion of subcomparison, and very plausibly account for the highly restricted cases of 'subcomparison' allowed by some Japanese speakers (e.g. 6a). Yet, as noted by Ishii, quantification over frequency (i.e. events), for example, cannot account for the full range of English subcomparatives, because in English we do not find the types of aspectual restrictions expected on an event-quantification account. Moreover, to obtain the reading for (9a) paraphrased in (9b), an approach in terms of event quantification fails, and reference to quantity-type variables seems to be crucial.<sup>5</sup>

Thus, in both major approaches to subcomparatives with which we are familiar, existence of the full range of subcomparatives found in English depends on the availability of quantity- and degree-type arguments within DP. We conclude that the difficulties with subcomparison observed in Japanese and adult English could be due to a lack of the determiners needed to license degree- and quantity-type arguments with APs and plural NPs. In § 4-6 we shall provide evidence that various predictions of this hypothesis are borne out. First, however, we shall examine an apparent counterexample to the hypothesis.

### 3. Subequatives

The second of our comprehension studies on four-to-five year olds was designed again to test the contrast between full deletion and subdeletion in comparatives. In addition, the second study examined

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<sup>5</sup> Ishii (1991:146-152) applies an event-quantification approach to (9a), but contrary to his discussion he obtains a semantic interpretation that is distinct from (9b) and not in fact possible for English speakers.

whether the same contrast between full deletion and subdeletion would be found with *equatives* (10a,b).

- (10) a. John has as many books as Mary has  
b. John has as many books as Mary has magazines

The results of the second study, in brief, were that the contrast between full deletion and subdeletion in comparatives was replicated, but there was no such contrast in equatives, and in fact children on average performed better on subdeletion than on full deletion with equatives. Five of twelve children were 'at chance' on *comparative* subdeletion (i.e., they received approximately the score predicted for random guessing), and there was a statistically significant contrast between deletion and subdeletion in comparatives. Yet, there was no statistically significant contrast between deletion versus subdeletion in *equatives*, and all twelve children were well above chance on *equative* subdeletion.

We propose that the contrast between subequatives and subcomparatives is due to the possibility of giving subequatives, but not subcomparatives, an interpretation in terms of 'parallel distribution'. For example, (10b) can be paraphrased as in (11).

- (11) For each magazine that Mary has, John has a book.

We will leave open the details of how the interpretation in (11) is obtained compositionally. (One possibility, along the lines of Ishii's approach to subcomparison, would be that a null distributive operator unselectively binds both the NP marked by 'as many' in the matrix clause, and the corresponding NP in the *as*-clause.)

Strikingly, the same contrast between subcomparatives and subequatives found in child English is also found in adult Japanese. Thus, even our informants who reject subcomparison in (6a) accept (12).

- (12) Equative subdeletion in Japanese  
John-wa [Mary-ga hon-o motte-iru hodo] zasshi-o motte-inai  
John-top Mary-nom book-acc have as-many-as magazine-acc  
have-not  
'John doesn't have as many magazines as Mary has books.'

(For our informants, Japanese *hodo* 'as many as' is most acceptable as a negative polarity item, hence the negation in 12.) Thus, whatever the correct account for the contrast between subcomparatives and subequatives in child English, the parallel we claim between child English and adult Japanese holds for subcomparatives and subequatives. We tentatively suggest that an approach in terms of parallel distribution be extended to (12), at least for the Japanese speakers who reject (6a). If this approach is borne out in further research, it may turn out that subequatives are 'the exception that proves the rule'. We now turn to a variety of observations confirming predictions of our hypothesis that the determiner systems in Japanese and child English do not license degree- or quantity-type arguments.

