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# Markedness Versus Maturation: The Case of Subject-Auxiliary Inversion

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An account of the acquisition of subject-auxiliary inversion is provided. We show that principles derived from linguistic and learnability theory to solve the logical problem of acquisition are sufficient to explain the developmental sequence associated with this construction. The fact that some children learn features of this construction at the same time, whereas others learn the same features at different points in development, is shown to be a problem for the Maturation Hypothesis of Borer and Wexler (1987).

## 1. INTRODUCTION

Subject-auxiliary inversion, the process that moves an auxiliary from its position between subject and verb in declarative sentences to presubject position, has undergone extensive analysis since the early days of generative grammar. I suggest that recent advances in transformational grammar—in particular, features of the government-binding theory of Chomsky (1981) as developed by Koopman (1983) and Aoun, Hornstein, Lightfoot, and Weinberg (1987)—allow us to account for the acquisition of subject-auxiliary inversion in an extremely elegant way.

This analysis has implications beyond the narrow case of subject-auxiliary inversion. As is well known, current work in generative grammar makes the major idealization of *instantaneous acquisition*, the assumption that there is no ordering relationship between pieces of linguistic knowledge. This assumption is assuredly false. Independently of whether this is a valid idealization for the purposes of linguistic theory, we would like to know whether a theory based on this assumption can shed any light

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on the theory of language development. Development theory must describe the actual stages that children go through on their way to achieving adult linguistic knowledge. It must also provide a mechanism that can combine with data that are plausibly part of children's linguistic environment to move them from their initial state of knowledge, through subsequently attested acquisitional states, yielding all and only the attested adult states. This article shows that current linguistic theory can serve as a model of actual language development. That is, the assumptions that the theory must assume to explain language development, even under the idealized conditions discussed earlier, suffice to provide an explanatory model of the sequence of stages that psychologists have actually observed in the course of a child's linguistic development. (See Hyams, 1986; Pinker, 1981, and the article in Roeper & Williams, 1987, for a survey of various other attempts that pursue this approach.)

The article has the following structure: First, I present the developmental problem. Then, because the solution to this problem depends on insights from learnability theory as it approaches problems of cross-linguistic variation, I present this theory. Next, I show its application to the developmental problem at hand. After presenting my analysis of subject-auxiliary inversion, I discuss the theory's implications for the so-called parameter setting model of language acquisition and the maturational hypothesis developed in recent work by Borer and Wexler (1987).

## STAGES OF ACQUISITION IN SUBJECT-AUXILIARY INVERSION

The data used here are taken from a range of studies of spontaneous production found in the literature. The facts that I wish to account for are discussed next.

Children may optionally go through a stage where they produce auxiliaries in medial position, as in (1a), but do not invert in either yes/no questions like (1b) or *wh* questions like (1c). This is particularly surprising because many authors have pointed out that questions with inverted auxiliaries are perhaps the most common construction in the child's input from the parents (see Newport, Gleitman, & Gleitman, 1977). Davis (1987) reported such a child, K, who never produced forms like (1b) or (1c) until 38 months (MLU IV)<sup>1</sup> even though he produced auxiliaries in 75% of possible medial declarative cases.

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<sup>1</sup>The mean length of utterance (MLU) is indicated by the number expressed in roman numerals (e.g., VI = 4 words).

- (1) a. John will kiss Mary.  
 b. %Will John kiss Mary  
 c. %Who will John kiss<sup>2</sup>

Some children pass through a stage where they control auxiliaries in medial position and begin to invert in yes/no questions like (1b) but not *wh* questions like (1c).<sup>3</sup>

The Harvard children studied by Bellugi (1968) exhibited this pattern. Bellugi claimed that at MLU Stage III, only sporadic presentation of formulaic negative auxiliaries occurs in medial position. These forms do not indicate real control of the auxiliary system. At Stage IV, these children begin to produce auxiliaries productively in medial position and in yes/no questions. They either omit the auxiliary entirely or they produce it in uninverted position in these constructions. The children first produce inverted yes/no questions with positive and then with negative auxiliaries. *Wh* questions with inverted auxiliaries are not produced until MLU V.

There are some children who begin to invert in *wh* questions at the same time that they invert in yes/no questions. The child, K, studied in Davis (1987), and all of the 23 children studied in Ingram and Tyack (1979) fall into this class. At 38 months (MLU IV), K began to invert in both *wh* and yes/no questions at the same time. Ingram and Tyack's children produced a similar pattern.

Children who invert in *wh* questions will always invert in yes/no questions. There is no stage where (1c) is attested without (1b).

Subject-auxiliary inversion is inhibited by negation in the sense that auxiliaries with negative contractions attached are inverted much later than their positive counterparts. Thus, there is a stage where (2a) but not (2b) is attested. This is particularly curious because nonnegative contracted *wh* forms are among the first to undergo subject-auxiliary inversion.

- (2) a. Would John come  
 b. Wouldn't John come

<sup>2</sup>The "%" sign indicates that a form is not attested at a certain stage of acquisition.

This stage is by no means obligatory in all children. The child, S, who was studied by Ken Reeder and reported in Davis (1987), began to produce auxiliaries in declarative and yes/no interrogative contexts at the same time (see Davis, 1987, pp. 617-618).

<sup>3</sup>Again, this is not a universal pattern. The child S, studied by Ken Reeder, went from a stage (at MLU II) where auxiliaries began to appear in medial, inverted yes/no and inverted *wh* positions at the same time. Ingram and Tyack (1979) also presented a cross-sectional study where they had the parents of 21 children collect mini corpora of about 225 questions per child. When one abstracts away from the *wh* question employing contracted auxiliaries, one also finds a pattern where *wh* and yes/no questions are coming into children's speech at the same time.

After children exhibit control of subject–auxiliary inversion in matrix clauses, they seem to overgeneralize both to *wh* elements and to embedded contexts that do not allow inversion in adult grammars. Thus, whereas (3a) and (3b) are unacceptable in the adult grammar, some children produce them.

- (3) a. \*How come will you go to the store?  
 b. \*I know who do you like. (Davis, 1987; Stromswold & Pinker, 1986)

The data to be explained are summarized in Table 1.<sup>3</sup>

One might object that production studies are a poor probe into what a child knows about a construction. Even though a child might not produce a structure, he or she might demonstrate perfect control of the construction if other techniques were used. I argue that even if we assume a difference between competence and production for this construction, the conclusions drawn using only production data are reinforced rather than undermined.

Let us consider the possible orders of production of auxiliaries in medial and inverted yes/no positions. There are three logically possible types of production orders: medial first and then inverted, inverted first and then medial, medial and inverted together. Of these three possibilities, only the first and last are attested. This is particularly curious given that Newport et al. (1977) showed that the young child's ability to use auxiliaries is positively correlated with the percentage of yes/no questions that the child's caretaker produces. They theorized that yes/no questions are good triggers because the auxiliary appears in the first position of the sentence in these constructions. We know that children pay particular attention to this position<sup>4</sup> and exposure to an auxiliary will be maximized if that category appears in this position.

Thus, I assume that children's early awareness about the existence of a lexical category of auxiliary is gleaned from this position. Normally, we would expect that this would lead to production of this category in the position where it is most frequently heard first, or at least that this should be an option. Nonetheless, it seems as if children learn the features of the lexical item from the source position but place it in a different syntactic position in their production even after they have clear evidence that this category appears in initial position. This suggests that, even in the hypothesized phase where children comprehend but do not produce any auxiliaries, the comprehension process is compromised by some principle that makes it difficult for them to place the auxiliary in its correct syntactic position.

