ERREICH, ANNE

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THE ACQUISITION OF INVERSION IN WH-QUESTIONS: WHAT EVIDENCE THE CHILD USES?

by

ANNE ERREICH

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Virginia Valian — Chairman of Examining Committee

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Martin L. Hoffman — Executive Officer

Professor Virginia Valian

Professor Katherine Nelson

Professor D. Terence Langendoen

Supervisory Committee

The City University of New York

Abstract

THE ACQUISITION OF INVERSION IN WH-QUESTIONS:

WHAT EVIDENCE THE CHILD USES?

by

Anne Erreich

Adviser: Professor Virginia Valian

This research is presented as a case study in the hypothesis-testing process for syntax acquisition. Early accounts (Bellugi, 1965, 1971; Klima & Bellugi, 1966; Brown, Cazden & Bellugi, 1969) proposed a stage at which children invert subject NP and Aux in yes-no questions but not in wh-questions, producing errors such as when daddy will come home?, where the mailman lives?. A more recent study (Ingram & Tyack, 1979) found no evidence of such a stage.

As to the source of the non-inversion errors, three accounts are presented. One, a performance account based on the derivational theory of complexity, is ruled out because it does not adequately predict the data. The other two accounts assume that the errors result from an incorrectly formulated rule. The surface structure account proposes that the rule is due to misleading data from embedded wh-questions (Maratsos, 1978, in press) which have the same

constituent structure as matrix wh-questions. Because the latter are inverted while the former are not, children may be misled into thinking that inversion applies optionally to both constructions. This proposal predicts not only the occurrence of non-inversion errors in matrix wh-questions, but also inversion errors in embedded wh-questions. The transformational account proposes that the status of inversion in yes-no questions must be relevant to the formulation of inversion in wh-questions because that portion of the derivation to which the rule applies is the same in both question types. The fact that inversion is optional in yes-no questions may mislead the child into assuming that it is optional in wh-questions also. The account assumes that children are sensitive to the underlying relationship between yes-no and wh-questions, and thus predicts a match in the form of their rule for the two question types.

The research addresses four questions:

1. What is the frequency of non-inversion errors among children?

2. What is the acquisition pattern for auxiliaries and inversion in yes-no and wh-questions?

3. What linguistic data are misleading for children who make non-inversion errors?

4. What formulation best represents children's inversion rule, an abstract transformational rule or a lexically-specific surface structure frame?

Subjects were 18 children ranging in age from 2;5 - 3;0, with an average MLU of 3.33. The elicitation task was designed to collect yes-no and wh-questions. Elicitation items consisted of embedded yes-no and wh-questions. Items were presented to children

during the course of a free-play session. Both spontaneous and elicited speech was taperecorded for transcription and analysis. Elicitation sessions lasted one hour, and children were seen for 1-3 sessions.

Results indicate that contrary to Ingram & Tyack (1979), non-inversion errors constitute a significant phenomenon in the speech of children learning inversion in questions; reasons for the discrepant findings are discussed. As to acquisition patterns for auxiliaries and inversion, the data suggest that children overall treat yes-no and wh-questions in a similar fashion. The most striking example is that 10 out of 18 children used an optional inversion rule in both question types. Although this match in rules supports a transformational account, the account is weakened in that the remaining children do not use matching rules in yes-no and wh-questions. The surface structure account lacks support in that children produce few inversion errors in embedded wh-questions. In general, the findings neither support nor reject a surface structure account and provide somewhat suggestive support for a transformational account.

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Introduction

This research is an investigation into the acquisition of syntax. Erreich, Valian & Mayer (1980) have suggested that an account of the syntax acquisition process would emerge from the specification of four components of a hypothesis-testing model:

1. what is learned
2. what the innate properties of the language acquisition mechanism are
3. what the content of the hypotheses is
4. what the nature of the evidence is which confirms or disconfirms hypotheses

The research is presented as a case study in the hypothesis-testing process. It focuses on the acquisition of a particular rule, more precisely, on the conditions for applying the rule, and in so doing, makes claims about the last two aspects of the model: the form of the rule which the child is testing, and the linguistic data which serve as evidence in the testing process.

Specifically, the research tries to account for the way in which children learn that the major sentence constituents, subject NP and Aux, which occur in that order in declaratives, are inverted in most wh-questions, i.e., Aux NP. That there is a period when some children do not perform the necessary inversion operation in wh-questions is attested to by the observation in young children of sentences such as <u>when daddy will come home?</u>, <u>where the mailman lives?</u>, etc.

The study addresses two kinds of issues: First, descriptive issues having to do with the facts about the acquisition pattern and

the non-inversion errors:

1. What is the frequency of non-inversion errors in wh-questions among children? Previous research which has been based on transcripts from three or four children, found such errors prevalent enough to merit the status of a stage in the acquisition of questions. A more recent study of 21 children claimed to find no evidence of such a stage. Thus, the generality of the phenomenon is unknown.

2. What is the acquisition pattern for auxiliaries and inversion in affirmative and negative yes-no and wh-questions?

Second, the research addresses explanatory issues having to do with the source of the non-inversion errors as a feature of acquisition:

1. What data serve as misleading evidence for children who make the errors?

2. What formulation best represents children's inversion rule, an abstract transformational rule or a lexically specific surface structure frame?

The first section of the dissertation presents what has traditionally been claimed to be the pattern in the acquisition of inversion and auxiliaries in yes-no and wh-questions. Earlier accounts (Bellugi, 1965, 1971; Klima & Bellugi, 1966; Brown, Cazden & Bellugi, 1969) have concluded that wh-questions pose some particular difficulty not inherent in yes-no questions such that the rules pertaining to auxiliaries and inversion do not apply in wh-questions until after the rules are already productive in yes-no questions; when children do start to invert wh-questions, they tend to do so for affirmative wh-questions prior to negative ones. However, a more recent account (Ingram & Tyack, 1979) claims to have found no

evidence to support a stage in which yes-no questions are correctly inverted, while wh-questions are incorrectly uninverted.

As to the source of the non-inversion errors which the earlier reports claim exist, two accounts have been proposed. The first, a transformational account (Bellugi, 1965, 1971; Brown et al, 1969), assumes that the child has a correct inversion rule, but is prevented from applying it due to some performance constraint; this account will be ruled out because it does not adequately predict the data. The second, a surface structure account (Maratsos, 1978, in press), assumes that uninverted wh-questions result from the child's having an incorrectly formulated rule due to misleading data from embedded wh-questions.

The second section of the dissertation re-analyzes some of the naturalistic data on which the traditional sequence is based, and offers additional data to argue for a somewhat different acquisition pattern for rules pertaining to inversion and auxiliaries in questions. Specifically, I claim that inversion and auxiliary rules apply in a similar fashion to both yes-no and wh-questions and that the pattern of inversion in affirmative and negative wh-questions, rather than being a peculiar feature of wh-questions, is also reflected in yes-no questions. Evidence for these claims derives from a consideration of data which have been overlooked in the past, and from an analysis which focuses on deeper, more abstract features of children's questions. As to the source of the non-inversion errors, a different transformational account is suggested which, like the surface structure account, assumes that uninverted wh-questions result from an incorrectly formulated rule. However, the transformational account

proposes that the misformulated rule is due, at least in part, to the role of yes-no questions as providing misleading data.

In sum, the first two sections of the dissertation describe two possible accounts of non-inversion errors in wh-questions, a surface structure account and a transformational account. The surface structure and transformational accounts differ essentially in the explanatory claims that they make about what data serve as misleading evidence for the non-inversion errors and, by implication, what form the child's rule takes. On a surface structure account, embedded questions provide the only possible source of misleading data. On a transformational account, whatever the role of embedded questions, yes-no questions are also a potential source of misleading data. Thus, what is at issue between the two accounts is whether yes-no questions act as evidence in the formulation of an inversion rule for wh-questions, such that the optional nature of inversion in yes-no questions is at least in part responsible for the non-inversion errors in wh-questions. This might be demonstrated by showing that, whatever the relevance of embedded questions, the status of inversion in yes-no questions is considered relevant to the formulation of an inversion rule in wh-questions, a finding which is not predicted by a surface structure account but is necessary on a transformational account.

The method section describes an elicitation study to collect more descriptive data pertaining to the non-inversion phenomenon. The study is designed to determine the frequency of non-inversion errors both across and within children, and the pattern for inversion in yes-no and wh-questions.

The results section presents the results of the elicitation study, and the final section consists of a discussion of the findings and their implication for syntax acquisition.

Inversion in Questions: Previous Accounts

The Accepted Pattern

It has previously been claimed that children, having acquired a subject-auxiliary inversion rule in yes-no questions, do not for some time extend that rule to wh-questions. Bellugi (1965, 1971), Klima & Bellugi (1966) and Brown, Cazden & Bellugi (1969) record the following stages in the acquisition of inversion in questions:

Stage 1. Auxiliaries are initially absent in both declaratives and questions; as a result, there is no possibility of inversion. Yes-no questions are indicated by rising intonation: he coming? Wh-questions are restricted to a few simple formulas: where NP go? Also, children appear to fail to understand many wh-questions.

Stage 2. Children's questions are somewhat more advanced in that there is some occurrence of articles, modifiers, inflections, prepositional phrases and unanalyzed negative auxiliaries such as can't or don't. However, there is still no productive use of auxiliaries, hence no productive inversion; while yes-no questions are essentially like those in stage 1, wh-questions are somewhat more productive now and children appear to be better able to understand them.

Stage 3. Auxiliaries start to appear in declaratives and in correctly inverted yes-no questions. Bellugi (1971) reports that inversion in yes-no questions coincides with the appearance of modal auxiliaries, implying that children produce very few uninverted yes-

no questions; that is, once modals start to appear in yes-no questions, they are overwhelmingly inverted. However, auxiliaries are absent from many wh-questions; as for those auxiliaries which do appear in wh-questions, although children are corrently inverting them in yes-no questions, they often fail to invert them in wh-questions: where we should put that?, what we saw?[1] Also, there seems to be a tendency for inversion to occur later in time in negative wh-questions than in affirmative ones: why he won't go?

To summarize, the acquisition of yes-no questions seems to differ from that of wh-questions in three respects: (1) auxiliaries appear in yes-no questions prior to wh-questions, (2) inversion is productive in yes-no questions prior to wh-questions, (3) inversion is productive in affirmative wh-questions prior to negative ones. There have been no attempts to explain the first fact, other than to assume that it is somehow connected with the relatively late occurrence of inversion in wh-questions. Rather, the traditional view has focused on the relatively late occurrence of inversion in wh-questions with some attention given to the disparity in the appearance of inversion for affirmative and negative wh-questions. In this regard, Maratsos (in press) has characterized the pattern for auxiliarty placement in wh-questions as omission, misplacement, correct placement: where we put that?, where we should put that?, where should we put that? He notes however, that children do not make clear demarcations between these stages; a child may be producing all three patterns to varying degrees during the same chronological sample. The importance of this last observation will become clear later in that it will provide support for a new view of the acquisition pattern.

A Challenge to the Accepted Pattern

The claims made by early accounts are weak in that they are based on longitudinal transcripts from only three children (Brown et al, 1969). A more recent study of the acquisition of inversion in questions contradicts these earlier findings. Ingram & Tyack (1979) examined cross-sectional samples of questions from young children to see if they could substantiate the existence of a stage in which children inverted subject NP and auxiliary in yes-no questions, but not in wh-questions. Their subjects were 21 children, aged 2:0 - 3:11; no MLU measure was taken. Their procedure consisted of instructing the parents of each child to write down verbatim every question that the child asked until 225 questions were collected. Their findings, based on percentage of inversion, did not reveal any subjects who inverted in yes-no questions but not in wh-questions. Rather, children appeared to have developing auxiliary systems with inversion in both kinds of questions. Only two subjects showed evidence of non-inversion errors, and these were very infrequent - four examples for one child, six for the other. Based on percentage of inversion, these two children were considered to use inversion in both yes-no and wh-questions. Ingram & Tyack (1979) thus argue against the existence of a stage in which there is inversion in yes-no questions but not in wh-questions. They further interpret their findings as evidence against a particular transformational account, an extension of the derivational theory of complexity. (See below for a discussion of DTC.)

The present study attempted to collect definitive data on children's questions to determine the frequency of non-inversion errors in

wh-questions, and their import in the acquisition of the syntax of questions.

Two Accounts of Non-Inversion Errors

Two accounts have been advanced to explain the occurrence of the non-inversion errors in Brown et al's (1969) data. The first is a derivational complexity account; this account is specifically tied to a transformational model of syntax acquisition, and makes claims about how the grammar is used in performance. The second might be called a linguistic evidence account; this makes claims about the child's underlying competence, and has up to now been couched in surface structure generalization terms. Later it will be shown that a linguistic evidence account may also be stated in terms of a transformational model.

What follows is a general explication, first, of the derivational complexity account, second, of the surface structure evidence account. Each section will consider and evaluate the two accounts as they have attempted to explain the patterns in the acquisition of properly inverted wh-questions. It will be concluded that the derivational complexity account is not even descriptively adequate, and is thus ruled out as a possible account, while the surface structure account constitutes a possible description of the data.