#### 4. Degree-phrases with Adjectives

A direct prediction of our hypothesis is that overt expressions of degree in APs should be impossible in both Japanese and child English. For example, pre-adjectival degree modifiers as in 'two meters tall' should be ungrammatical. The prediction is clearly confirmed for Japanese, where our informants categorically reject (13a), requiring instead a circumlocution such as (13b).<sup>6</sup>

- (13) a. \*John-wa sei-ga ni meetoru takai  
John-top height-nom two meters tall-is  
'John is two meters tall.'  
b. John-wa sei-ga ni meetoru da  
John-top height-nom two meters is  
'John's height is two meters'

We so far have only preliminary evidence about the availability of degree-phrases in APs in child English, but this evidence is consistent with the prediction. Snyder & Das (in preparation) have examined transcripts of spontaneous production for (7) English-

<sup>6</sup> Interestingly, some of our informants allow (13a) on the reading, 'John is two meters taller (than someone understood from the discourse)'. This suggests to us that Japanese may form comparatives with a null comparative morpheme that, unlike simple APs, can take a degree-type argument. This observation thus supports an approach in which the restrictions observed in Japanese are tied to the determiner system proper, rather than being a global (but language-specific) property of Japanese argument structure.

speaking children (mean age of last transcript: 5;0). They find that only two of the seven children use degree-modifiers in APs productively by the end of their transcripts. For the two children who do acquire the relevant degree-modifiers, the ages of first clear use are 4;5 ('ten feet tall') and 3;9 ('four years old'). Thus, a majority of the children examined are not producing degree expressions in APs even at ages in the four-to-six range, precisely as predicted by our hypothesis.

### 5. *Wh*-questions of Degree and Quantity

Another immediate prediction of our hypothesis is that *wh*-questions of degree and quantity should function differently in Japanese and child English than they do in adult English. This is because in adult English such questions involve generation of a *wh*-expression (*how* or *how many*) in a degree- or quantity-position (presumably SPEC) within the DP. Again this prediction appears to be borne out, in that *wh*-questions of degree in Japanese and in child English (in contrast to adult English) are not subject to the Left Branch Constraint. Japanese exhibits LBC effects with possessors, for example, in (15) (contrast 14). Yet, no such LBC effect is found in the *wh*-question of degree in (16).

(14) John-ga dare-no hon-o yonda-no  
John-nom who-gen book-acc read-interrog  
'Whose book did John read?'

(15) ?\* Dare-no John-ga hon-o yonda-no  
who-gen John-nom book-acc read-interrog  
'Whose book did John read?'

(16) Dono gurai ie-ga ookii-no?  
to-what extent house-nom big-is-interrog  
'How big is the house?'

Very similar LBC violations have been reported by Hoekstra, Koster, and Roeper (1992) for child English and child Dutch, in a study of children in the age-range of four-to-six years. For example, English-speaking children in the age-range often allow (17a) to have both the adult interpretation in (17b), and a non-adult interpretation as in (17c) (in apparent violation of the LBC).

- (17) a. How did John paint the cup yellow?  
b. 'By what means did John paint the cup yellow?'  
c. 'How yellow did John paint the cup?'  
(Hoekstra, Koster, & Roeper, 1992)

Although we will not attempt a detailed account of the semantics of degree questions in Japanese and child English, we suggest an approach in terms of a discourse relation, rather than syntactic binding, between the *wh*-word and a semantic degree argument in the predicate. As discussed by Cresswell (1976), even in English the semantic degree-argument of a gradable predicate can be supplied through the discourse as well as in the syntax. For example, when we say that John is tall, the discourse determines whether we mean 'tall for a three-year-old' or 'tall for a basketball player'. As suggested in the gloss of (16), we take the Japanese equivalent of 'how' to be interpreted more literally as, 'to what extent'; that is, as an adverbial element related through the *discourse* to the semantic degree-position in the predicate.<sup>7</sup>

### 6. The Syntactic Representation of Number

Still another prediction of our approach is that bare numeral modifiers, which we take to be licensed in adult English by a null plural determiner, will be either absent or different in nature in Japanese and child English. Again, the prediction appears to be borne out. As is well-known, Japanese numerals with plural NPs take the form of numeral classifiers, rather than pronominal modifiers of the English type. For example, in (18), the English phrase, 'three people',