<sup>4</sup>See Shipley, Smith, and Gleitman (1969) for evidence that sentence-initial position is particularly salient for the young child.

TABLE 1  
Stages in the Development of Subject-Auxiliary Inversion

<i>Children</i>	<i>Stage I</i>	<i>Stage II</i>	<i>Stage III</i>
Harvard children	—no medial auxiliary	—auxiliary in medial and inverted position in yes/no questions	—auxiliary in medial position and inverted in yes/no and <i>wh</i> questions
MLU	—no inverted auxiliary	—no inversion in <i>wh</i> questions	
Age	III <sup>a</sup> 35–36 mo. Adam 36–41 mo. Sarah 22–25 mo. Eve	IV 36–42 mo. Adam 41–43 mo. Sarah 25–27 mo. Eve	V + 42+ mo. Adam 43+ mo. Sarah 27+ mo. Eve
S	—auxiliary in medial position in declaratives and yes/no questions	—auxiliary in medial position  —inversion in yes/no and <i>wh</i> questions	Same as Stage II
MLU	IV	IV	
Age	24–30 mo.	30–36 mo.	
K	—auxiliary in medial position, no inversion	—auxiliary in medial position  —inversion in yes/no and <i>wh</i> questions	Same as Stage II
MLU	IV	IV	
Age	33–40 mo.	40+ mo.	

<sup>a</sup>The mean length of utterance (MLU) is indicated by the number expressed in roman numerals (e.g., III = 3 words).

*Sources.* Harvard children data—Cazden (1972, p. 54) and Bellugi (1968). S data—Davis (1987, pp. 617–622). K data—Davis (1987) and Ingram and Tyack (1979).

Several possibilities suggest themselves. The first could be that children do a full analysis of the auxiliary and realize from the co-occurrence restrictions between auxiliaries and the presence of verbal affixes that auxiliaries are in construction with the verb and therefore must start in the verb phrase (VP). Once it is clear that this is the source position, some constraint on movement might prevent them from appearing in the surface position. This alternative is unlikely for two reasons. First, the auxiliary contractions that children allow in initial position suggest that they allow unanalyzed material to surface in this position. That is, in order to explain

the early occurrence of these contracted forms in initial position, I have to assume that they are unanalyzed forms not related to the medial environment. Thus, there is no reason why the lexical auxiliary could not be present as an unanalyzed form first, unrelated to the VP-internal position.<sup>5</sup> Moreover, this would be quite plausible when we consider the fact that verb-ending agreement, either with the subject, inflection for tense, or with the auxiliary, takes some time to develop. Thus, I would predict that there could be a stage before concord is mastered where the auxiliary and verbal forms are mastered as unanalyzed units, allowing the auxiliary to appear exclusively in the initial position.

The second possibility is suggested in Hyams (1986). Hyams claimed that auxiliaries are prohibited from medial position in child grammars due to an initial misanalysis of a supervenient Pro Drop parameter in the grammar. If the medial position is the source position for inverted auxiliaries, we would predict that no inverted auxiliaries could appear until the child corrected the initial misanalysis and that once auxiliaries appeared in medial position, they should appear in inverted position as well. We see that Hyams's account cannot explain the lack of subject-auxiliary inversion in early stages by the fact that some children go through a stage where auxiliaries appear exclusively in medial position (see Davis, 1987). More tellingly though, this account assumes that the child must analyze auxiliaries as related to a sentence-internal position, but the contraction data show that these categories can clearly show up as either misanalyzed or unanalyzed categories, base generated in the initial position.

The point is that to explain the child's production data, we must assume that the initial comprehension of the construction is also somehow compromised. Thus, even if the child is gleaning information about the existence of auxiliary words from initial position, he or she cannot use this information to effectively compute the correct structure for sentences with inversion. Thus, production data turn out to be a fruitful paradigm to study in this case.

### 3. ON THE GRAMMAR OF SUBJECT-AUXILIARY INVERSION

I now briefly review the treatment of subject-auxiliary inversion within the government-binding theory. This theory claims that subject-auxiliary in-

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<sup>5</sup>The relevant contracted forms are cases like: *What's these things*. Davis (1987) showed that although the contracted auxiliaries may be unanalyzed in these structures, they cannot be taken as simple alternants of the *wh* forms. They only appear in sentence-initial position, whereas the *wh* forms also appear in embedded and other contexts at this time in children's speech. If contracted forms were taken as variants of the *wh* elements, they should appear in every possible *wh* context.

version is a subcase of head movement that moves an auxiliary across the sentence (inflection phrase or IP) to the head of the presentential complementizer (CP) position in nonselected CPs.<sup>6</sup> I follow Chomsky (1986) and others in claiming that the complementizer position follows standard X-bar conventions in having a specifier, head, and complement position, with the complementizer or auxiliary filling the head position.

Thus, the structure of (4) is (5). Co-occurring *wh* movement moves a *wh* element to the specifier of CP position, as in (6).

(4) Have you taken linguistics?

(5) [<sub>CP</sub> [<sub>C</sub> have<sub>i</sub> [<sub>IP</sub> you [<sub>I</sub> e<sub>i</sub> [<sub>VP</sub> e<sub>i</sub> taken linguistics]]]]]

(6) [<sub>CP</sub> who<sub>i</sub> [<sub>C</sub> has<sub>j</sub> [<sub>IP</sub> e<sub>i</sub> [<sub>I</sub> e<sub>j</sub> [<sub>VP</sub> e<sub>j</sub> taken linguistics]]]]]

Evidence that there can be both a specifier and head position in CP comes from the fact that in many languages both of these positions can co-occur, as shown by (7) from Dutch. Old English and a variety of other languages provide similar examples.

(7) Ik vraag me of *wie* of dat hij gezien heeft  
 I ask myself who whether he seen has  
 'I ask myself whether he has seen who'

There are many reasons for assuming that auxiliaries, as well as complementizers, can appear in the head of the CP position. The most important is that we get an immediate explanation for the complementarity of auxiliaries and overt complementizers in the Germanic languages. Even though there are languages that allow examples like (7), (8) is not allowed, at least in languages of the Germanic family, and possibly in all the world's languages.<sup>7</sup>

(8) I know who that had you seen.

If movement is to the head of CP position, then the unacceptability of (8) follows from the fact that the position is already filled by the complementizer *that*, and thus the auxiliary has no unoccupied landing site to move to. Movement to the head of CP is allowed in matrix clauses because overt complementizers must be selected by a verb that governs

<sup>6</sup>See den Besten (1983) and Chomsky (1986) for justification of this assumption.

<sup>7</sup>This claim was first made by den Besten (1983). I discuss superficial counterexamples to this claim later.



them.<sup>8</sup> Therefore, lexical complementizers only occur in embedded clauses. This frees up the head of CP in the matrix position for the auxiliary to move into. The ungrammaticality of (9) is explained by claiming that even if a complementizer is not lexically present, it leaves an empty category in this position.<sup>9</sup> Thus, the position is not vacant and so it is not a possible landing site for auxiliary inversion.

(9) He said had Harry given the book to the men.