The Derivational Complexity Account

The derivational complexity account derives directly from what has come to be known as the "derivational theory of complexity" or DTC. DTC proposed that transformations, which connect deep structures and surface structures, represent actual computations which speakers

made in generating sentences and which listeners made in reverse in order to understand sentences. The total number of transformations which applied in any particular derivation was thought to directly determine the computation time required to produce or comprehend that sentence. (Fodor & Garrett (1966) have reviewed the literature on DTC and conclude that derivational complexity as measured by the number of transformation necessary to derive a sentence does not directly correspond to psychological complexity; they conclude that there is only an indirect relation between a speaker's grammar and her performance. For a more complete discussion and critique of the DTC controversy, see Valian, 1979.)

The Derivational Complexity Account of Non-Inversion Errors. How has the derivational complexity account explained the non-inversion errors? Given the formal nature of transformational machinery, a transformational rule, once acquired, should apply without exception in all cases where it is obligatory; i.e., an obligatory rule must apply wherever its structural description is matched by some terminal string in the underlying structure of a derivation. Since subject-aux inversion is obligatory in wh-questions, and there is independent evidence from yes-no questions that children possess such a rule, inversion ought to apply automatically in most wh-questions.[2] The transformational account has tried to explain why the inversion rule does not automatically apply in wh-questions where it is obligatory, and why, once subject-aux inversion does start to apply in wh-questions, it applies differentially to affirmatives and negatives.

The derivational complexity account has therefore assumed that the child has a correctly formulated rule of subject-aux inversion,

henceforth, SAI (Langendoen, personal communication):[3]

(1) SAI: SD: Q (Wh-X) NP Tense ($\left\{\begin{matrix}\text{Modal}\\\text{Have}\\\text{Be}\end{matrix}\right\}$) X

1 2 3 4 5

SC: 1 2 4 3 Ø 5

(condition: obligatory when 2 is non-null)

(Note that linguists have assumed that in the adult grammar the same formulation of subject-aux inversion applies to both yes-no and wh-questions.) The derivational complexity account has claimed that in the child's grammar, this rule properly applies in yes-no questions, but is not applied in the appropriate wh-questions due to a constraint on the number of transformations that the child can perform; i.e., the fact that the derivation of wh-questions requires SAI in addition to wh-movement places too high a computational load on the child, which then results in the leaving off of the inversion transformation (Bellugi, 1965, 1971; Brown et al, 1969; Maratsos, 1978, in press). The fact that affirmative wh-questions are inverted before negative ones (Bellugi, 1971; Brown et al, 1969) is thought to provide further support for a complexity limit; this pattern indicates that negation also places too great a processing load on the child which results in the leaving off of the inversion operation.

In summary, the derivational complexity account proposes a limit on the formal complexity a child can handle at one time to explain the later occurrence of inversion in wh-questions as opposed to yes-no questions, and the later occurrence of inversion in negative wh-questions as compared with affirmative ones. The account assumes that the child already has a correctly formulated rule, be-

cause children can correctly perform inversion in yes-no questions. No claims are made about how the correct rule was acquired. However, the same data pattern could be viewed as evidence for a different kind of transformational account, a competence account, in which the child has an incorrectly formulated inversion rule. This view, that the problem is one of rule formulation rather than rule execution, will be more fully examined later.

Problems with the Derivational Complexity Account. A serious problem with the derivational complexity account is that it presents no principled explanation for the omission of inversion rather than wh-movement. As others (Klima & Bellugi, 1966; Bellugi, 1971; Prideaux, 1976; Labov & Labov, 1976; Maratsos, in press) have noted, if the child has SAI and wh-movement properly formulated, and a performance limit prevents both from being performed, why is it always inversion which is left out? Errors such as *can you bake what? rather than *what you can bake?, suggesting that wh-movement rather than SAI has been omitted, have not been observed, and their absence undercuts the derivational complexity account unless it can explain why SAI is vulnerable to the complexity limit while wh-movement is not. In that respect the derivational complexity account does not provide an adequate description of the data and is thus also rejected as a possible explanation for the non-inversion errors in wh-questions.

The Surface Structure Evidence Account

The notion of linguistic evidence derives from a consideration of hypothesis-testing models. Most current theories of syntax acquisition could be characterized as hypothesis-testing models;

i.e., they assume that the syntax acquisition device is one which, given its innate properties and the evidence available to it, projects hypotheses about the form of syntactic rules. (The use of the term "syntactic rules" in this section is neutral with respect to any particular theory of what form syntactic rules take; i.e., whether they are formulated as transformations, as surface structure generalizations (Prideaux, 1976), or as lexically specific frames (Maratsos, in press).

Any hypothesis about the formulation of a rule must be consistent with some portion of the incoming data to be of use to the child; consistent data confirm the child's hypotheses while inconsistent data disconfirm them. What then would lead the child to formulate and maintain a rule that is incorrect from the standpoint of adult grammar? That is, under what circumstances would an incorrect rule be in accord with linguistic data in the child's environment? One such case can occur when the child uses as evidence for the incorrect rule a set of utterances which she has at least partially misanalyzed.

For example, some classes of utterances may actually provide ambiguous data for rule formulation, in that, given a particular misanalysis of their surfaces structures, more than one formulation of a rule could have generated them. Mayer, Erreich & Valian (1978), Erreich et al (1980), and Valian, Mayer & Erreich (in press) present examples which provide potentially ambiguous data regarding the formulation of phrase structure and transformational rules. Presumably, a child will abandon an incorrectly formulated rule in favor of a correct formulation as evidence which is inconsistent with the incorrect rule mounts. However, the notion of linguistic evidence is

not tied to any particular model of syntax acquisition; that is, some set of utterances may provide confirming or disconfirming evidence about the formulation of a particular rule whether that rule is formulated as a transformation or a surface structure generalization.

Surface Structure Account of Non-Inversion Errors. On Maratsos's (1978, in press) surface structure model, the child acquires a set of surface structure frames which characterize the sentence types of her language, in coordination with a dictionary which is lexically specific in that it notes the privileges of occurrence for words in those frames (see also Braine, 1963, 1976; Kuczaj, 1976; Prideaux, 1976, for other illustrations of this approach). On this account the child needs to formulate the following surface structure frames which are potentially relevant to wh-questions:

(2) uninverted yes-no questions: I can eat the apple?

NP (Aux) V ({NP / ADV / PP})

(3) inverted yes-no questions: can I eat the apple?

Aux NP V ({NP / ADV / PP})

(4) wh-subject questions: who can eat the apple?

Wh-word (Aux) V ({NP / ADV / PP})

(5) inverted wh-questions: what can I eat?

Wh-word Aux NP V ({NP / ADV / PP})

(6) embedded wh-questions: I asked what I could eat.

NP V Wh-word NP (Aux) V ({NP / ADV / PP})

How has the surface structure account tried to explain the occurrence of non-inversion errors in wh-questions? Maratsos (1978, in press) has suggested that they are due to misleading data from embedded questions regarding the necessity of inversion in matrix wh-questions. Embedded wh-questions have the same constituent structure as matrix wh-questions; however, the former must not be inverted while the latter must be inverted: I asked what I could eat versus what can I eat?[4] The child mistakenly thinks that inversion does not obligatorily apply in matrix wh-questions because embedded wh-questions are uninverted.[5] Whether or not the child is able to process the entire matrix-plus-embedded sentence, she focuses only on the embedded wh-segment because of its similarity to matrix wh-questions.

Problems with the Surface Structure Account. Maratsos (in press) claims that the order of acquisition of the preceding construction types (2-6) is due to two factors. The first claim is that a bias toward declarative word order makes constructions in which Aux is not contiguous to V harder to analyze; therefore, inverted wh-questions (5) are harder to acquire than wh-subject questions (4) which are never inverted. Although Aux and V are not contiguous in inverted yes-no questions (3), Maratsos argues that this difficulty is offset by the fact that Aux is located in the salient initial position in the frame, making yes-no questions still easier to analyze than inverted wh-questions.

There are two objections to Maratsos's argument. First, it predicts that wh-subject questions should precede inverted yes-no questions in acquisition, and this has yet to be shown. Second, the form of the argument seems invalid on a surface structure gen-

eralization model: an appeal to the primacy of some particular word order generally depends on the assumption that other word orders are alterations of the canonical word order. But the surface structure generalization model makes no such assumption. Rather, each particular word order frame is learned in a left-to-right fashion independently of the other. Thus, there is no basis for the primacy of declarative word order. One might appeal to the greater frequency of declarative sentence types compared to others. However, Newport (1975) has calculated the mean proportion of sentence types which mothers address to their children and to adults and finds that 38% of the utterances addressed to children are declaratives (as opposed to 87% to adults), while 44% are yes-no questions (as opposed to 9% to adults). Hence, on both theoretical and empirical grounds, there is no reason on a surface structure account for children to have any particular bias toward declarative word order.

Maratsos's second claim concerns the nature of the misleading data which account for children's non-inversion errors. Maratsos claims that the conflicting data consist of embedded wh-questions; i.e., that the order of Aux and V in embedded wh-questions (6) encourages the child to reproduce that order in matrix wh-questions (5), producing *<u>what I could eat?</u> on analogy with <u>I asked what I could eat</u>. No such misleading data exist for the formulation of the wh-subject question frame.

The problem with the second claim is that the surface structure generalization account cannot explain the uni-directional nature

of the overgeneralization: if the non-inversion pattern in embedded questions is overextended to matrix wh-questions because the two constructions are considered similar, there ought to be an equal amount of over-extension of the inverted pattern from matrix wh-questions to embedded ones. The only immediately available example of this latter type of overgeneralization is *I know what is that (Menyuk, 1969).

Summary of the Surface Structure Account. In summary, some previous accounts have assumed that the rules pertaining to auxiliaries and inversion apply first in yes-no questions, and are not immediately extended to wh-questions when the latter are acquired. As to the cause of the non-inversion errors, the surface structure account has argued that embedded wh-questions constitute misleading data as to the necessity of inversion in matrix wh-questions; given the sort of lexically specific frames which are assumed to represent children's syntactic knowledge on a surface structure account, embedded questions constitute the only possible source of evidence relevant to the formulation of a rule for matrix wh-questions.

The following section will dispute the descriptive claims of Brown et al (1969) and Ingram & Tyack (1979) regarding the acquisition pattern for inversion. A somewhat different view of the inversion data will be proposed, one which predicts the occurrence of non-inversion errors. In addition, a transformational model will be proposed and contrasted with the surface structure account in so far as they make differing claims regarding the source of evidence for non-inversion errors in wh-questions.

Inversion in Questions: A Revised Account

The Accepted Pattern Revisited

Recall that in research which found evidence of non-inversion errors, the production of correctly inverted yes-no questions has been claimed to differ from that of wh-questions in three respects: (1) inversion is claimed to be productive in yes-no questions prior to wh-questions; (2) auxiliaries are claimed to occur in yes-no questions prior to wh-questions; (3) inversion is claimed to be productive in affirmative wh-questions prior to negative ones. The three findings imply that rules for auxiliaries and inversion are applied first to yes-no questions and then in a second and separate process, to wh-questions, and that inversion in wh-questions applies in two stages, affirmatives, then negatives, rather than in an across-the-board manner.

Here I reanalyze the data which have been thought to support the accepted sequence in children's acquisition of inversion Earlier accounts have ignored a portion of the relevant data, i.e., yes-no questions, and thus may have provided a misleading view of the acquisition pattern. The revised sequence proposes that (1) inversion applies generally to both yes-no and wh-questions; (2) the Aux expansion rule also applies generally to yes-no and wh-questions, (3) the diffential use of inversion in negative and affirmative wh-questions is also reflected in yes-no questions. What follows is a re-analysis of the naturalistic data that have been used to support the accepted pattern, and predictions about what the acquisition pattern might look like if all the relevant data were sampled.

Children May Produce Inverted as well as Univerted Wh-Questions. First, recall that Maratsos has characterized the pattern for Aux placement in wh-questions as omission, misplacement, and correct placement, but he observes that children do not make clear demarcations between the stages, i.e., all three patterns may be productive for a child during the same chronological sample. Most research has failed to note the import of this observation; the focus on the incorrectly uninverted wh-questions has all but ignored the fact that at the same time that children are producing incorrectly uninverted wh-questions, they may also be producing correctly inverted ones, i.e., that inversion may be optional for these children. (The observation does not imply that all children who produce correctly inverted wh-questions will also necessarily produce incorrectly uninverted ones.)

For example, Labov & Labov (1976) present a sample of wh-questions, all of which occurred on the same day, when their subject was 3;10. The sample includes eight correctly inverted wh-questions (e.g., what do you do when you want to be rich? how do babies get inside the mommies? why are we going down?) as well as seven incorrectly uninverted wh-questions (e.g., where this comes from?, what NOT starts with?, why you said to daddy you might be kidding?) Further, an examination of transcripts from four other children found both inverted and uninverted wh-questions.[6] Although the children produced more inverted than uninverted forms, both forms did appear to be productive for each child.