<sup>7</sup> A similar approach can be applied to the semantics of comparative deletion and subdeletion-with-ellipsis in Japanese and child English. The idea would be that in comparative deletion, for example, 'Mary reads more books than John buys' would be interpreted along the lines of, 'The number of books that Mary reads is greater than (the number associated with) what John buys'. Here we assume operator movement from direct object position in the *than*-clause, and a discourse-mediated process by which the individual-type variable is understood as a quantity-type variable. (The quantity-type argument in the matrix clause might come from a null comparative element, but there would be no way of introducing a quantity-type variable in a DP within the *than*-clause; subcomparison would thus be disallowed.) Another approach would be to interpret this example along the lines of, 'Relative to what John buys, Mary reads a lot of books.' Here the *than*-clause would be interpreted as a type of free relative, and related through the discourse to the semantic quantity argument of an implicit quantifier ('a lot of').

corresponds to the Japanese phrase, 'hito-o san-nin', where *san-nin* is interpreted along the lines of, 'a set of three', and has been argued by Miyagawa (1989) to stand in a predication relation to the NP *hito* 'person(s)'.

- (18) Mary-wa hito-(tati)-o san-nin miru  
 Mary-top person-(PL)-acc 3-CL see  
 'Mary sees three person(s)'

As discussed by Miyagawa (1989), Greenberg (1972) has observed that numeral classifier systems (with optional plural marking) and prenominal number modifiers (with obligatory plural marking) stand in complementary distribution to one another across the world's languages. A language may have one, or neither, but not both. (Notice that plural-marking is strictly optional in Japanese, as illustrated in 18.) In light of the present discussion, this generalization may again be related to parametric variation in the way degree and quantity expressions are syntactically realized within the NP /DP system.

Cazden (1968) has also examined the use of plural marking in the longitudinal transcripts of spontaneously produced English from three children studied by Brown (1973). Cazden reports that all three children mastered the obligatoriness of plural marking in nouns preceded by a numeral fairly early. Yet, with semantically plural NPs not preceded by a numeral or 'plural' quantifier, the children were still using plural marking only about half the time at the end of their transcripts (ages 4;1, 2;3, 3;6). In all of the cases reported, plural marking was obligatory in adult English. These findings suggest to us that children treat bare numeral modifiers, not as specifiers of a null plural  $D^0$ , but rather as plural determiners in their own right. Semantically plural NPs in adult English always occur with a null  $D^0$  that forces overt plural marking on the  $N^0$ . The children, it would seem, either use bare NPs or assume a null  $D^0$  that imposes no morphological requirements on the  $N^0$ .

## 7. Conclusions

In this paper we have demonstrated a striking parallelism between Japanese and child English in the syntactic representation of degree- and quantity-type arguments. We have argued that in adult

English the syntactic representation of degree and quantity is mediated by null determiners that are plausibly absent from the  $D^0$  inventories of Japanese and child English. This hypothesis is supported by evidence from subcomparatives, *wh*-questions of degree, degree phrases with APs, bare numeral modifiers with NPs, and plural marking on semantically plural NPs.

Our findings support Cresswell's contention that degree-and quantity-type arguments are semantically and syntactically distinct from individual-type arguments. Moreover, if the differences we have observed between adult English versus Japanese and child English are all plausibly derived from a small difference in the determiner system of these languages, then this result lends support to the view that parametric variation (and thus language-specific syntactic knowledge) should be understood in terms of the lexically encoded properties of functional categories (cf. Borer 1984; Pica 1987; Chomsky 1991, 1993; Hyams 1994). Such a view contrasts with the widely held 'switchbox' model of parameters. Thus, we believe that parallel research in comparative syntax and child language acquisition holds the potential to provide important insights into both Universal Grammar and language-specific syntactic knowledge.

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