The appropriate structure is given in (10).

(10) He said [<sub>CP</sub> SPEC [<sub>C</sub>e<sub>i</sub> [Harry had given the book to the men]]].<sup>10</sup>

<sup>8</sup>Government is defined as follows:

$\alpha$  governs  $\beta$  IFF

$\alpha$  c-commands  $\beta$  and

the first maximal projection that dominates  $\alpha$  dominates  $\beta$ .

<sup>9</sup>Stowell (1981) provided extensive justification for this assumption by claiming that because complementizers leave an empty category in place when they are not present, we can predict the environments where null complementizers can appear. For example, if we assume that empty complementizers, like other empty categories, must be in the environment of the verb in order to survive the lexical government condition of the ECP—which says that an empty category must be governed by a lexical head and have a local antecedent—we explain why (a) and (b) and (c) are acceptable, but (d) is out.

(a) I know that John is great.

(b) I know [e] John is great.

(c) That John is great is well known.

(d) \*John is great is well known.

<sup>10</sup>One might argue that the matrix-embedded complement distinction is untenable based on constructions like (a–c), where the auxiliary appears in presentential position as well.

(a) My mother said that never had she seen such a mess.

(b) I know that so many politicians have the people rejected, that it's getting hard to find another candidate.

(c) I said that had John been smarter, I would have hired him.

Evidence that the preposed auxiliary is not in the same position in embedded and matrix complements comes from the fact that further movement is blocked in embedded structures, even though it is allowed when other items actually appear in the Head CP position, as shown by the contrast in (d) and (e).

(d) \*Which friend never have you kissed?

\*On which table have so many books you put that your arm is tired.

(e) Who do you think that Ethel likes?

If we claim that auxiliaries in these embedded structure are adjoined to IP, rather than hanging as head of CP, and we adopt Lasnik and Saito's (1988) definition (f) of a barrier, we explain this contrast, because movement across the preposed auxiliary position crosses two barriers, as shown in (g). Lasnik and Saito differ from Chomsky in that all X<sub>max</sub> categories count as barriers (there is no exclusion) and VP is taken to be L-marked, where "L-marked" means 'governed by a lexical category'.

As in standard analyses, I assume that movement of the auxiliary is a species of Head movement and that this movement is governed by the empty category principle (ECP). The crucial point about Head movement is that it is more local than phrasal movement. We cannot move a head over another head because this would block the antecedent government condition of the ECP, even though we can sometimes move a phrase over another phrase. The contrast is given in (11) and (12).

- (11) a. The men were being scolded.  
       b. \*Being the men were scolded.
- (12) a. I wonder how to solve the problem.  
       b. Which problem do you wonder how to solve.

### 3.1 The Doubly Filled Comp Filter

As mentioned earlier, English contrasts with Dutch and a variety of other languages in that it disallows two elements in the CP except in matrix position. This is what explains the ungrammaticality of (7) in English. Generative grammarians have claimed that languages like English are governed by a so-called doubly filled Comp filter. I follow Aoun et al. (1987) in expressing the filter as in (13).

- (13) \*<sub>CPi</sub> [ $\alpha$ ,  $\beta$ ] where ( $\alpha$ ) is in Spec CP and ( $\beta$ ) is a lexical item.

This means, that if a complementizer must be indexed, either with the index of the category in its specifier or its head, the CP cannot contain a lexical head.

In order to understand how this filter works, we must discuss some basic features of index percolation. By standard assumptions of X-bar theory, the head of a phrase normally gives its features to the category that dominates it. I assume that all categories are given an identifying index when they are

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- (f)  $\alpha$  is a barrier for  $\beta$  if  
     (i)  $\alpha$  is a maximal projection  
     (ii)  $\alpha$  is not L-marked and  
     (iii)  $\alpha$  dominates  $\beta$

(Lasnik & Saito, 1988, p. 18)

- (g) [<sub>CP</sub> which friend [<sub>IP</sub> never [<sub>IP</sub> have [<sub>IP</sub> you kissed ]]]]

In order to explain the relative position of the auxiliary and subject position in embedded structures, we follow Koopman and Sportiche (1989), who claimed that subjects co-occur in the Spec of VP position in D-structure. In the structures with embedded preposed auxiliaries, these subjects simply remain in this position, with the auxiliary adjoining to the IP position. The structure is given in (h).

- (h) [<sub>IP</sub> never [<sub>IP</sub> e [<sub>I</sub> has<sub>i</sub> [<sub>VP</sub> my mother [<sub>VP</sub> e<sub>i</sub> seen such a mess ]]]]

inserted into the phrase structure. Feature identification between head and dominating phrase is then formally represented by percolating the head's index onto the dominating category. Percolation is normally forced simply to identify the category type of the dominating phrase with that of the phrase's head. Percolation may also be forced from something in the specifier position to satisfy other principles of grammar (see Aoun et al., 1987; Koopman, 1983). Percolation is always obligatory where grammatical principles force it, but there are contexts where this head/phrase correlation can be overridden in order to satisfy additional syntactic constraints. It should be noted that overriding the relationship between a head and its maximal projection is not optimal because it serves as an exception to otherwise overwhelmingly attested generalizations about the role that heads play in giving phrases their features.

Obligatory percolation occurs in embedded contexts because verbs select particular types of complements. There is a lot of evidence that the selection relation is determined very locally under *government*. This means that the selection relation cannot occur directly between the higher verb and the head of CP. Given the definition of government provided earlier, the intervening CP phrase blocks the government relation. Because an additional selectional constraint would be violated if percolation did not occur, this information must percolate from the head of the CP onto the dominating phrase. This indicates that a tensed CP headed by the tensed complementizer *that* is actually present, yielding a structure like (14).

- (14) I [<sub>VP</sub> think [<sub>CP</sub><sub>i</sub> [<sub>C</sub> that<sub>i</sub> [<sub>S</sub> John is smart]]]]

Verbs also select for *wh*-filled CPs, with these CPs being interpreted as indirect questions. As shown in (15), a *wh* element must be in Spec CP in order for the embedded complement of a verb like *wonder* to yield an acceptable sentence.

- (15) a. I wonder who you saw.  
b. \*I wonder that you saw John.

Because this is selectional information, it must also percolate up to the dominating phrase. Thus, a sentence like (16) is unacceptable in English with any of its possible structures. In (16b), the index of the head of the complementizer has percolated up, and the doubly filled Comp filter is not respected. In addition, the sentence cannot be interpreted as an indirect question because the *wh* index has not percolated. In (16c) and (16d), the *wh* word has percolated its index. Thus, the CP, although correctly interpreted as an indirect question, violates the doubly filled Comp filter because the

CP is indexed while containing two distinct lexical items. In (16d), this is compounded by having a doubly filled Comp with two percolated indices.

- (16) a. \*I wonder who that you saw.  
 b. I wonder [<sub>CPj</sub> who<sub>i</sub> [<sub>C</sub> that<sub>j</sub> [<sub>S</sub> you saw]]]  
 c. I wonder [<sub>CPi</sub> who<sub>i</sub> [<sub>C</sub> that<sub>j</sub> [<sub>S</sub> you saw]]]  
 d. I wonder [<sub>CPij</sub> who<sub>i</sub> [<sub>C</sub> that<sub>j</sub> [<sub>S</sub> you saw]]]

This entails that languages that respect the doubly filled Comp filter will disallow CPs containing a head and specifier in embedded contexts. English is such a language and so it disallows structures like (7). However, as discussed in Aoun et al. (1987), structures like (17), which also have two elements in the CP, are allowed.