Children May Produce Uninverted as well as Inverted Yes-No Questions. Second, in looking at the acquisition of inversion in wh-questions, most research has failed to report fully on the status

of children's yes-no questions other than to note that children showed evidence of productive inversion in yes-no questions prior to wh-questions. This observation gives the impression that during the period when children are producing uninverted wh-questions, they are producing only inverted yes-no questions. However, an examination of transcripts for the above children, who were producing both uninverted and inverted wh-questions, shows that during the same period of observation, three of them were also producing both uninverted and inverted yes-no questions.[7] Presumably the occurrence of these uninverted yes-no questions has been overlooked because, unlike uninverted wh-questions, the former are perfectly grammatical. Therefore, the stage 3 findings which are in need of explanation are not only that some children produce uninverted wh-questions, but, were complete data on these children available, it appears likely that these children would also be producing uninverted yes-no questions.

Children May Not Acquire Auxiliaries Differentially in Yes-No and Wh-Questions. Third, previous reports (Maratsos, 1978, in press; Klima & Bellugi, 1966; Dale, 1972) have claimed that auxiliaries appear first in yes-no questions, and as long as months later, in wh-questions. All the research has been based on analyses of the questions of Adam, Eve, and Sara presented in Bellugi, 1965. Bellugi's raw data are not available, thus it has been necessary to depend on other acccunts of her data. A close inspection of the conclusions suggests that the apparent absence of auxiliaries in wh-questions may simply be an artifact of previous analyses.

Although Maratsos has concluded simply that auxiliaries occur

in yes-no questions before they occur in wh-questions, Klima & Bellugi (1966) and Dale (1972) have concluded more specifically that the wh-questions reported to be lacking auxiliaries are actually lacking do, and Dale further implies that those wh-questions lacking do are also lacking inversion. Give this picture of Bellugi's data, a simpler and more coherent analysis presents itself: if it is the case that the auxiliaries which are absent in wh-questions are all forms of do, and if the set of questions from which do is absent is identical with the set of questions which lacks inversion, then there exists a linguistic principle which accounts for this pattern of errors: the interaction of SAI with the rule of do insertion. When SAI occurs in an environment where only a tense marker is available for fronting (recall that Tense is one of the elements included in the Aux category, hence is available for fronting by SAI), then do must be inserted left-adjacent to that stranded tense marker. This interaction of SAI and do insertion therefore predicts that wherever SAI operates, and moves only Tense, do will occur; wherever SAI does not operate (and where neither be nor a modal occurs) do will be absent because there is no stranded tense marker to trigger do insertion.[8]

In fact, the data from Bellugi (1965, as presented in Dale, 1972, and Klima & Bellugi, 1966) support this prediction. For yes-no questions, do occurs appropriately in all cases where inversion has applied. (Sufficient information on uninverted yes-no questions is not available.) The wh-questions presented fall into three categories:

1. uninverted wh-questions with main verbs and no do insertion:

why you caught it?, what we saw?

2. inverted wh-questions with do insertion: what did you doed?

3. inverted and uninverted wh-questions with modals and be (these indicate that it is not the auxiliary category which occurs later in wh-questions, but rather that do may not occur in those sentences where SAI has not applied): where's his other eye?, how can he be a doctor?, where we should put that?

The first category of errors has been treated as if the child's wh-questions were less advanced than her yes-no questions in two respects: lack of inversion and lack of an auxiliary. However, if the missing auxiliary is do, and if do is absent in uninverted wh-questions which contain only a main verb, it becomes apparent that the second feature is simply a principled outcome of the first: do insertion cannot occur unless SAI has first applied to a sentence lacking any other auxiliary. There is thus no evidence that the phrase structure rule which expands Aux is acquired for yes-no questions prior to wh-questions; in fact it seems that the child's knowledge of the interdependence of SAI and do insertion is quite sophisticated, given their systematic interaction in the child's speech.[9]

Children May Prefer Non-Inversion in Negative Yes-No as well as Wh-Questions. Fourth, previous research has noted that inversion is productive in affirmative wh-questions prior to negative ones, leaving the impression that inversion in wh-questions appears in two stages as opposed to an across-the-board appearance in yes-no questions. Again, failure to include data on the status of yes-no questions has biased the interpretation of the sequence. There are

data from at least one child, Noah (Valian, personal communication), which indicate the same preference for non-inversion in negative yes-no questions that has been noticed in negative wh-questions; again, one can only assume that the existence of these uninverted negative yes-no questions has been overlooked since, unlike their wh-counterparts, the former are fully grammatical. During a one month period, Noah produced about 450 affirmative yes-no questions; of these, about 400 were uninverted, while 54 were inverted. As for his negative yes-no questions, all 14 were uninverted (that's not Noah's airplane?, he doesn't have a mouth?, we're not on a cement mixer?). Therefore, the inclusion of yes-no questions as relevant data indicates that the differential application of inversion to affirmative and negative wh-questions may be paralleled by a similar preference for non-inversion in negative yes-no questions.

A Revised Acquisition Pattern

In contrast to the generally accepted conclusions regarding the use of inversion, the revised sequence predicts that (1) inversion applies generally to both yes-no and wh-questions (although this may not be apparent since wh-questions are not productive as soon as yes-no questions, but for reasons unrelated to inversion), (2) that the presence or absence of auxiliaries in wh-questions, in particular, do, is systematically related to the occurrence or non-occurrence of inversion, and hence simply follows from the facts about the acquisition of inversion, and (3) that the differential application of inversion in affirmative and negative wh-questions is reflective of a similar pattern in yes-no questions (and is

possibly due to pragmatic or formal complexity factors).

Unfortunately, it is impossible to assess currently available data on non-inversion errors (Bellugi, 1965, 1971; Klima & Bellugi, 1966; Brown et al, 1969) as either confirming or disconfirming the revised sequence because the utterances of three children have been collapsed in the data presentation. This format precludes the determination of the proportion of inverted to uninverted yes-no and wh-questions for any one child. Two additional problems with the above presentations of Bellugi's data are that they give incomplete information regarding the children's yes-no questions and question routines. Given these data deficits, the rationale behind the elicitation study is the possibility of collecting, for each child, representative data on questions.

A Transformational Evidence Account

The Form of the Child's Rule. In view of the re-analysis of the acquisition data, what formulation of the inversion rule best represents these children's knowledge of inversion? On a transformational account, the child who produces both inverted and uninverted yes-no and wh-questions could have an optional subject-auxiliary inversion rule which applies to both kinds of questions:

(7) SAI: SD: Q (Wh-X) NP Tense ({Modal / Have / Be}) X

1 2 3 4 5

SC: 1 2 4 3 Ø 5

(Note that when no condition is stated, a rule applies optionally.)

This rule applies properly in yes-no questions, in which inversion is

truly optional in the adult grammar, but potentially generates some incorrectly uninverted matrix wh-questions.

Data Which Provide Evidence for the Child's Rule. If the preceding optional rule is claimed to represent the child's knowledge of inversion when she is producing both inverted and uninverted wh-questions, what linguistic data could provide evidence for this incorrect formulation? There must exist data to support an incorrectly formulated rule such that the rule is considered optional in the derivation of two sentence types when it is in fact obligatory in one (matrix wh-questions), and optional in the other (yes-no questions).

On a transformational account, there are two candidate data sets: embedded wh-questions and yes-no questions. Embedded wh-questions could be the source of misleading data since they have the same constituent structure as matrix wh-questions, but are uninverted. Whether a child considers embedded questions as relevant data depends on whether the matrix/embedded distinction is used as a criterion for ruling out embedded questions as evidence.[10] However, on a transformational model, the status of inversion in yes-no questions must be considered relevant to the formulation of an inversion rule in wh-questions because it is the case that the portion of the derivation to which the structural description for inversion applies is the same in the case of yes-no and wh-questions; the fact that inversion is optional in yes-no questions may mislead the child into assuming that inversion is also optional in wh-questions.

An account which depends on the optional status of inversion in yes-no questions as the source of the misleading data could only be couched in terms of a transformational model. Unlike a surface

structure account, a transformational model assumes that the child's knowledge is represented in terms of abstract categories, relations and rules; in this case, the child is thought to be sensitive to that portion of the underlying constituent structure which is common to matrix wh-questions and yes-no questions. Surface structure accounts have no mechanism for taking account of relations between sentences by way of their underlying structures; thus there appears to be no obvious way for such models to account for any effect that yes-no questions may have in the formulation of an inversion rule which applies to wh-questions.

The new transformational account proposed here represents a subtle shift away from the traditional analysis of the inversion problem. From the point of view of the transformational account there exist data in the form of yes-no questions which provide evidence that all questions which manifest a particular underlying structure may be optionally inverted. Therefore, children formulate an optional rule which is general in that it applies to all matrix questions; in using that incorrect rule they produce some inverted yes-no and wh-questions; and some uninverted yes-no and wh-questions. Although the optional inversion rule is incorrect, it generates uninverted yes-no questions, which happen to be grammatical, as well as uninverted wh-questions, which are not. The fact that inversion is truly optional in yes-no questions but obligatory in wh-questions makes it appear as though the child learns to invert wh-questions by way of a separate and more complex process than the process by which she learns to invert in yes-no questions. The transformational analysis argues that the child's inversion rule

applies generally to all questions, and that uninverted wh-questions occur not because the child is unable to perform inversion or because she does not know that inversion applies to wh-questions, but because the child is unaware that inversion is obligatory in this case.

In addition, the transformational account predicts that the pattern of inversion for wh-questions, such that inversion is productive for affirmatives prior to negatives, is not peculiar to wh-questions, but is also manifest in yes-no questions. At this point, one can only speculate that this pattern of control for inversion, if it is indeed general to both question types, reflects pragmatic or formal complexity factors.

Finally, the transformational account suggests that the claim that auxiliaries are acquired in yes-no questions prior to wh-questions is an artifact of previous analyses. The current analysis predicts that the auxiliaries which are missing in wh-questions are forms of do, and that the utterances lacking do are precisely those which are uninverted. If this is so, the lack of the auxiliary do is simply a principled outcome of non-inversion, i.e., do ought to be missing from utterances in which inversion has not occurred.

Summary

Previous accounts have made two sorts of claims: (1) claims regarding the patterns of use for inversion and auxiliaries in affirmative and negative yes-no and wh-questions; (2) claims regarding the source of evidence for children's non-inversion errors in wh- questions.

The transformational and surface structure accounts differ essentially in this second claim, i.e., what data serve as misleading evidence for the non-inversion errors, and by implication, what form the child's rule takes.

If embedded questions serve as evidence, and the child formulates an optional rule in response to the surface similarities between matrix and embedded questions, that optional rule should apply in embedded questions as well as matrix wh-questions, resulting in some inversion errors in embedded questions. (Because embedded questions are difficult to elicit, no such attempt was made in this study but spontaneous embedded questions were categorized as to inversion or not.) Thus, a surface structure account predicts errors of non-inversion along with correct cases of inversion. On this account the non-inversion errors are the result of an optional rather than a non-inversion rule for wh-questions. A non-inversion rule is ruled out because it would suggest that children ignored matrix wh-questions entirely.

If yes-no questions serve as evidence, and the child links them and wh-questions as the transformational account claims, there should be a match in the form of a child's rule for the two question types. On a surface structure account, there exists no principled relation between yes-no and wh-questions, hence no basis on which to predict any systematic inversion patterns in the two question types. Therefore, the match in inversion rules in yes-no and wh-questions which is predicted on a transformational account is only coincidental from the point of view of a surface structure account. Table 1 presents the possible response patterns for any one child and an

Table 1
Possible Response Patterns

	Child's Yes-No Q's	Child's Wh-Q's	Interpretation for a transformational account
1.	Inverted	Inverted	Pattern is predicted due to match in both rules.
2.	Uninverted	Inverted	Pattern is not predicted due to mismatch in rules.
3.	Optional	Inverted	Pattern is irrelevant because rule is already correctly formulated.
4.	Inverted	Uninverted	Pattern is not predicted due to mismatch in rules.
5.	Uninverted	Uninverted	Pattern is predicted due to match in rules.
6.	Optional	Uninverted	Pattern is not predicted due to mismatch in rules.
7.	Inverted	Optional	Pattern is not predicted due to mismatch in rules.
8.	Uninverted	Optional	Pattern is not predicted due to mismatch in rules.
9.	Optional	Optional	Pattern is predicted due to match in rules.

interpretation of that pattern as consistent or inconsistent with the transformational account. If all the children fell into patterns 1, 5, and 9, a transformational account would be supported. Inasmuch as the children are expected to distribute themselves rather more noisily, it will be helpful to have additional measures that will support the account. For example, the data might indicate support for the transformational account if other rules are treated similarly in yes-no and wh-questions. If inversion and the Aux expansion rule apply similarly to both question types, or if the pattern of differential inversion which applies to affirmative and negative wh-questions is also reflected in yes-no questions, then the transformational account would be supported . Sensitivity to parallel structure in superficially diverse constructions is directly in the spirit of a transformational model, but would be difficult to explain on a surface structure account.

A third set of predictions can be derived by extrapolating from the data in Bellugi (1965, 1971). Patterns 4 and 6 in Table 1 would be expected in the basis of her data. No other predictions can be derived, since her account is wholly descriptive.

The method section, which follows, will describe the elicitation procedure in detail. The elicitation task was designed to collect yes-no and wh-questions to test claims regarding children's inversion patterns, and claims regarding the source of evidence for children's non-inversion errors. Elicitation items consisted of embedded yes-no questions and embedded wh-questions. Items were presented to children during the course of a free play session in their homes in the presence of a parent. Both spontaneous and elicited speech was

taperecorded for transcription and analysis. Elicitation sessions lasted one hour, and children were seen for 1-3 sessions each. Findings in this study were based on analysis of these data.

Method

Subjects

Subjects were 18 children, seven girls and 11 boys, ranging in age from 2;5 to 3;0 ($\bar{X}$ = 2;8) whose parents all spoke Standard English. All the children came from white middle class families, and were recruited through successive recommendations from each mother.

The purpose of the study was to determine the frequency and distribution of non-inversion errors in children who were in the process of learning the syntax of questions. Given the ages at which such errors were observed in the children of other studies, children in the age range of 2 to 3 years were observed. It was necessary to rule out two categories of children: those who were too linguistically advanced in that they already had the adult form of the inversion rule, and those who were too linguistically unsophisticated in that they did not use subject NPs and auxiliaries with regularity, thereby making the determination of inversion impossible. In determining the subset of children who could qualify as subjects, one-hour elicitation sessions were taperecorded and analyzed for 41 children, aged 1;10 to 3;32. Of these, 18 children qualified as subjects; 14 other children, 8 girls and 6 boys, appeared already to have the adult inversion rule in yes-no and wh-questions, i.e., they made no inversion errors and used Aux in obligatory contexts at least 95% of the time (the transcripts of two of these children were later analyzed for comparative purposes); 6 other children, 3 girls and 3 boys, failed to use subject NPs and

auxiliaries with enough regularity to qualify, i.e., they used Aux less than 50% of the time; 3 remaining children, all boys, were ruled out as too shy or too difficult to understand.

The mean length of utterance for the 18 children who qualified as subjects ranged from 2.66 to 4.26, with an average MLU of 3.33 (See Table 3 for MLU for individual children.) For Brown's three children, stage 3, the stage at which most non-inversion errors were observed, spanned an MLU range of 2.75 - 3.50 (Brown, 1973). Unfortunately, no MLU measures were given for the children whose speech constitutes other previous data (Kuczaj & Brannick, in press; Labov & Labov, 1976; Ingram & Tyack, 1979), thus making a comparison impossible. (In terms of age, the present subjects are comparable to Brown's and Ingram & Tyack's children; Kuczaj & Brannick's children were somewhat older, 3;2 - 4;10, and the age at which Labov & Labov's child was observed to produce the heaviest concentration of non-inversion errors was also somewhat later, 3;10.)

Materials

The elicitation task was designed to collect yes-no and wh-questions from children. Elicitation items (see Table 2) consisted of (1) embedded yes-no questions (15-30 per session) to elicit yes-no questions (ask X if S), (2a) embedded wh-questions from which the wh-term and auxiliary had been deleted (15-30 per session) to elicit wh-questions, (ask X NP), (2b) embedded wh-questions which contained neither a surface subject nor an auxiliary verb (10-15 per session) to elicit wh-questions (ask X wh-term infinitive NP). Each child received all three types of elicitation items, but because children had great difficulty in responding to items such as (2b),

Table 2
Sample Items from Elicitation Task

1. Elicitation of yes-no questions: ask X if S

   ask Anne if she has any sisters.

   ask Anne if she can swim.

   ask mommy if she likes coffee.

2. Elicitation of wh-questions:

   a. ask X NP

      ask Anne her mommy's name.

      ask mommy the way to bake a cake.

      ask Anne the reason she likes cats.

      ask mommy the best time to go to the park.

   b. ask X wh-term infinitive NP

      ask mommy what to do with the cow. (referring to a toy animal)

      ask mommy how to feed the elephant.

      ask Anne where to put the book.

fewer such items were included in the elicitation.

Procedure

Observation took place during a free play situation in the child's home, which involved the child, the child's caretaker, and the experimenter. Elicitation items were strategically integrated into the play situation by the mother and the experimenter, frequency being dependent on the child's receptiveness to the elicitation mode. Both spontaneous and elicited speech was taperecorded by the experimenter in cooperation with the child's caretaker who often corroborated uncertainties about the child's utterances. All child utterances and elicitation items were transcribed for analysis, with the addition of glosses or contextual comments which appeared relevant. Imitations were indicated as such in the transcripts. In accordance with criteria devised by Bloom, Hood & Lightbown (1974), an utterance was considered an imitation if it was an exact repetition or reduction-without-change of a child or adult utterance within five preceeding utterances.

Elicitation sessions lasted one hour each, and successive sessions were taped no more than one week apart. It was expected that children's questions would be categorized as uninverted yes-no questions, inverted yes-no questions, uninverted wh-questions, inverted wh-questions.

The following criteria determined the number of hours of data to be collected for each child:

(1) if first hour of transcript contains < 5 examplars of any category, return for a second hour.

(2) if two hours of transcript contain ≥ 2 and < 5 examplars

of any category, return for a third hour.

The rationale which underlay the second criterion was that, if after two hours of speech a child had produced fewer than two instances of a category, she was highly unlikely to produce more than four instances during a third hour. If that did occur, it would suggest that the child had moved into a different stage of acquisition by the third hour. The criteria were intended to insure, on the one hand, the collection of a representative data sample, and on the other hand, the collection of that sample during a single stage of the child's linguistic development.

Scoring

The transcripts for all elicitation sessions for each child were analyzed to determine whether a child had an inversion, non-inversion or optional rule in yes-no and wh-questions. It was first necessary to separate out questions which did not qualify for scoring. An examination of naturalistic data from three children not in the study (Noah, Naomi, and Jessie), led to selection of criteria by which questions were judged scorable, unscorable, or questionable, and within scorable questions, criteria by which a question was judged to be inverted or uninverted. A categorized list of questionable, scorable and unscorable questions was maintained for every child who qualified as a subject.

Scorable Questions.

Clear Cases of Inversion

correct utterances: inverted tensed modal, have or be (am I a big boy?, what can I eat?)

inverted tensed do, untensed main verb (does he have a horsie?, what does she want?)

Clear Cases of Non-Inversion

1. uninverted tensed modal, have or be (she is the mommy cat?, what his name is?)
2. no do insertion, tensed main verb (Brown, 1968, has referred to this category as "preposing strong" verbs: she likes you?, where this comes from?)

The following kinds of mistakes did not disqualify a question as scorable because the status of inversion could still be determined:

1. questions containing an incorrect choice of wh-term as long as the status of inversion could be determined (how color('re) they?)

2. questions missing words irrelevant to the determination of inversion (do you know that is?)

3. questions with incorrect number agreements? (toys is out in the rain?)

In determining the number of scorable questions for any child, utterance types, rather than tokens, were calculated. This method prevented routine-like questions from artificially inflating the frequency of children's scorable questions. Thus, for example, any number of instances of what's this? counted as one scorable question.

Unscorable Questions.

1. imitations

2. questions with missing or indeterminate subject NPs, copulas, auxiliaries, or do ((do) you like milk?, where the lion?)

3. wh-subject questions (what makes the giraffe stand up?, who gave me this?)

4. aux-copying: questions containing either (a) inverted tensed modal, have or be copied, but not deleted from original position (are the fire-engine are too big to hook up?, what is daddy is doing?) or (b) inverted tensed do, tensed main verb (did mommy bought this?, what did daddy bought?)

"Questionable" Inversion in Questions. The largest category of questions with questionable inversion status were those missing do, modal, have or be in which it could not be determined whether the verb was tensed or not (Brown, 1968, has referred to this category as "preposing weak" verbs: why mommy put up curtains?, how them buy their tents?) In these, the verb either (1) lacks tense entirely, (2) is untensed because inversion has occurred but do insertion has not, rendering the tense element undetectable, or (3) is actually tensed but this can not be ascertained because the tensed form is identical to the untensed form.

Other questions with questionable inversion status were:

(1) questions with the indeterminate NPs or auxiliaries ((did) you have lunch?)

(2) aux-copying with unmatched tenses (are you went to Alabama?)

(3) aux-copying with unmatched auxiliaries (do you can name three things?)

(4) examples which either result from be-insertion or lack ing (are you go to school?)

Spontaneous/Elicited Condition. All scorable questions were marked as either spontaneous or elicited. Elicited questions were

defined as responses whose syntactic form was an appropriate response to an elicitation item. That is, elicitation items were either requests for a wh-question (ask mommy her favorite food) or requests for a yes-no question (ask Anne if she can swim). Replies such as what is your favorite food? and can you swim? were considered elicited responses. Replies such as do you like spaghetti? and where you like to swim? were considered spontaneous responses because it was not clear whether such questions were actually responses to the elicitation items.

VP Type Measure. As noted earlier, frequency for scorable questions was based on question types rather than tokens. However, any one child could have the following different wh-question types, with a variety of NPs: where's NP?, where is NP?, what's NP?, what is NP? Given variable NPs, where's NP? could count as one scorable question type each time it occured with a different NP. What was needed was a measure which could control for such "stereotypical" items thus providing a better determination of how productive a child's use of the inversion and non-inversion pattern was. The VP type measure was developed for this purpose. This measure determines the number of different verb phrase types a child uses in the inverted form and in the uninverted form, with a separate determination for spontaneous and elicited questions. For example, despite variability in NPs and wh-terms, all tokens of where's NP?, where is NP?, what's NP? and what is NP? were counted as one VP type.

In determining frequency for VP type, the following criteria were employed:

1. contractions and full forms (e.g., 's and is) were considered

to be tokens of the same VP type because most children had both forms, appeared to be able to use them interchangeably, and never used them simultaneously.

2. forms of the same verb which differed in terms of person and number (e.g., am, is, are) were considered to be different VP types, the rationale being that although adults may have these forms categorized as instances of the verb be, it was not clear that the children, none of whom used all three forms, had such an abstract category.

3. forms of the same verb which differed in terms of tense (e.g., can, could; is, was) were considered to be different VP types, because, in this case also, it was not clear that children had these verbs organized as differently tensed examplars of the same abstract verb stem.

Total VP Type Measure. Frequency for distinct VPs (VP type measure) was determined separately for spontaneous and elicited questions. In collapsing across the spontaneous/elicited condition for the purpose of obtaining an overall measure of variety for VPs, one could not simply sum the frequencies in the spontaneous and elicited conditions because there was often duplication of VPs between those conditions. Therefore, a total VP type measure was an assessment of how many distinct VP types occurred, collapsing across the spontaneous/elicited condition.

Given the stringency of the VP type measure, the criterion for classifying a child as using inversion or non-inversion productively was two total VP types; this requirement indicated that a child was able to use a pattern with at least two different verbs. (Bloom, 1970, considered five instances of a construction as demonstrating

a productive rule; however, her criterion did not take into account either the total number of utterances which a child produced, or the type/token distinction.)

Wh-term Type Measure. The type/token distinction was also applied in determining the frequency of wh-term types in children's questions. Who, what, where, when, why, how, which (one) were all considered to be separate wh-term types. A small number of other wh-terms such as how old, what time, etc., were grouped together under the category other.

Results

Distribution of Inversion/Non-Inversion Patterns

An analysis of each child's scorable questions was performed to determine frequency of VP types; a minimum of two total VP types constituted evidence for a productive inversion or non-inversion pattern. A child could have a productive inversion and non-inversion pattern in each question type, and could then be categorized as having an optional rule. On the basis of this analysis, children were categorized according to which of the inversion patterns in Table 1 they exemplified. Table 3 indicates that ten out of 18 children were found to use inversion optionally in both yes-no and wh-questions (optional/optional pattern). Five children did not invert in yes-no questions, but used an optional inversion rule in wh-questions (uninverted/optional pattern). One child used an optional inversion rule in yes-no questions but did not invert in wh-questions (optional/uninverted), and one child produced uninverted yes-no questions and inverted wh-questions (uninverted/inverted). Finally, one child seemed to have already learned the adult form of the inversion rule (optional/inverted).[11] The following inversion patterns were not exemplified by any children: inverted/uninverted, uninverted/uninverted, inverted/optional. These results are summarized in Table 3.