- (17) [<sub>CP</sub> who<sub>i</sub> [<sub>C</sub> will<sub>j</sub> [<sub>S</sub> John marry e<sub>i</sub>]]]

Because this is a matrix clause, there is no selection relation between any dominating material and elements in the CP (there are no dominating elements). Moreover, the question interpretation in these cases is not a matter of selection and so the *wh* need not percolate its index either. Because no index needs to percolate, (17) respects the doubly filled Comp filter. Recall, though, that this structure is not optimal, because it violates normal percolation conventions.

With these natural assumptions, I derive the fact that English only allows two things in CP in the matrix position.

#### 4. CROSS-LINGUISTIC VARIATION AND THE LOGICAL PROBLEM OF ACQUISITION

Languages of the world must pick from the limited array of choices that universal grammar allows. Languages differ with respect to what elements they allow in both Spec CP and Head CP position. A language like English only allows +*wh* elements into Spec CP, whereas Germanic languages are more permissive, allowing any nonphrase (NP) in this position. English and German allow either a complementizer or auxiliary-like element into the head of CP position, but German and Romance languages are again freer in allowing other inflected verbs in this position as well, as shown by (18).

- (18) a. Kommen - Sie.  
           Come     - you.  
           ‘Will you come?’  
       b. Viens - tu.

Come - you.  
 'Will you come?'

Some languages, like Chinese, allow no inversion at all in the head CP position.

- (19) a. Ni shi zhong guo ren.  
           You are Chinese country person.  
           'You are Chinese person'  
       b. \*Shi ni zhong guo ren?  
           Are you Chinese country person?  
           'Are you a Chinese person?'

Languages can also differ with respect to whether they obey the doubly filled Comp filter. Children must thus be able to search through a plausible amount of primary linguistic data to discover which of this range of possibilities matches their language. Lightfoot (1990) argued that the projection of CP is not automatic but rather follows only when a specifier or head position actually appears in the child's primary linguistic data. The projection of the CP, with its head, then follows to satisfy X-bar theory. This means that the child must not only create a head for the auxiliary to move to, but the entire maximal projection.

The assumption that this must be done in a way that conforms with the demands of the logical problem of acquisition, the linguist's idealized acquisitional state, places fairly heavy restrictions on what we can assume the child must have as default hypotheses versus those that he or she can deduce from evidence. The logical problem of acquisition encompasses a range of plausibility conditions that linguists believe any learning theory for natural language must conform to. For example, it is well known that a variety of ungrammatical sentences are simply never considered by children to be possibilities for their language. Logically, this could be the result of overt negative examples; a parent's telling the child that a particular sentence is bad in the child's language. As is well known, however, this approach flounders when we consider first the fact that much of the negative evidence needed could only be contained in examples whose complexity simply makes them implausible candidates for part of the child's teaching corpus.

It is not enough to claim that children will assume that sentences are ungrammatical until they hear an exemplar, because there are many examples of both overgeneralizations and productions that outstrip utterances that children have actually heard. An example of overgeneralization and an explanation for it are given later.

These considerations guide the theory for how children choose between options that are admitted by their universal grammar. For example, because languages that respect the doubly filled Comp filter and those that do not are possible, both options must be part of universal grammar. If we supposed that children's first hypothesis was that this filter did not apply to their language, then the only way for them to discover that it did would be by actually hearing the negative example of a doubly filled Comp violation like (20), coupled with the information that such sentences were not part of the language.

(20) \*I wonder who that you know.

Because negative evidence is to be avoided, I assume that children must make the contrary hypothesis. They assume that their language obeys the doubly filled Comp filter until confronted with positive evidence in the form of actually produced sentences that prove them wrong. This so-called projection problem, or the problem of projecting from the class of possible grammars to the actual language that children are hearing, was first discussed by Baker (1979). Berwick (1985) claimed that the projection problem can be solved by endowing children with an innate learning principle called the subset principle (see also Wexler & Manzini, 1987). The subset principle assures that children will make the most restrictive hypothesis concerning the grammar of their language as their first guess.

for all target languages  $L_i$  of the family of recursive languages  $L$ , there exists an effective procedure that can enumerate positive examples  $S_1, S_2, \dots$  such that (1)  $S_i$  is included in  $L_i$  and (2) for all  $j$  greater or equal to 1, if  $S_i$  is in  $L_j$ , then  $L_j$  is not in  $L_i$ . (Berwick, 1985, pp. 37–38)

This principle suggests an ordered sequence of hypotheses or a markedness hierarchy about the types of grammatical descriptions that children would hypothesize for their language. The default value under this hypothesis is the value setting of a grammatical principle that generates the smallest external language.

I now sketch out what the markedness hierarchy must be for the factors involved in subject–auxiliary inversion even under the idealized conditions of instantaneous acquisition. This particular ordering follows as a simple consequence of the ban on negative evidence. The crucial point is that, without any additional assumptions, this hierarchy orders the stages that children go through as they learn this construction in way that entirely conforms to the actually observed acquisitional sequence.

## 5. MARKEDNESS THEORY AND THE STAGES OF ACQUISITION

In order to apply markedness theory to the problem of language acquisition, we must sketch how marked and unmarked parameter settings could be encoded into the child's language faculty. We model the child's moving through the markedness hierarchy for a given parameter as resetting probabilities that are associated with parameter values by universal grammar. We assume that the child controls all possible settings for parameters in the initial stages of development. Unmarked settings for parameter values have greater initial associated probabilities than their marked counterparts. Probability settings can be incremented or decremented depending on the ability of the grammars they produce to provide an analysis for the input strings of the child's primary linguistic data. As one parameter value is incremented or decremented, we assume that the other values of the parameter are inversely affected. We can either think of the child trying the hypothesis with the highest probability first then associating increments or decrements to the other values accordingly, or we can think of a child trying all parameter settings at the same time. These approaches can yield very different results in cases where parameter settings are more than binary valued. Choosing the appropriate algorithm is beyond the scope of this article.

At some point, we assume that one parameter value converges and the other values are abandoned, at least with respect to the current language under analysis. Given the initial high probability associated with an unmarked setting, relatively little evidence from the environment should allow the child to lock onto this value setting. It would take much more evidence from the environment to move a child to the corresponding marked parameter setting. Even more evidence would be needed to drive a child to assume multiple marked value settings.<sup>11</sup>

If we assume the grammatical description of subject-auxiliary inversion provided earlier, we see that children need to learn several things in order to

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<sup>11</sup>This last point is reinforced if we assume something like Berwick's (1985) assumption that the child is only allowed to change his or her grammar incrementally, one change at a time.

We should emphasize that the preceding discussion provides only the form of the model that would be needed to allow markedness principles to play a role. We can at least say that this model is formally coherent. Kazman (1989) provided a formal model of this type, although not for this construction.

Moreover, we know from the probability learning literature that human beings (and even lower species) can rank hypotheses probabilistically and can tune behavior to these probabilities given environmental stimuli. This literature provides various functions to govern the probability tuning and it is beyond the scope of this article to choose the appropriate one (see Estes, 1975, for a survey).



know that even simple subject-auxiliary inversion is possible. Because auxiliary inversion is governed by the head constraint, children must understand that auxiliaries are either generated in or can move to the head of the sentence position in order for further movement to the head of CP position to occur.

In addition, they need to discover that an auxiliary is a possible filler for the head of CP position and that sentences in English have CP positions. Given markedness theory, this means that because children can discover that their language allows auxiliaries in the head CP position *from positive evidence*, I predict that their initial hypothesis must be that auxiliaries cannot occur in this position and that the CP position does not even exist. If they assumed the opposite, they would generate auxiliary inverted sentences, that, in a language where these were not possible, would need negative evidence (correction) in order to be excised. Therefore, we are not surprised to discover that even though children's teaching corpus presents them with many examples of inverted auxiliaries in the perceptually salient initial position, they hesitate in producing examples of this type. Given that hypothesizing this constituent involves creating a new X-max (CP) and moving a nonbase-generated category into this phrase as its head, and developing the computational control necessary to deal with movement, we are not surprised that the onset of acquisition is delayed until the second or early third year.

The same analysis also explains why, even though many children gain awareness of the auxiliary from the initial inverted position, they would be driven to assume a displaced position for this category.

Notice that this account makes the change from nonauxiliary inversion to inversion stage highly data driven. As soon as children have strong evidence (presumably enough examples from the adult corpus) that a revision is necessary, their initial hypothesis should be revised. This seems to be the right sort of account because the noninversion stage seems to be optional. The children studied by Ingram and Tyack (1979), and the child K, studied by Davis, do seem to go through this stage. But Davis (1987), citing data supplied by Ken Reeder, reported a child S, whose spontaneous production shows that he went from a stage where auxiliaries were omitted from both medial and inverted positions directly to a stage where these auxiliaries appeared in both positions (from Reeder, who studied this child at bimonthly intervals from age 16 to 47 months).

The next two facts are linked within grammatical theory and have a uniform explanation. Children may go through a stage where they only invert in yes/no but not in *wh* contexts and all children who invert in *wh* contexts also invert in yes/no questions. Within the grammatical framework proposed earlier, inversion in *wh* contexts presupposes inversion in yes/no questions. In both cases, children must realize that the head of CP



position can be filled with an auxiliary. Inversion in *wh* constructions involves having a filled Spec and head of CP position, in violation of the doubly filled Comp filter. Given the subset principle, children's first hypothesis must be that their language respects this filter.

Recall that in matrix contexts, English licenses doubly filled CPs because matrix clauses are not selected by any verb. In this case, nonpercolation of the index of the auxiliary in the head position does not violate any independent grammatical principles except those of X-bar theory. Therefore the index does not need to be percolated. If we do not percolate, though, we produce a structure that violates the basic tenet of X-bar theory that projects the features of the maximal projections from their heads. We assume then, that children guided by X-bar theory would resist producing phrases that violate principles of this theory. Therefore, we are not surprised if some children resist inverting in these cases, preferring to omit auxiliaries in these constructions. The structure that would be generated if the auxiliary percolated up its index in a *wh*-inverted question is illustrated in (21). We can see that this structure violates the doubly filled Comp filter.

(21) [<sub>CP</sub><sub>i</sub> who<sub>j</sub> [<sub>C</sub>did<sub>i</sub> [<sub>S</sub> John like e<sub>j</sub>]]]

The structures in (22) are examples of the lack of inversion in child grammars in these cases (from Bellugi, 1968, and Davis, 1987, respectively).

- (22) a. What you gonna wear?  
 b. What the mouse is doing?  
 c. What he's saying?

Inversion in yes/no questions requires only one of the two just discussed revisions to initial hypotheses. Namely, the doubly filled Comp filter remains in its unmarked setting, but the child needs to assume that an auxiliary can fill the head of CP position. Thus, there is a logical relationship between these two constructions such that knowing that an auxiliary could be the head of CP in a *wh* construction entails knowing that it could be the head of CP simpliciter. This allows us to correctly predict that a stage where a child would exhibit inversion in *wh* but not yes/no questions could not occur.

Evidence that an approach in terms of the doubly filled Comp filter is on the right track comes from two sources. The first is the fact that contracted auxiliaries are attested very early in the acquisition sequence. In some cases, they are found even before inversion in simple yes/no questions. For example, Davis (1987) reported on a child K. In an elicited imitation task, this child produced sentences of the following type:

- (23) a. And what's the mouse is doing?  
b. What's he's doing? (From Davis, 1987, p. 627.)

The repetition of the auxiliary indicates that K did not relate the contracted form to the medial auxiliary position. Further evidence for this conclusion is that subject-verb agreement, which was obligatory when the auxiliary was in medial position, was optional when the auxiliary was inverted.

- (24) a. What's these flat things?  
b. Where's the eyes?  
c. What's these for? (From Davis, 1987, p. 628.)

We might be tempted to conclude that these children simply took the contracted forms as free variants of *wh* question words. However, Davis pointed out that this would predict that they should occur freely in all the environments where uncontracted *wh* elements occur. However, this pattern was not attested in either K's spontaneous speech or in his elicited imitation. He produced embedded *wh* phrases, but these were never contracted. This shows us two things. First, it shows that K has not correctly deduced that auxiliaries can appear in head of CP position from contracted forms. Second, these examples show the influence of the doubly filled Comp filter. If the child does not analyze contracted forms as simple variants of *wh* forms, then he or she must have some way of generating these categories in this position. There are two possible analyses that a child could give to these structures. In the first analysis, guided by knowledge about the structure of categories from X-bar theory, the child could generate such a form by placing the clitic into the Head CP position in the syntax and then contracting it onto the Spec CP by a postsyntactic contraction rule. Thus, this initial structure of a contracted form is (25) and the postcontracted form is (26).

(25) [<sub>CPi</sub> who [<sub>C's<sub>i</sub></sub> [John seeing e<sub>i</sub>]]]

(26) [<sub>CPi</sub> who's<sub>i</sub> [<sub>C'</sub> [John seeing e<sub>i</sub>]]]

Notice that even though a structure like (25) has an indexed CP and elements in the Spec and head position, it crucially doesn't violate the doubly filled Comp filter, which bans such structures only when the head is lexical. Therefore, these structures collapse into cases of simple subject-auxiliary inversion.

Examples like (27) demonstrate that a contracted auxiliary is taken to be

in the head position in the adult grammar as well. Unless we assume this, then both the doubly filled Comp filter and the condition of one element per head position would be satisfied in (27).<sup>12</sup>

(27) \*I wonder <sub>CP</sub>[who'll <sub>C</sub>[e [John see]]]

It is crucial to make reference to the doubly filled Comp filter, which crucially distinguishes lexical from nonlexical heads to make sense of the stage where the child only inverts contracted forms.

Alternatively, to explain cases where these contracted forms appear even before simple inversion, we must assume that children could treat these structures as pure cliticized forms at all levels of representation, as in (26). In this case, the structure is completely canonical as far as the grammatical principles that we have been discussing are concerned, and so we would expect it to be attested from the earliest stages. Presumably, once children were able to relate these uncontracted forms to full auxiliaries, they would see that they should appear in the head of CP position, at S-structure as well.