Frequency of Auxiliaries in Questions and Declaratives

Table 4 presents the percentage of Aux in obligatory contexts in each child's speech. An obligatory context was defined, in

Table 3
Distribution of Children Across Inversion Patterns: Ages, MLU, Scorable Questions, Total VP Types

Inversion pattern Yes-no Q's/Wh-Q's	Child	Age	MLU	#Hours tran-script	# Scorable Questions				Total VP Types			
					Yes-no questions		Wh-questions		Yes-no questions		Wh-questions	
					Uninv.	Inv.	Uninv.	Inv.	Uninv.	Inv.	Uninv.	Inv.
Uninverted/Inverted	Brian	2;5	2.71	2	5	0	0	20	4	0	0	2
Optional/Inverted	Lauren	2;7	2.66	3	10	5	1	16	6	4	1	2
Optional/Uninverted	Mark	2;9	3.92	1	15	5	12	10	9	5	8	1
Uninverted/Optional	Sara	2;7	3.19	2	6	0	8	6	6	0	7	3
	Laura	2;8	3.32	3	12	1	3	38	10	1	3	9
	Peter	2;9	2.66	2	13	1	9	19	9	1	9	4
	Jonathan	2;10	3.91	2	39	1	15	15	23	1	11	2
	Ilana	2;11	3.21	2	21	1	25	28	16	1	20	7
	$\bar{X}$	2;9	3.26		18.2	.8	12.0	21.2	12.8	.8	10.0	5.0
Optional/Optional	Eddie	2;5	3.54	2	5	34	9	35	4	16	7	8
	Leo	2;6	3.27	2	5	38	14	31	5	26	13	9
	Jamie	2;6	3.71	2	11	14	12	15	5	13	7	5
	Tommy	2;6	4.17	2	6	32	22	19	6	23	12	4
	Joshua	2;8	4.26	3	10	12	9	36	7	10	7	11
	Ben	2;8	3.25	1	8	12	5	8	5	7	4	2
	Scott	2;8	3.15	2	17	18	27	15	13	15	17	5
	Jana	2;10	2.95	2	5	14	7	21	4	12	6	4
	Andrew	2;10	2.83	3	15	8	8	9	12	5	5	2
	Candice	3;0	3.28	3	19	19	13	20	14	11	9	4
	$\bar{X}$	2;8	3.44		10.1	20.1	12.6	20.9	7.5	13.8	8.7	5.4
Overall total				37	222	215	199	361	158	151	146	84
Overall $\bar{X}$		2;8	3.33	2.1	12.3	11.9	11.1	20.1	8.8	8.4	8.1	4.7

Note: Uninv. = Uninverted, Inv. = Inverted

Table 4
Percent Presence of Aux in Obligatory Contexts by Groups: Current Analysis

Inversion pattern	Child	Yes-no Q's N	Yes-no Q's % present	Wh-Q's N	Wh-Q's % present	Declaratives N	Declaratives %present
Uninverted/Inverted	Brian	10	.60	54	.98	196	.81
Optional/Inverted	Lauren	17	.88	35	.74	183	.78
Optional/Uninverted	Mark	22	.91	29	.90	55	.82
Uninverted/Optional	Sara	5	1.00	19	.85	115	.86
	Laura	24	.67	78	.85	180	.92
	Peter	20	.75	49	.94	67	.78
	Jonathan	48	.83	51	.96	93	.80
	Ilana	30	.83	71	.88	106	.90
	$\bar{X}$		.82		.90		.85
	Range		.67-1.00		.85-.96		.78-.92
Optional/Optional	Eddie	41	.96	82	.57	46	.41
	Leo	46	1.00	71	.92	37	.97
	Jamie	29	.86	57	.55	183	.63
	Tommy	39	.97	80	.84	174	.83
	Joshua	27	.82	70	.84	113	.82
	Ben	22	.91	18	.95	63	.89
	Scott	37	.94	73	.83	168	.86
	Jana	27	.74	39	.72	50	.88
	Andrew	27	.89	33	.70	128	.84
	Candice	43	.89	47	.79	112	.85
	$\bar{X}$		.90		.77		.80
	Range		.74-1.00		.55-.95		.41-.97
Overall $\bar{X}$			.86		.82		.81
Overall range			.60-1.00		.55-.98		.41-.97

Note: N = number obligatory contexts in which presence/absence of Aux could be determined.

accord with Brown (1973), as one in which the presence of an auxiliary element was obligatory and could be determined. Each child's entire transcript was examined for the purpose of this analysis, and the presence of Aux was determined for all complete matrix declaratives and questions, spontaneous as well as elicited. The results of a Wilcoxon test indicated that, overall, there was no significant difference in the frequency of auxiliaries in yes-no and wh-questions, $\underline{T} = 65.5$, n.s., nor was there any difference in the frequency of auxiliaries in yes-no questions and declaratives, $\underline{T} = 52.0$, n.s. A Wilcoxon test performed on the optional/optional group indicated that auxiliaries occurred more frequently in yes-no questions than in wh-questions, $\underline{T} = 4.5$, $\underline{p} < .02$, and that there was a trend for auxiliaries to occur more frequently in yes-no questions than in declaratives, $\underline{T} = 6.5$, $.05 < p < .10$. There were not enough subjects in the uninverted/optional group to test the significance of the results for that subgroup. A Mann-Whitney U Test indicated that there was no difference between the uninverted/optional group and the optional/optional group in the frequency of occurrence of Aux in obligatory contexts for yes-no questions, $\underline{U} = 15$, n.s., or declaratives, $\underline{U} = 21$, n.s.; however, in wh-questions there was a greater frequency of occurrence of Aux in the uninverted/optional group than in the optional/optional group, $\underline{U} = 7$, $\underline{p} < .05$.

Two other analyses of Aux occurrence were performed, using calculations thought to represent those used in previous studies. The following examples demonstrate the difference between the various methods.

yes-no and wh-questions	present analysis	previous analysis #1	previous analysis #2
1. what you did?	+ Aux	- Aux	- Aux
2. why you like it?	"questionable"	- Aux	- Aux
3. what are you doing?	+ Aux	+ Aux	+ Aux
4. she bought me this?	+ Aux	- Aux	+ Aux
5. you like it?	"questionable"	- Aux	+ Aux
6. she can come back?	+ Aux	+ Aux	+ Aux

The difference between the present analysis and previous analysis #1 is due to the transformational account of tense as an abstract element included in the Aux category, thus available for inversion, while do is inserted as a separate operation. Thus, a question may contain tense independently of whether do-insertion has occurred. For example, on a transformational account, questions 1 and 4 are considered +Aux because they contain a verb marked for tense and 2 and 5 are considered questionable because the presence of tense is indeterminable. The fact that do insertion has failed to occur in these utterances in no way renders them -Aux. Surface structure accounts do not consider tense as part of an Aux category, but they do analyze do as an auxiliary. Thus, on previous accounts, lack of do has often constituted lack of Aux. On such an analysis, 1, 2, 4 and 5 are all considered -Aux.

The rules for previous analysis #1 are the most consistent way for a non-transformational account to determine the occurrence of Aux. Analysis #2 was prompted by the possibility that, in addition, a non-transformational account might consider any yes-no question

which was grammatical not to be lacking Aux, thus all yes-no questions like 4, 5 and 6 would be considered +Aux.

Table 5 presents the results of previous analyses #1 and #2 for the presence of Aux. For the optional/optional group auxiliaries occured somewhat more regularly in yes-no questions than wh-questions under both analyses. However, the occurrence of Aux in wh-questions is not infrequent for any child: Aux occurred from 43% to 95% of the time in wh-questions.

Preference for Non-Inversion in Negative Questions

An analysis was performed to determine whether the preference for non-inversion in negative wh-questions found in earlier studies was paralleled by a similar preference in negative yes-no questions. In affirmative questions children overall used inversion randomly in yes-no questions (216 inverted versus 217 uninverted), and preferred inversion in wh-questions (361 inverted versus 188 uninverted). For negative questions, although they were few in number, children produced only uninverted questions (5 yes-no questions, 11 wh-questions). Therefore, in terms of preference for non-inversion in negative questions, the uninverted/optional and the optional/optional groups are indistinguishable. (In order to include the largest possible number of negative questions in this analysis, the figures were based on an analysis of scorable questions rather than number of VP types; this accounts for the greater ratio of inverted to uninverted wh-questions, since the scorable question measure does not control for "stereotypicality" in wh-questions.)

Table 5
Percent Presence of Aux in Obligatory Contexts by Groups:
Previous Analyses

Inversion pattern	Child	Yes-no Q's N	Yes-no Q's %present		Wh-Q's N	Wh-Q's %present
Uninverted/Inverted	Brian	24 (38)	.25	(.53)	56	.95
Optional/Inverted	Lauran	51 (89)	.22	(.55)	40	.66
Optional/Uninverted	Mark	25 (30)	.72	(.76)	31	.52
Uninverted/Optional	Sara	9 (15)	.33	(.60)	20	.55
	Laura	30 (36)	.53	(.61)	87	.76
	Peter	25 (30)	.60	(.67)	53	.79
	Jonathan	66 (98)	.41	(.60)	63	.60
	Ilana	44 (60)	.52	(.65)	81	.69
	$\bar{X}$		.48	(.63)		.68
	Range		.33-.60	(.60-.67)		.55-.79
Optional/Optional	Eddie	60 (79)	.65	(.74)	91	.48
	Leo	51 (56)	.91	(.91)	84	.73
	Jamie	36 (43)	.69	(.74)	59	.51
	Tommy	46 (55)	.79	(.82)	93	.68
	Joshua	46 (46)	.67	(.68)	81	.65
	Ben	25 (29)	.76	(.80)	22	.60
	Scott	43 (51)	.77	(.81)	84	.58
	Jana	34 (42)	.56	(.65)	52	.46
	Andrew	52 (80)	.40	(.61)	42	.43
	Candice	73 (104)	.51	(.65)	48	.56
	$\bar{X}$		.67	(.74)		.57
	Range		.40-.91	(.61-.91)		.43-.73
Overall $\bar{X}$			.57	(.69)		.62
Overall range			.33-.91	(.53-.91)		.43-.95

Note: N = number obligatory contexts in which presence/absence of Aux could be determined.

Numbers in parentheses constitute previous analysis #2 (relevant for yes-no questions only); other numbers constitute previous analysis #1.

Effect of Spontaneity on Inversion

Table 6 presents an assessment of the effects of elicitation on the use of inversion. The analysis was based on number of VP types rather than scorable questions to achieve a measure of the productive use of inversion in questions under both conditions. A fair number of "stereotypical" inverted wh-questions were thus ruled out, largely in the spontaneous condition. A two-factor repeated measures analysis of variance was performed; there were two within-subject factors, spontaneity (spontaneous vs. elicited) and question type (yes-no vs. wh). The results indicated that inversion was more likely to occur in spontaneous questions than elicited questions, F (1, 17) = 5.67, $p < .05$. There was no significant difference in the frequency of inversion in yes-no questions and wh-questions, and there was no interaction.

Frequency of Inversion by Wh-term

An analysis was performed to determine whether children's tendency to invert varied as a function of wh-term used. The frequency and distribution of wh-terms was calculated for inverted and uninverted wh-questions, collapsing across the spontaneous/elicited condition. (Because of the focus on wh-terms, scorable questions rather than VP types constituted the basis of this analysis; the VP type measure collapsed across wh-terms, thus ruling out a measure of the frequency and distribution of wh-terms.) The findings, which are presented in Table 7, indicate that children tend to prefer inversion with who, what, where, which (one) and the collection of terms included under the category other. They tend to

Table 6
Frequency of Inversion in Spontaneous/Elicited Conditions

	Spontaneous		Elicited			
	#VP types	inversion	#VP types	inversion	Σ	$\bar{X}$
Yes-no questions	138	.43	192	.38	330	.41
Wh-questions	135	.49	116	.31	251	.40
Σ	273		308		581	
$\bar{X}$		.46		.34		

Table 7
Frequency of Inversion by Wh-Term

Wh-term	Uninverted questions		Inverted questions		Total
	N	%	N	%	
What	64	.24	199	.76	263
Where	43	.28	112	.72	155
Why	51	.77	15	.23	66
When	23	.92	2	.08	25
How	13	.72	5	.28	18
Who	1	.06	15	.94	16
Other	4	.33	8	.67	12
Which (one)	0	0	8	1.00	8
Total	199		364		563

Note. This analysis is based on an examination of scorable questions and collapses across spontaneous/elicited conditions.

prefer non-inversion with why, when, and how.

Variability of wh-terms used

Table 8 shows how many different kinds of wh-terms children used in uninverted and inverted wh-questions, separately for the spontaneous and elicited conditions. A two-factor repeated measures analysis of variance was performed; the two within subject factors were spontaneity (spontaneous vs. elicited) and inversion status (inverted vs. uninverted). The results indicated that children produced more wh-term types in spontaneous than elicited wh-questions, F (1, 17) = 12.01, $p < .01$, but that there was no significant difference in the number of wh-term types as a function of whether the child inverted in the question. There was an interaction between spontaneity and inversion status, F (1, 17) = 29.71, $p < .001$. The results of a Scheffé Test of multiple comparisons indicated that fewest wh-term types occurred in the elicited inverted condition, and that there was no difference in number of wh-term types in the other three conditions.[12] A Mann-Whitney U Test indicated that there was no difference in the number of wh-term types produced by the uninverted/optional group and the optional/optional group in any condition; spontaneous uninverted, U = 24, n.s., spontaneous inverted, U = 19, n.s., elicited uninverted, U = 13, n.s.; elicited inverted, U = 12, n.s. Therefore, the two groups are indistinguishable in terms of variability of wh-terms used.