Because children do not associate the contracted form with any lexical item, but rather treat it as an unanalyzed form, it is natural that it is not treated as lexical in these early stages of grammar. Only when children recognize that contracted forms are related to uncontracted auxiliaries can such examples cause them to change their initial hypothesis of no subject-auxiliary inversion and strict adherence to the doubly filled Comp filter.

The change from unmarked to marked parameter is again highly data driven. Children need a sufficient number of *wh* questions to show them that the unmarked percolation of head index to CP is overridden in the case of matrix clauses. *Wh* movement from object position will contain the relevant data. Movement from the subject position, as in (28), could be analyzed with the *wh* in its base-generated subject position, or with *wh* movement and no auxiliary movement, in which case the auxiliary remains in its base-generated position as well.

(28) [<sub>CP</sub>[<sub>C</sub>[<sub>S</sub> who [<sub>INFL</sub> is [<sub>VP</sub> eating]]]]]

<sup>12</sup>Additional evidence is provided by so-called *wanna* contraction. In *wanna contraction*, the *to* phrase cliticizes onto the *want* phrase. Nonetheless, VP deletion provides evidence that the cliticized auxiliary also remains in the auxiliary position. VP deletion cannot take place if the adjacent auxiliary is unfilled. Thus, the grammaticality of "I wanna try voting and I know YOU wanna too" shows that the *na* is in the auxiliary position at the point where VP deletion applies.

It would be possible, though, for children who heard enough examples of movement from the object position to come to the marked conclusion. Placing a rather heavy burden on the data that children actually receive seems to be correct again, because the acquisition of *wh* inversion varies with respect to whether it occurs at the same time or later than the acquisition of yes/no questions. The children studied by Bellugi seem to invert in yes/no questions before *wh* questions, but the children S and K studied by Davis (1987) and by Ingram and Tyack (1979) invert in both yes/no and *wh* questions at the same time.

Further confirmation of the role of the doubly filled Comp filter comes from overgeneralizations of subject-auxiliary inversion to embedded contexts. These cases are disallowed in the adult grammar. Interestingly, Davis (1987) mentioned that the overgeneralizing child that he tested also consistently omitted the *that* complementizer. He showed that this cannot be related to an avoidance of closed class items because *that* is consistently present in this child's speech when it is used as a determiner. Phinney (1981) presented evidence that suggests that this is a rather widespread phenomenon. Phinney interpreted this omission as suggesting that the child has not yet figured out selectional properties of matrix verbs and therefore does not see complement clauses as embedded. We would interpret this slightly differently, claiming that whereas lexical features of predicates determine their selectional features at all stages of development, selection is not under government at these early stages of development, as is true in adult nonword order sensitive languages.<sup>13</sup>

If this is true though, then once children hypothesize that index percolation is not obligatory in simple clauses, allowing subject-auxiliary inversion in these contexts, they will also be led to suppose that this process is possible in complement clauses as well. This is because percolation is only forced in embedded clauses to satisfy selectional restrictions in cases where these relations meet the government requirement. By hypothesis, these selectional relations are not appreciated by children until a later stage in their grammar, presumably when enough co-occurring tensed clauses and *that* complementizers are discovered that lead children to understand that this complementizer signifies a particular type of clause that only shows up in the government domain.

The last fact that I must account for is the inhibitory role that negation plays in the acquisition of subject-auxiliary inversion, that is, why an example like (29a) is acceptable before (29b).

<sup>13</sup>A child would simply need to master cyclic *wh* movement to realize that selection was in fact under government in English. Assuming that the ECP applies to *wh* movement, the underlined trace of the *wh* in "Who<sub>i</sub> do you believe [<sub>CP</sub> e<sub>i</sub> [<sub>IP</sub> e<sub>i</sub> likes linguistics]]" would have to be embedded in order to be properly governed.

- (29) a. Who would John kiss?  
b. Who wouldn't John kiss?<sup>14</sup>

Here, I rely on the head movement condition, which insures that movement to the head of CP can only be through the head of S. In tensed sentences, agreement occurs in the head of S position as a feature of universal agreement. Normal tensed auxiliaries exhibit subject-verb agreement even in English. Thus, children have clear evidence that these categories must have either been base generated or moved to the agreement slot. They can then move to head CP from this position. Moreover, we know that children at this stage produce sentences that respect the subject-verb agreement condition, indicating that they understand this fact. Things are not so clear with cliticized negations. Consider a case like (30).

- (30) a. I could not come to dinner.  
b. I couldn't come to dinner.

The orthography here leads one to expect that the *not* cliticizes onto the auxiliary, which in this case is the right conclusion. However, there are other cases where orthography is misleading. Consider the contrast in (31).

- (31) a. Joanne is writing a letter and Sari is writing a letter too.  
b. Joanne's writing a letter and Sari's writing a letter too.  
c. \*Joanne's writing a letter and Sari's too.

The contrast between (31b) and (31c) can be explained if we assume that cliticization is to the right and that clitics must have lexical items to attach to. Because the attachment site has been deleted by VP deletion in (31c), cliticization is impossible. The clitic has no host position. Presumably, data like (31) are not part of children's primary linguistic data, and so we must assume that the direction of cliticization is unknown by the young child.

In a case like (30), this means that even though the words *could* and *not* or its clitic appear in adjacent positions, children cannot assume that the negative has cliticized onto the agreement-marked phrase. Subject-auxiliary inversion is probably the main piece of evidence in children's primary linguistic data that suggests that cliticization onto the agreement phrase has taken place. Thus, even when children have mastered the basics of the subject-auxiliary inversion case, the fact that auxiliaries can be the head of CP and the fact that index percolation is not obligatory in root clauses will still cause children to have trouble with negative auxiliaries until they realize that the negative marker has in fact attached to the auxiliary itself.

<sup>14</sup>"Inverted auxiliaries appear in Yes/No questions, first in positive and then in negative environments" (Davis, 1987, p. 613, commenting on the data from the Harvard children).

Thus, the basic stages of acquisition of this construction are accounted for. Children need evidence to assume that the auxiliary can appear in the head of CP position. Until sufficient evidence appears in the primary linguistic data, they will maintain the initial setting of no auxiliary in head CP. It is possible for children to invert in yes/no but not *wh* questions because production of yes/no questions involves simply allowing auxiliary in head CP. Inversion in *wh* environments involves this as well as revising the percolation conventions for embedded questions. This revision (nonpercolation of a head index) is nonoptimal from the perspective of X-bar theory. It is nonetheless necessary in order to make these structures conform to the unmarked setting of the doubly filled Comp filter. Contractions are plausibly nonlexical elements, and so we predict that they can appear in inverted position. The problem with negative auxiliaries was explained by the indeterminacy of their cliticization site.

The hierarchy of hypotheses defined by the Subset Principle as applied to current linguistic theory determines the direction of children's conservatism. Children will be conservative to the extent that data force them to move from the subset (unmarked) to the superset (marked) language. We need to assume that the evidence that children hear in the primary linguistic data—which by all accounts contain a host of yes/no and *wh* questions—does not drive them immediately to correct production of these constructions. The reason that I have given in all cases has been that evidence that the *primary* linguistic data are giving children is counterbalanced by the fact that the data force them to move to a superset language. The hierarchy is in turn justified by the role it plays in solving the logical problem of acquisition, in particular the need to handle cross-linguistic variation without resorting to negative evidence. The same assumptions play a role in the theory of actual language development in that they force children to be cautious about revising these initial hypotheses. If they are incorrectly revised, they can only be corrected through the use of negative evidence. Thus, we expect a time lag between receipt of evidence and revision of hypothesis. The interplay of grammatical principles—and, in particular, the logical dependency between auxiliary inversion in yes/no and *wh* questions—allows us to explain the nonexistence of a stage where inversion in *wh* but not yes/no questions is attested.