Status of Inversion in Embedded Wh-Questions

Table 9 presents data regarding the status of inversion in embedded wh-questions. The results show that overall, children produced very few embedded wh-questions. As compared to 560 scorable

Table 8
Variability of Wh-Terms Used

Inversion pattern	Child	Number of wh-term types: Sponateous questions Uninverted	Sponateous questions Inverted	Elicited questions Uninverted	Elicited questions Inverted
Uninverted/Inverted	Brian	0	2	0	0
Optional/Inverted	Lauren	1	2	0	1
Optional/Uninverted	Mark	3	2	4	3
Uninverted/Optional	Sara	2	3	3	1
	Laura	1	3	1	1
	Peter	2	3	2	1
	Jonathan	3	2	3	0
	Ilana	5	2	5	1
	Σ	13	13	14	4
	$\bar{X}$	2.6	2.6	2.8	.8
Optional/Optional	Eddie	3	4	3	3
	Leo	4	5	3	5
	Jamie	1	3	4	2
	Tommy	4	3	4	0
	Joshua	2	5	2	1
	Ben	1	2	3	0
	Scott	3	4	5	2
	Jana	3	3	3	2
	Andrew	3	2	2	0
	Candice	3	4	3	2
	Σ	27	35	32	17
	$\bar{X}$	2.7	3.5	3.2	1.7
Overall total		44	54	50	25
Overall $\bar{X}$		2.4	3.0	2.8	1.4

Table 9
Frequency of Inversion/Non-Inversion in Embedded Wh-Questions

Inversion pattern	Child	Total # embedded wh-Q"s	# Scorable embedded wh-Q's	# Incorrect inversions	% Incorrect inversions
Uninverted/Inverted	Brian	0	0	0	0
Optional/Inverted	Lauren	0	0	0	0
Optional/Uninverted	Mark	0	0	0	0
Uninverted/Optional	Sara	0	0	0	0
	Laura	1	0	0	0
	Peter	1	0	0	0
	Jonathan	8	3	0	0
	Ilana	1	0	0	0
	Σ	11	3	0	0
	$\bar{X}$	2.2	.6	0	0
Optional/Optional	Eddie	0	0	0	0
	Leo	1	0	0	0
	Jamie	0	0	0	0
	Tommy	5	4	2	.50
	Joshua	0	0	0	0
	Ben	0	0	0	0
	Scott	2	1	0	0
	Jana	4	1	0	0
	Andrew	12	4	0	0
	Candice	6	4	2	.50
	Σ	30	14	4	.10
	$\bar{X}$	3.0	1.4	.4	.01
Overall total		41	17	4	.06
Overall $\bar{X}$		2.3	.9	.2	.003

Note: Total column includes embedded wh-questions in which status of inversion is either irrelevant or indeterminate.

matrix wh-questions, children produced only 17 scorable embedded wh-questions. Only two children showed evidence of incorrect inversion in embedded wh-questions; these two children produced two errors each.

Ratio of Total VP Types to Number of Scorable Questions

An analysis of the ratio of total VP types to number of scorable questions was performed for children overall and for the two subgroups separately, for both yes-no and wh-questions. The purpose was to devise a measure of stereotypicality with which to compare the two question types: the higher the ratio, the less stereotyped the questions. The results indicated that both overall, and by subgroup, wh-questions were more routine-like than yes-no questions:

uninverted/optional:	yes-no questions - .72
	wh-questions - .45
optional/optional:	yes-no questions - .71
	wh-questions - .42
overall	yes-no questions - .71
	wh-questions - .41

A comparison of the ratios for the uninverted/optional and optional/optional groups further suggests that the two subgroups are indistinguishable in terms of the routine-like nature of wh-questions as compared to yes-no questions.

Inversion as a Function of Wh-Term Type

An analysis was performed to control for the possibility that, for any one child, inversion might be specific to particular wh-terms. For each child, wh-term types were categorized as occurring in either

inverted or uninverted questions. For inclusion in the analysis, a wh-term was required to occur at least twice since a single occurrence did not allow for a valid determination as to preference for inversion/non-inversion. Table 10 shows the number of wh-terms which occurred in inverted, uninverted and both inverted and uninverted questions. Of those wh-terms which occurred more than once in a child's questions, many were present in both inverted and uninverted questions, indicating that the inversion operation was not wh-term specific for these children.

Inversion as a Function of VP Type

An analysis was performed to control for the possibility that children used inversion with one set of verbs and non-inversion with another set. For each child, VP types were categorized as to whether they occurred in inverted or non-inverted questions. Neither across all children, nor for any individual child was there any indication that inversion was limited to a particular set of verbs or to a particular kind of verb (e.g., motion verbs).

Two Children With the Adult Inversion Rule

The speech of two children who appeared to have the adult inversion rule was analyzed for comparative purposes. These children were ruled out as too linguistically advanced to be subjects in the study because their initial assessment indicated that they regularly used NPs and auxiliaries, and regularly used inversion in both yes-no and wh-questions. (Their ages, 2;8 and 2;10, and MLU's, 3.94 and 3.86 respectively, were well within the range of those measures for the children in the study.) A subsequent analysis of their

Table 10

Number of Wh-Term Types Occurring in Inverted and Uninverted Questions

Inversion pattern	Child	Uninverted only	Inverted only	Both	Total	Proportion of both to total
Uninverted/ Optional	Sara	1	1	2	4	.50
	Laura	0	0	2	2	1.00
	Peter	1	2	1	4	.25
	Jonathan	1	0	2	3	.67
	Ilana	3	0	2	5	.40
	$\bar{X}$					.56
Optional/ Optional	Eddie	0	0	3	3	1.00
	Leo	0	2	5	7	.71
	Jamie	1	0	3	4	.75
	Tommy	1	0	3	4	.75
	Joshua	0	1	3	4	.75
	Ben	1	1	1	3	.33
	Scott	1	1	3	5	.60
	Jana	0	1	2	3	.67
	Andrew	1	0	2	3	.67
	Candice	0	0	4	4	1.00
	$\bar{X}$					.72

Note: Only those children who had an optional inversion rule in wh-questions were included in this analysis.

transcripts indicated that these two children used an inversion/ inversion pattern; that is, in accord with the adult rule, they correctly inverted in wh-questions, but where the adult rule allows for an optional inversion pattern in yes-no questions, they used only an inversion rule.

Discussion

Present Study as Compared to Previous Studies

Early accounts of the acquisition of inversion in questions (Bellugi, 1965, 1971; Klima & Bellugi, 1965 and Brown Cazden & Bellugi, 1969) have observed a significant number of non-inversion errors in wh-questions. In particular, the early accounts have claimed that rules pertaining to auxiliaries and inversion are not productive in wh-questions until sometime after they are already productive in yes-no questions, and that when children do start to invert in wh-questions, they tend to do so for affirmative wh-questions prior to negative ones. These accounts have proposed that children use inversion and auxiliaries first in yes-no questions, and only later extend the rules to wh-questions.

In contrast to these early accounts, Ingram & Tyack (1979) found no evidence of a significant number of non-inversion errors in the children they studied, and so have argued against the existence of a stage in which children invert in yes-no questions, but not in wh-questions. They claim that their children used inversion in both kinds of questions.

Findings in the present study support each of these two views in part. Like the earliest accounts, the present study has found that non-inversion errors in wh-questions are, in fact, characteristic of the speech of children in the process of acquiring inversion in questions. Like Ingram & Tyack, present findings indicate that many children use the same rule in yes-no and wh-questions, although that rule is often an optional inversion rule rather than an obligatory inversion rule. In general, however, the results

of this study suggest a different view of the patterns of acquisition for inversion and auxiliaries than has been held by previous research. The following sections present the major features of that view; the discussion first focuses on overall descriptive features, then on theoretical aspects, and suggests reasons for the discrepancy between the findings in this study and those in other studies.

Developmental Relationship Between Uninverted/Optional and Optional/Optional Group

Is the uninverted/optional pattern developmentally prior to the optional/optional pattern which is itself prior to the correct optional/inverted rule, or do the two groups represent two distinct acquisition sequences for inversion? If the former is the case, the two groups represent two consecutive stages in the same acquisition sequence. If the latter is the case, the two groups represent alternative paths in the acquisition sequence, the next stage of which is the correct rule for both groups.

It is impossible to resolve this question outside the context of a longitudinal study. In several respects, the two groups are equally advanced: there is no difference in the number of wh-term types produced in each group; both groups have almost identical total VP type/scorable questions ratios for yes-no and wh-questions; both groups prefer non-inversion in negative questions; both groups use Aux with equal frequency in yes-no questions and declaratives. On the other hand, the optional/optional group has a slightly higher MLU, produces more embedded questions, and uses Aux less frequently in wh-questions than the uninverted/optional group.[13] On the whole, however, it would seem that for broad descriptive

purposes, the findings justify treating both groups of children as a unit since they behave similarly on most independent measures. Therefore, unless specific differences between the two groups dictate otherwise, general findings will be discussed for the children overall.

Commonalities in Treatment of Yes-No and Wh-Questions

One striking feature of the data which was not predicted by earlier accounts is the consistency with which children overall apply certain rules in a general way to yes-no and wh-questions. Previous accounts reported a good deal of discontinuity as regards yes-no and wh-questions: the use of auxiliaries and inversion, the preference for non-inversion in negative questions -- all these were thought to apply differentially to yes-no and wh-questions. Present findings dispute these results, and indicate that with respect to the above operations, children overall treat yes-no and wh-questions in a similar fashion. The discrepancy between previous and current findings appears to have been the result of different methods of collecting data and selecting a population to be studied, failure to include relevant data, i.e., data on yes-no questions and inverted wh-questions, and differing levels of analysis, i.e., an abstract transformational analysis versus a surface-form bound analysis.

Optional Rules

A second interesting feature of the data is the finding that, for many children, rules pertaining to auxiliaries and inversion are used optionally in those places where they are obligatory in the adult grammar. That is, rather than being acquired in an all-or-none fashion, the use of auxiliaries and inversion occurs optionally

at an early stage in their acquisition. Why should this be so? There is some reason to expect that children's first hypothesis about many rules is that they apply optionally. Bickerton (1971) notes that adult English provides data which represent rules - plus - exceptions (e.g., the use of the past-tense morpheme, or the fact that inversion applies to wh-questions, except wh-subject questions and certain wh-terms like how come), and there are data which represent true areas-of-variability (e.g., inversion in yes-no questions, dative and particle movement). It is highly unlikely that children have a recognition device which can immediately distinguish between the two cases, thereby enabling them to interpret the first case as an obligatory rule with individual exceptions, and the second case as a truly optional rule. Thus it is not unreasonable to suppose that, in the face of such variable data, a child's first guess about a rule is that it is optional until such time as the two cases are distinguished.[14]

Children Produce Inverted as well as Uninverted Wh-Questions

Of the sixteen children in this study who produced uninverted wh-questions, fifteen also produced inverted ones. This finding suggests that many children produce incorrectly non-inverted wh-questions at the same time that they produce correctly inverted ones; that is, non-inversion errors are the result of an optional inversion rule, not a "non-inversion" rule.

Early studies appear to have been so taken with the significance of non-inversion errors that they all but ignored the correctly inverted wh-questions that occurred at the same time as the errors.

None of the early studies presents any figures on the proportion of inverted to uninverted wh-questions. This neglect may have been due to the fact that the early studies often intended to use the non-inversion errors as evidence for the derivational theory of complexity (DTC). The fact that wh-questions required one transformation more than yes-no questions led to the conclusion that inversion was more difficult to perform in the former; i.e., the extra operation caused a momentary performance overload under performance constraints such that children were thought to leave off inversion. Correctly inverted wh-questions were uninteresting with respect to finding support for DTC.

Correspondingly, Ingram & Tyack (1979) have interpreted their findings as providing evidence against a DTC account of the acquisition of inversion in questions. (Recall that the present study rules out DTC as a possible account for non-inversion errors in advance, because DTC cannot explain why SAI is vulnerable to the complexity limit while wh-movement is not.) Because Ingram & Tyack found only two out of 21 subjects producing any non-inversion errors, and only two such errors per child, they concluded that non-inversion errors are an idiosyncratic feature of the acquisition pattern for inversion, rather than a characteristic stage.

What accounts for the discrepancy in the frequency of non-inversion errors found in the present study and in Ingram & Tyack's? Ingram & Tyack's failure to find a significant number of errors appears to be due to three features of their method. First, their data were collected by parents who were instructed to write down all questions the child asked until 225 questions were collected.

This procedure is faulty in two ways. First, it assigns parents the role of collecting data. In the course of observing 41 children and their parents for the current study, it was noted that parents were not good at hearing non-inversion errors. Despite Ingram & Tyack's claim that such errors are striking to the ear, most parents, upon initial contact, were not able to tell the experimenter whether their child produced such utterances. During the elicitation sessions, even after careful coaching, parents often corrected non-inversion errors when asked to verify their child's utterances; the discrepancy between what the child actually said and the parent's perception of the utterance appeared when the tape was later analyzed. Contrary to Ingram & Tyack's assumption, then, non-inversion errors are more striking to the ear of a trained observer than to a parent interested in the content rather than the syntax of their child's utterance.

Second, Ingram & Tyack instructed parents to simply write down any questions the child spoke. In contrast, in the present study the use of a taperecorder was found to be indispensible for the analysis of children's utterances. This technique freed the analysis from dependence on the parent's interpretation of unclear utterances, and clarified the composition of utterances which would have otherwise been judged unintelligible or indeterminate as regards inversion errors even by the parent. These procedures make the present data more reliable.

Third, it seems likely that differences in sampling procedure account for the fact that the current study found many non-inversion errors while Ingram & Tyack found almost none. Ingram & Tyack

chose subjects who matched Bellugi's subjects in two ways: age and upper bound for number of morphemes. (According to Ingram & Tyack, MLU counts were not available for their subjects and so could not be used as a criterion.) In selecting subjects for the present study, one-hour elicitation sessions were taperecorded and analyzed for the purpose of ruling out both children who were too linguistically unsophisticated in that they failed to use subject NPs and auxiliaries with enough regularity for the determination of inversion, and children who were too linguistically advanced in that they already had the adult form of the inversion rule. The remaining children were thought to be those who were in the process of learning inversion in questions, and among these children, non-inversion errors were found to constitute a significant phenomenon. It is of course not the case that all children of a certain age or even MLU range will be found to produce such errors; but it does appear that a significant number of children produce non-inversion errors on the way to learning the syntax of questions. Without such a screening procedure, Ingram & Tyack are likely to have collected data from subjects who were inappropriate to the goal of their study in that they had already learned the correct form of the inversion rule. (Recall that the present study also found 14 such children within the age and MLU range of the actual group of 18 subjects; the former were, of course, ruled out as participants.)

Children Produce Uninverted as well as Inverted Yes-No Questions

All of the 12 children who produced inverted yes-no questions

also produced uninverted ones. (The remaining children in the study produced only uninverted yes-no questions.) It appears that the pattern of inversion in these children's yes-no questions is the result of an optional inversion rule.

In looking at the acquisition of inversion in wh-questions, the early studies failed to report fully on the status of children's yes-no questions other than to note that children showed evidence of productive inversion in yes-no questions prior to wh-questions. This gave the impression that there was a period when children produced only uninverted wh-questions and only inverted yes-no questions. Presumably, the uninverted yes-no questions were overlooked because the focus of the studies was on errors; wh-questions are ungrammatical when they lack inversion, but uninverted yes-no questions are fully grammatical.

Optional Inversion Rule in Yes-No and Wh-Questions

In the early studies it appeared that yes-no questions were unlike wh-questions with respect to inversion; the former were supposedly inverted at a time when the latter were uninverted. In contrast, the present study had predicted that the predominant inversion pattern would consist of an optional inversion rule in both kinds of questions. This prediction was borne out by the finding that 10 out of 18 children demonstrated use of an optional inversion rule in yes-no and wh-questions. This strong optionality finding occurred under stringent criteria for the having of an inversion or non-inversion pattern. Recall that scorable questions were reduced to VP types to determine number of different verb phrase types, which

were further reduced to total VP types to control for duplication of verb phrases in spontaneous and elicited questions. Finally, a child needed to produce two total VP types per pattern to qualify as using that pattern productively. The rigor of the criteria lends validity to the finding that the predominant pattern was an optional inversion rule in both yes-no and wh-questions.

This finding suggests that children formulate an inversion rule which is general in that it applies to all matrix questions. Although an optional inversion rule for all questions is incorrect from the standpoint of adult grammar, it produces inverted yes-no and wh-questions and uninverted yes-no and wh-questions. Uninverted yes-no questions happen to be grammatical, while uninverted wh-questions are not. The fact that inversion is truly optional in yes-no questions but obligatory in wh-questions makes it appear as though the child has learned to invert propertly in yes-no questions but not in wh-questions. The present findings suggest that the non-inversion errors occur not because the child is unable to perform inversion, or because she does not know that inversion applies to wh-questions, but because she has not yet acquired a particular refinement on the rule -- the condition which states that inversion is obligatory in wh-questions.

The fact that wh-questions may be understood and produced later in acquisition than yes-no questions does not obviate this analysis, since the difficulty inherent in wh-questions may well be unrelated to the problem of inversion. Klima & Bellugi (1966) report that there is a time lag in the comprehension and production of yes-no and wh-questions at a point before inversion could act as a contri-

buting factor, which suggests that wh-questions are more complex than yes-no questions in some other way. They note, in particular, that even at stage 1, when children are not producing auxiliaries and hence cannot have inverted questions, they correctly comprehend yes-no questions and produce them with rising intonation but do not produce questions that even superficially resemble wh-questions (the exception being a small number of routines such as what's that?), and they often do not understand wh-questions which are addressed to them. A natural candidate for the added complexity of wh-questions is the difficulty posed by the wh-construction itself. The child must ascertain two interrelated facts about wh-questions: (1) what the features of the wh-word are, and (2) what constituent in the underlying structure it replaces. Given the additional burden imposed by wh-questions, it is not surprising that they come under the child's productive control later than yes-no questions, for reasons unrelated to the issue of inversion.

Auxiliaries in Yes-No and Wh-Questions

Previous research (Maratsos, 1978, in press; Klima & Bellugi, 1966; Dale, 1972) has claimed that auxiliaries are acquired first in yes-no questions, and as long as months later in wh-questions. All the research has analyzed the questions of Adam, Eve, and Sarah presented in Bellugi, 1965. In contrast, the present study found that, overall, there was no significant difference in the frequency of auxiliaries in obligatory contexts in yes-no and wh-questions, nor was there any difference in the frequency of auxiliaries in questions and declaratives, overall. Thus, the overall findings support the notion that children's Aux expansion rule is formulated

in a general, across-the-board manner, so as to apply with equal frequency to yes-no questions, wh-questions, and declaratives.

However present findings do indicate that the optional/optional group used auxiliaries more frequently in yes-no questions than wh-questions, and that there was a trend for a greater frequency of auxiliaries in yes-no questions than in declaratives; for wh-questions alone, the uninverted/optional group used auxiliaries more frequently than the optional/optional group. It is not clear what could account for these mixed findings. The difference in the use of auxiliaries are significant but not large. Per cent of occurrence of auxiliaries in wh-questions for the optional/optional group (77%) is the critical subgroup mean: this frequency was less than the mean occurrence of auxiliaries in yes-no questions for the same group, and less than the mean occurrence of auxiliaries within wh-questions alone as compared to the univerted/optional group. But a mean of 77% indicates that even children in this group were using auxiliaries most of the time. The fact that both groups used auxiliaries quite frequently across all sentence types cautions against making too much of these differences.

How can we explain the discrepancy between present findings which, for the most part, point to a general Aux expansion rule, and earlier findings that auxiliaries are used in yes-no questions before wh-questions? An attempt to reconcile the different results is represented by Previous Analyses #1 and 2 (Table 5). On a transformational account, tense is considered an abstract element included in the Aux category, thus available for fronting; do is inserted as a separate operation. Thus, a question may contain tense independently of whether do-insertion has occurred. On a surface structure account,

the occurrence of tense alone does not constitute the presence of an Aux element; thus, even in the presence of a tensed main verb, lack of do has constituted lack of Aux. Previous Analyses #1 and #2 have tried to reanalyze present data according to surface structure principles. The results do indicate that for the optional/optional group, auxiliaries occur somewhat more regularly in yes-no and wh-questions. But in these analyses, the lowest frequency for the occurrence of Aux in wh-questions is 43%, or almost half the time. Even this lowest frequency is higher than what one is led to expect on the basis of earlier studies. Altering the principles of analysis has made current findings for the optional/optional group look somewhat like earlier results, but not entirely. Thus, it is difficult to understand previous findings in this regard. One possibility is that earlier findings with regard to the occurrence of auxiliaries were an artifact of small sample size.

Non-Inversion in Negative Questions

Previous research had claimed that inversion was productive in affirmative wh-questions prior to negative ones, implying that the application of inversion to wh-questions occurs in two stages as opposed to an across-the-board application in yes-no questions. Present findings suggest that the preference for non-inversion in negative wh-questions is also reflected by a similar preference in negative yes-no questions. The reason for this preference is unclear, but is perhaps due to some performance constraint such that negation is more easily managed by children if they need not in addition worry about inversion. Nevertheless, the failure of previous studies to include data on yes-no questions obscured the

possibility that children have the same preference for non-inversion for both negative yes-no and wh-questions.

The Transformational Account and the Surface Structure Account

Recall that on a transformational account, there are two data sets which could serve as evidence for non-inversion errors: embedded wh-questions and yes-no questions. Whether a child considers embedded questions to be relevant data depends on whether the matrix/embedded distinction is used as a criterion for ruling out embedded questions as evidence. However, on a transformational model, the status of inversion in yes-no questions must be considered relevant to the formulation of an inversion rule in wh-questions because that portion of the derivation to which the SD for SAI applies is the same in the case of yes-no and wh-questions. The fact that inversion is optional in yes-no questions may mislead the child into assuming that it is also optional in wh-questions. This claim assumes a relationship between yes-no and wh-questions, since the inversion rule which applies in the former is claimed to be extended to the latter; therefore, a transformational account ought to predict a match in the form of a child's rule for the two question types.

What support do the findings in the present study provide for a transformational account? Table 1 presents the possible response patterns for any child and an interpretation of that pattern as supporting a transformational account. (Recall that a surface structure account would predict only the occurrence of an optional inversion rule in wh-questions, but makes no predictions regarding a relation-

ship between inversion rules in yes-no and wh-questions.) If we ignore three children, each of whom falls into a different response pattern (and so can not be considered to be particularly significant), the remaining children provide ambiguous support for the transformational account. The account is supported by the finding that 10 out of 18 children use the same inversion rule, an optional rule, in yes-no and wh-questions; however, the account is weakened by the existence of the 5 children in the uninverted/optional group, whose inversion rule in the two question types obviously does not match.

On a surface structure account yes-no and wh-questions are independent; children's knowledge about inversion in one is separate from their knowledge of the rule in the other question type. Thus any match in rules is coincidental, and not confirming or disconfirming. On a surface structure account, therefore, embedded wh-questions are the only data set that could provide misleading data for non-inversion errors. Regarding this claim, it was pointed out that if a child is sensitive to evidence from embedded wh-questions, and formulates an optional rule in response to them, that optional rule is expected to apply in embedded wh-questions also, resulting in some inversion errors there. However, the finding that children produce few inversion errors in their embedded wh-questions weakens the account of embedded wh-questions as the source of children's non-inversion errors in matrix wh-questions.

These findings raise two issues. First, how can one account for the uninverted/optional group? Second, are there additional findings which could decide between a transformational or surface

structure account of the optional/optional response category, which is predicted on a transformational account but could also be consistent, even if only coincidentally so, with a surface structure account?

The Optional/Optional Group

As regards the latter issue, it is important to know whether children in the optional/optional category used yes-no questions as evidence for their non-inversion errors. What is at issue between the two accounts is whether the status of inversion in yes-no questions is at least in part responsible for the status of the rule in matrix wh-questions.

Findings which support the role of yes-no questions as misleading data are ambiguous. Confirmation would consist of findings which indicate that for the purpose of particular rules, i.e., inversion, auxiliary expansion, etc., children treat yes-no and wh-questions identically; this would suggest that in applying and formulating certain rules, children analyze yes-no and wh-questions at a level of abstractness which allows their more superficial difference to be ignored in favor of more general similar features. The results indicate three such similarities: for purposes of inversion and auxiliary use children do not distinguish between yes-no and wh-questions, and their exclusive use of non-inversion in negative wh-questions is matched by an exclusive use of non-inversion in negative yes-no questions. A possible discrepancy is the finding that children in the optional/optional group do tend to use auxiliaries more frequently in yes-no than wh-questions; however,

this finding may be tempered by the fact that, despite the significant difference, auxiliaries occur quite frequently even in their wh-questions. Thus, the transformational account is rather more supported as an explanation for the performance of the optional/optional group than is the surface structure account.

The Uninverted/Optional Group

The following formulation represents the inversion rule for children in the uninverted/optional group; this rule is simply a variation of the SAI rule proposed in (7) for children in the optional/optional group:

(8) SAI: SD: Q Wh-X NP Tense ({Modal / Have / Be}) X

1 2 3 4 5

SC: 1 2 4 3 ∅ 5

(Note that when no condition is stated, a rule applies optionally.)