## 6. AN ASYMMETRY BETWEEN CHILD AND ADULT GRAMMARS AND ITS ANALYSIS<sup>15</sup>

Up to this point, it has appeared as if all stages of child language development mirrored possible adult languages exactly. For the most part,

<sup>15</sup>This asymmetry was pointed out to me by Peter Culicover and Henry Davis.

this is true, but there is one exception that must be incorporated into our analysis. Recall that some children pass through a stage where they invert in yes/no but not in *wh* questions. Greenberg (1963) claimed that this configuration is not a possible adult language. His universal 11 states: "Inversion of statement order so that V precedes subject occurs only in languages where the Q word or phrase is normally initial. This same inversion occurs in yes/no questions only if it also occurs in interrogative questions" (Greenberg, 1963, p. 83). Therefore, I must explain why this nonadult stage occurs in language development and why it does not persist into the adult state. Let us tackle the second problem first.

First recall that, given current analyses, movement of a question word is to Spec CP, and therefore triggers the creation of a CP node. In matrix position, which is the domain of the child's primary linguistic data, interrogative inversion without corresponding subject-auxiliary inversion causes the creation of a phrase without a head.

This is highly marked, given X-bar Theory, and I would therefore predict that languages that had movement to a specifier position causing the creation of a category would also have a process moving to a head in the same category. This explains why, in the normal case, languages with overt question formation also contain some kind of head-inversion process.

We may extend these remarks to explain why the stage where there are yes/no questions without corresponding *wh* questions does not persist in adult languages. Chomsky (1988) proposed a principle of "economy of derivation," which states that languages do not tend to move categories unless some grammatical principle requires it. If subject-auxiliary inversion really applies to provide a category with a head, and if that category must be created only if something else moves into specifier position, I predict that this process should only be triggered in cases where there is corresponding overt question formation or other movement into Spec CP.

If this is true, though, I must still explain why some children allow an impossible adult language to exist as a stage. In other words, what forces them to adopt an analysis that ignores the economy principle and to produce inverted yes/no questions without corresponding *wh* interrogatives? The answer to the first part of the question may come from the well-attested salience of the first position of a sentence for young children, which I discussed earlier. Recall that Newport et al. (1977) showed that this general trend applies in the case of auxiliaries. They showed that a child's tendency to produce auxiliaries in his or her own speech is positively correlated with the number of yes/no questions produced in the mother's speech. Given the special role that this position plays in children's comprehension, we might expect that they would need a minimal number of examples to make them aware of the presence of this category in this position. The fact that they do not produce such structures initially (i.e.,



before medial auxiliaries) is testimony to the marked nature of the construction. Over a short period of time, however, we would expect that children would come in contact with enough examples to suggest that inversion was occurring in yes/no questions, even though this meant a superficial violation of economy considerations.

Why then, in order to save economy, wouldn't children immediately assume that inversion also applied in *wh* questions? Presumably, the reason is that this assumption has liabilities of its own in terms of markedness theory. Either children must assume that their language allows violation of the doubly filled Comp filter, a move that they should only make on the basis of positive examples, or they would have to assume that the auxiliary in head position did not percolate its features to the CP, again a marked assumption about the head, maximal projection relation. Thus, there would still be pressure on children to retain a conservative stance vis-à-vis inversion in *wh* interrogatives, even though this leads to a marked assumption with respect to economy. Children would have to give up this assumption as they accumulated enough examples of inversion in *wh* structures. Given that the auxiliary in these cases is not in such a salient position, more examples would be needed to force this restructuring, explaining the time lag between the presence of inversion in yes/no and *wh* interrogatives.

## 7. SUBJECT-AUXILIARY INVERSION AND MATURATION THEORY

Borer and Wexler (1987) presented an interesting theory of syntactic development known as the maturation thesis. This theory maintains that although language development is governed at all stages by principles of universal grammar, various subsets of these principles become available at different times during development. As an example of this, consider their account of the inability to comprehend nonactional passives, as reported in Maratsos, Kuczaj, and Fox (1978). Borer and Wexler claimed that this stage is attested because the rule (Move NP—discussed later) that is needed to generate such structures is not yet part of children's repertoire of rules. Moreover, the schedule of appearance of this and other pieces of grammatical competence is genetically preprogrammed in much the same way as puberty. This means that no matter how much *teaching data* children's linguistic environment contains, they cannot learn that the rule is an appropriate part of their grammar until this option becomes genetically available to them. This analysis is designed to deal with a kind of *reverse poverty of the stimulus* problem that is characteristic of language development.



Recall that Chomsky's original presentation of the poverty of the stimulus argument claimed that the primary linguistic data did not contain the correct evidence to allow children to choose the right settings for principles of their grammar. Thus, the environment did not contain the right sort of information to predict children's subsequent state of knowledge of their language and their subsequent linguistic behavior.

In the passive and auxiliary cases discussed, and in many other cases, it seems that we have the converse problem with respect to the relationship between the environment and children's subsequent knowledge. That is, in some cases, the data that children are exposed to contain all of the evidence that they need to acquire a certain rule or principle, but nonetheless there is a lag in the presentation of these data and the acquisition of the rule or principle. For example, in the case just discussed, nonmaturational accounts have claimed that the lag in presentation and acquisition of nonactional passives stems from the paucity of this type of example in children's teaching corpus. Borer and Wexler pointed out that the nonmaturational story is based on shaky ground indeed if this is the only explanation that it can provide, because the evidence for this claim is quite slight. Moreover, some constructions are acquired with no time lag. In these cases, acquisition of a piece of linguistic knowledge proceeds smoothly and rapidly from the onset of presentation of relevant data. Thus, it seems that if we consider children's relation to their linguistic environments alone, we cannot provide a well-defined function that maps from the appearance of relevant stimuli in children's primary linguistic data to the onset of acquisition of the properties of these stimuli.

Borer and Wexler suggested three possible solutions to the reverse poverty of stimulus or "triggering" problem: maturation, a theory of syntactic markedness, or intrinsic ordering. They observed that intrinsic ordering, which relies heavily on elaborate structural descriptions for construction-specific rules, no longer has a place within linguistic theory and so should no longer have a place within linguistically based acquisition theory. I agree with them on this issue. They suggested that markedness theory is suspect because "Often there is no linguistic motivation for the markedness assumption" (Borer & Wexler, 1987, p. 125).

In this article, I have exhaustively justified every markedness assumption by showing that only the particular ordering adopted herein can be combined with the subset principle to allow children to cope with cross-linguistic variation in adult languages. Given the ordering adopted, children can use a reasonable sample of primary linguistic data to decide which of universal grammar's options they are hearing. Other orderings would force illicit recourse to negative evidence. Therefore, it can at least be said that this criticism does not apply in the case of subject-auxiliary inversion.

This is interesting because subject-auxiliary inversion is clearly a case

where the triggering problem applies. Newport et al. (1977) showed that questions, which contain a host of inverted auxiliaries, are the most frequently attested constructions in many children's linguistic environment. Therefore, if data were all that children needed, we might expect that inverted questions would be the first type of construction mastered. Nonetheless, there is a clear time lag between presentation of these data and mastery of the construction. Thus, this is clearly a potential case for a maturational account because of the unconnectedness of the properties of the stimulus with the onset of acquisition. I have dealt with this case using a theory that couples variable rates of exposure to stimuli with an independently justified markedness theory and have provided a clearly explanatory alternative to a maturational story.

I would make the stronger claim: On both conceptual and empirical grounds, it is the preferred approach. The conceptual advantage of this theory comes from the fact that the assumptions that one makes regarding what counts as the marked or unmarked case are all independently constrained by pattern of cross-linguistic adult data and the relation of these cross-linguistic patterns to the logical problem of acquisition. The assumptions that one needs to explain stages of development must also suffice to explain how children could learn any attested adult data from exclusively positive evidence. The markedness theory that results from ordering the parameter values of universal grammar according to the Subset Principle is independently justified by its solution to this logical problem. The fact that it can also explain actual stages of development in language acquisition simply provides the theory with extra support and correspondingly provides acquisition theory with a constrained range of alternatives to explain development.

This theory seems more testable as a first guess than a maturation theory. The latter, though limited to dealing with principles of universal grammar, has the capacity to arrange the order of presentation of these principles in nonindependently justified ways. That is, a possible move in this theory and one that is actually used in the passive case is that, in addition to the substantive theory of grammar containing a rule called Move NP, we have another substantive theory claiming that this rule only becomes available to children at some specified point in development, the point of development not being justified by anything but the observed sequence of stages that the theory is designed to explain.

In contrast, to explain the variability of stages of development, we combine the markedness theory that explains children's initial conservatism regarding acquisition of a particular structure with variable presentation of evidence of the construction within their primary linguistic data. The variable presentation is empirically attested in study after study, and moreover, can influence the time of onset of a particular construction in a

child's production. The markedness theory of language acquisition combines a constrained theoretical apparatus with a theory of the connection between presentation of data and acquisition that is reasonable and empirically verified in a number of cases.

On the empirical front, the variability across children with respect to whether subject-auxiliary inversion applies in yes/no and *wh* questions makes this case an extremely difficult one for the maturation account to handle. Some children (K and the children from the Ingram & Tyack study) seem to acquire inversion in these two constructions at the same time, whereas others (the Harvard children and S) acquire subject-auxiliary inversion in yes/no questions before inversion in *wh* contexts. Notice that this problem is different from the simple assumption of different rates of maturation. Thus, I do not take it to be a problem for maturation theory that some children show competence in both production of medial auxiliaries and yes/no questions at an earlier stage than others.

Assuming as I have done that parameterized principles of grammar are available at all stages of development, two factors can influence their time of acquisition. The first is whether the parameter value moves the language acquisition device from the subset to the superset value of the language. The second is the frequency with which a construction providing evidence for this move from subset to superset language appears in the child's primary linguistic data. Therefore, it is not a surprise if children hearing many *wh* questions would acquire the marked setting for both the head movement and doubly filled Comp parameter at the same time. A unique construction is giving the child evidence for resetting both parameter values, and we are allowing the frequency of occurrence of the construction to play a causal role.

Data can also play a causal role within a maturation theory, but this role is post hoc. That is, parameter settings arrive on their own biologically determined schedules. This is what allows maturation theory to abstract facts about the presentation of the data and the point of acquisition of the association constraints. Idealizing under this assumption, once maturation makes a particular setting of a parameter available, a single instance of a construction exhibiting this setting should trigger acquisition. Consider subject-auxiliary inversion in this light. If we assume that relaxation of the doubly filled Comp filter in matrix clauses and the fact that auxiliaries can move to the head of CP position are maturationally linked, then we predict that all children who invert in yes/no questions should invert in *wh* questions, because we must assume that children will hear at least one example of each type of such simple constructions at the same point of their development. Therefore, we would be surprised by children who inverted in yes/no but not in *wh* constructions.

If we make the opposite assumption—that the principles are unlinked—

then children who acquire both types of inversion constructions at the same time become the problem.

Under the unlinked assumption, it is a pure coincidence that the principle triggering head movement of the auxiliary and the principle responsible for relaxation of the doubly filled Comp filter develop at the same time. It remains a mystery that in some children but not in others these grammatically unrelated principles—which should be subject to different rates of maturation—unfold at the same time, conveniently yielded inversion in *wh* constructions and yes/no questions simultaneously. The fact that data from a unique construction provide information about both of these unrelated parameters cannot be causal in the scheduling of principles in universal grammar.

The variability of developmental patterning is interesting because subject-auxiliary inversion is one of the few constructions that has been studied in enough different laboratories to make comparative analysis possible. If it turns out to be the case that other data handled by maturation theory have the same variability as this case, then a maturation story will be correspondingly weakened.

The goal of this article has been to show that a well worked-out markedness theory can be combined with the empirically attested variable input to provide an account that explains the lag between data presentation and acquisition of a construction. Thus, whereas I agree with Borer and Wexler that features of the environment cannot bear the burden for explaining developmental staging, I disagree with them in claiming that other independently justified aspects of learnability and linguistic theory cannot shoulder this burden when coupled with environment influence.<sup>16</sup>

This article is a first step at trying to make a markedness story plausible, but there may be other subtheories involved in dealing with this issue. I would claim that this is the appropriate strategy to follow at this point in our understanding of language development. This is because by assuming a nonmaturational account, we are led to search for independently motivated principles, either in terms of markedness or learning theory, to deal with the triggering problem. By assuming maturation, we are led to a theory that merely catalogs points in time when different principles come into play without searching for any understanding of why particular principles appear in any given order. With respect to markedness type solutions, we

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<sup>16</sup>I should mention that markedness theory and the subset principle may not be all that is required to handle all of the cases where maturation has been invoked. For example, Berwick and Weinberg (1984) invoked an independently motivated uniqueness principle to explain features of the acquisition of the passive. Care must be taken to insure that when the full story is told, the learning theory has a principled structure of its own. Otherwise, many of the conceptual charges that we have leveled against maturation theory will apply to non-maturational accounts as well.

are on firm ground because the theory has extensive empirical justification. But with respect to language-learning principles that are sometimes invoked in nonmaturational stories, we must admit that things are on shakier ground, and it could turn out that no coherent or general learning principles outside of those provided by universal grammar will be forthcoming.

Thus, I cannot say for sure that a maturational account will not ultimately prove correct and that the order of acquisition of rules and principles will have a fairly arbitrary relationship to environmental stimulus. However, the point is that we will never discover any relationship, or develop our markedness or learning theory further, if we assume maturation in the first instance.

## 8. CONCLUSION

I have presented an analysis of subject-auxiliary inversion that used independently motivated markedness principles from linguistic theory and variability of data presentation to explain both the variability and order of acquisition of subject-auxiliary inversion. I have tried to show that markedness theory can explain the time lag between presentation and control of inversion in young children. The main point has been to show that markedness theory constrains the child's space of hypotheses concerning this rule to an extent that all of the possible orders of acquisition that markedness allows are actually attested in the child's language development. I also showed that this type of analysis is superior to that provided by maturation theory for this case and suggested why we might prefer to pursue this approach in general.

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