Previous accounts are contradicted by the existence of the uninverted/optional group in that children invert in wh-questions while they appear unable to do so in yes-no questions. The present account is also contradicted because children's rule in wh-questions is unlike their rule in yes-no questions. What could account for children's optional inversion rule in wh-questions? Yes-no questions could not serve as the model for the optional inversion rule in wh-questions because these children do not have an optional rule in yes-no questions. It is possible that their optional rule in wh-questions is the result of combined evidence from correctly inverted matrix wh-questions and correctly uninverted embedded wh-

questions. However, only one child in this group produced any scorable embedded wh-questions, and all were correctly uninverted, making it unlikely that these children collapse across matrix and embedded wh-questions to formulate an optional inversion rule which then applies to both construction types.

It has been noted by some researchers (Labov & Labov, 1976) that at a very early stage, before children use inversion productively in either yes-no or wh-questions, they do produce correctly inverted wh-question routines such as what's NP?, where's NP?, and so on. If such inverted wh-question routines are part of children's repertoires before they have a productive inversion rule, some children might find it easier to analyze and apply inversion first in wh-questions because they are examplars of a sentence type already known to them.

Although the above account might explain the finding that some children learn to invert wh-questions prior to yes-no questions, it does not explain why the five children in the uninverted/optional group have an optional rule in wh-questions rather than simply an inversion rule. Nothing in the current findings appears to provide a solution to this problem.

Distribution of Children Across Possible Inversion Patterns

One striking finding is that, rather than distributing themselves more or less randomly across all possible inversion patterns, most of the children fall into one of two inversion patterns, uninverted/optional or optional/optional. How can one account for the finding that some patterns are represented while others are not?

A surface structure account cannot explain inversion patterns across yes-no and wh-questions because it does not predict any systematic relation between the form of a child's inversion rule in the two question types. A transformational account, however, predicts that children will use the same form of the inversion rule in yes-no and wh-questions. Thus the following patterns ought to be represented: inverted/inverted, optional/optional, uninverted/uninverted. Given this prediction, the findings pose two problems. First, how does one account for the patterns which were predicted to occur but are not found to occur? Second, how does one account for the patterns which occur, but were not predicted to occur?

With regard to the first problem, two of the three predicted patterns were found to occur: optional/optional and inverted/inverted. The two children who represented the latter pattern were ruled out as too linguistically advanced to be subjects because they regularly used subject NP's, auxiliaries, and inversion in yes-no and wh-questions during initial assessment; a subsequent analysis showed that they used only inversion in yes-no questions. It seems likely that more children with an inversion/inversion rule would have been found if the analysis had included more such linguistically advanced children. The occurrence of this group is surprising on any but a transformational account, since the eventual form of the adult rule is optional/inverted.

The fact that the account incorrectly predicts the occurence of an uninverted/uninverted pattern might mean that it is insufficiently constrained. One way to constrain the account is to

again assert the principle that children use linguistic evidence in the formulation and testing of rules. There does not seem to be any evidence which would lead children to formulate only a non-inversion rule in wh-questions. Whether they use yes-no or embedded wh-questions as evidence, they would have to formulate at least an optional inversion rule; a non-inversion rule in wh-questions seems impossible because its existence would suggest that children had never noticed the very construction (inverted wh-questions) for which they were presumably formulating a rule. Thus, by evoking the principle of evidence, the transformational account can be constrained to predict only the occurrence of two patterns, inverted/inverted and optional/optional; these patterns are represented by 12 out of 20 children.

The second problem for the transformational account is the occurrence of three patterns which are not predicted: uninverted/optional (5 children), optional/uninverted (1 child), uninverted/inverted (1 child). With regard to the uninverted/optional group, it was noted earlier that although there is some reason to expect that children could learn to invert in wh-questions prior to yes-no questions, no explanation could be found for the fact that these children had an optional rather than simply an inversion rule in wh-questions. This finding weakens the transformational account. With regard to the other two disconfirming patterns, the finding that only one child fell into each pattern makes it difficult to draw any conclusions as to their effect on the transformational account. With a larger sample of children, and with a larger sample of utterances per child, these two patterns might drop

out. More data is required to resolve this issue.

Effects of Elicitation

The results indicate that elicitation depresses inversion, i.e., children tend to invert spontaneous questions more frequently than elicited ones for both yes-no and wh-questions. This suggests that inversion is more "work" than non-inversion such that when children are placed into a forced situation in that they are required to respond in terms of vocabulary and syntax not of their choosing, they tend to omit the inversion operation. The effect of elicitation may also be reflected in the finding that the least variability in wh-terms occurs in elicited inverted questions. Given that elicitation depresses inversion, one would expect relatively few elicited wh-questions to be inverted, and a small variety of wh-terms to occur in elicited inverted questions.

The finding that children tend to produce non-inversions in response to elicitation items may suggest the relevance of embedded wh-questions as evidence for non-inversion errors. However, production data make this an unlikely possibility since there are very few inversion errors in the embedded wh-questions that children produce. It may be that elicitation items, i.e., embedded wh-questions, influence children's performance but not the formulation of their inversion rule. This could account for the finding the elicitation depresses inversion, but that children do not appear to have an optional inversion rule which applies across matrix and embedded wh-questions. Given limited production data and the ambiguous interpretation of the effect of elicitation, one can neither accept

nor reject embedded wh-questions as the source of evidence for non-inversion errors. (Recall that embedded wh-questions may serve as relevant evidence for either a transformational or a surface structure account; it is the role of yes-no questions as potential evidence that distinguishes between the two accounts.)

The Source of the Non-Inversion Errors

Unfortunately, the findings in this study do not provide unambiguous evidence regarding the source of children's non-inversion errors. Findings that children on the whole produced few embedded wh-questions, and even fewer inversion errors in those that did occur, combined with findings that they tend not to invert in response to elicitation items (embedded questions), provides ambiguous support for embedded wh-questions as the source of the errors in matrix wh-questions. Findings that indicate that children formulate and apply rules across diverse construction types suggest that children may use yes-no questions as evidence. No other source of evidence has been suggested by other research, and the present study has also failed to suggest other alternatives. As far as the results of the present study are concerned, then, the source of evidence for chilren's non-inversion errors remains an unanswered problem.

Acquisition Sequence for Inversion

The findings contradict previous accounts of the acquisition pattern for inversion in yes-no and wh-questions. Previous accounts claimed that children learn to invert first in yes-no questions, then later extend inversion to wh-questions. Only one child, Mark, ap-

peared to have such an inversion rule, optional/uninverted. More than half the children used an optional/optional inversion rule, as predicted in the present account. The only other major group of children had an uninverted/optional rule; this pattern had not been predicted either by previous accounts or by the current account.

Given this static picture of the data, what can be concluded regarding the acquisition sequence? Unfortunately, very little is certain based on these cross-sectional data. For the optional/optional group, it is almost impossible to determine the acquisition sequence. There are several candidates for the stage which might have preceded their optional/optional rule; three possible ones are the following:

1. uninverted/uninverted: then, when inversion was acquired, it applied to both yes-no and wh-questions, resulting in an optional/optional rule.

2. optional/no productive wh-questions: then, when wh-questions started to occur, inversion was modeled after the optional rule in yes-no questions, resulting in an optional/optional rule.

3. uninverted/optional: then inversion is extended from wh-questions to yes-no questions, resulting in an optional/optional rule. (This finding would argue against the role of yes-no questions as evidence for children's non-inversion errors.)

A longitudinal study might be able to resolve the developmental relationship between the two major groups of children, thus indicating whether yes-no questions play a role for some children (see #3 above). Such a study might also have greater success in collecting data on embedded wh-questions as a source for non-inversion errors, either for

all children, or some subgroup (depending on the relationship between children with an optional/optional rule, and those with an uninverted/optional rule). The emphasis on collecting yes-no and wh-questions in this study may have "crowded out" the occurrence of embedded wh-questions. If the longitudinal collection of naturalistic data were to result in no more embedded wh-questions than the current findings, or more embedded questions, but without inversion errors, it would suggest that these are not the cause of the non-inversion errors. If more such errors were found, the role of embedded wh-questions would be supported.

Inversion as a Function of Wh-Term

Current findings indicate that children tend to invert more in the presence of which (one), who, what, and where, in descending order. They tend to invert less with how, why, and when, in descending order. Previous accounts differ: Labov & Labov (1976) found that choice of wh-term contributed to likelihood of inversion in the following descending order: how, which, who, where, what, when, why. Kuczaj & Brannick (in press) found that inversion occurred first with what and where, and was only later extended to when, who, why, how. Clearly, there is a good deal of variability in children's use of inversion as a function of wh-term. It may be the case that there is no underlying acquisition principle at play here, but rather that children differ in the order in which they acquire the concepts that underlie the various wh-terms.

In any case, these findings do not necessarily disconfirm the claim that children's inversion rule in wh-questions, whatever form it takes, applies generally to the wh-question construction. In

order to argue that a child's rule applies generally to some construction type, it is not necessary to argue, as is often assumed, that the child automatically knows the entire domain of application of that rule. Whatever terms enter into children's rule statements, unless those terms are actual lexical items, children need to learn for any lexical item whether it is, in fact, an instantiation of that term; once this is determined, the child can decide whether a lexical item may participate in a particular rule. For example, some members of the set of wh-terms, such as how come, do not, in fact, undergo inversion, and children need to learn that there are exceptions to the general rule applying to other wh-terms. Also, there may well be as yet unspecified factors that influence the difficulty of this determination; for example, Ross (unpublished paper) has proposed a syntactic analysis of the degree of "integrated-ness" of the various wh-terms within the sentences in which they occur as an explanation for why inversion may apply later to some of them than to others.

Conclusions

Two sorts of predictions have been made: (1) predictions regarding the usage patterns for inversion and auxiliaries in affirmative and negative yes-no and wh-questions; (2) predictions regarding the source of evidence for children's non-inversion errors in wh-questions. The first set of predictions has been supported by the results of this study in that for the most part, children do tend to treat yes-no and wh-questions similarly. In formulating and applying certain rules, children analyze yes-no and wh-questions

at a level of abstractness which allows their superficial differences to be ignored in favor of more general similar features. As to the source of children's non-inversion errors, the findings are ambiguous with regard to embedded wh-questions, and provide some weak support for the role of yes-no questions as the source of the errors. Thus, the findings do not support or reject a surface structure account, and provide only suggestive support for a transformational account of children's non-inversion errors in wh-questions.

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Notes

[1]Labov & Labov (1976) wonder why their daughter produced inverted wh-questions before her first inverted yes-no questions, then showed variability in inverted wh-questions 18 months later, long after she had consistently inverted in yes-no questions. It is likely, however, that her early inverted wh-questions represent unanalyzed routines rather than being the result of an inversion rule. The only example of the six total such utterances they present is what's that?

[2]On a transformational account, inversion does not apply to two classes of wh-questions: (1) wh-subject questions: who spilled the milk? (2) particular wh-words: how come you forgot the book? how long until he arrives? (Brown & Hanlon, 1970). In both cases, inversion never applies because the deep structures of these wh-questions do not meet the structural description of the inversion rule. The wh-terms in the second class of questions are probably base generated; in any event, they clearly differ from other wh-terms in that the former may not be used in echo questions: he arrives when? versus *he arrives until how long? (R. Fiengo, personal communication).

[3](Wh-X) is a schema that represents a fronted wh-phrase such as who, how many, etc. Assuming that wh-movement precedes SAI, a fronted wh-term forms part of the environment for SAI.

[4]One might consider whether relative clauses do not also provide conflicting data regarding the necessity of inversion in matrix wh-questions since relatives contain the same constituents as wh-questions but never allow for inversion: I know just the person who you should call versus who should you call? Perhaps relatives have not been claimed to be relevant to the formulation of wh-questions because the former are not interrogatives in any sense, whereas embedded questions are at least indirect questions.

[5]It has also been suggested (Brown & Hanlon, 1970; Maratsos, in press; Kuczaj & Brannick, in press) that two other classes of wh-questions provide conflicting data about the necessity of inversion in wh-questions: (1) wh-subject questions: who will bake the cake? and (2) particular wh-forms: how long until you finish?, how come you won't eat?

The first class, wh-subject questions, is not likely to supply conflicting data on either a transformational or surface structure account; for this to be the case, children would be obliged to be ignorant of grammatical relations like subject and object. That is, the claim that children produce *who daddy saw today? on analogy with who saw daddy today? necessitates that children believe who to be the subject of both sentences, a situation which renders children incapable of understanding the meaning of their own productions.

On a transformational account, wh-subject questions are irrelevant to the formulation of SAI. The rule of SAI (whether correctly formulated, or as will be suggested, incorrectly formulated as optional) never applies to wh-subject questions because their deep structures contain an empty NP node and thus do not meet the SD of SAI.

As for particular wh-forms such as how come or how long until, they may well provide conflicting data about the necessity of inversion in wh-questions; however, the small size of this set of words and their relatively infrequent occurrence, especially as compared to the size and frequency of the set of inverted wh-questions, makes it unlikely that they provide the bulk of data regarding the status of inversion in wh-questions.

[6]The data come from Naomi, J. Sachs, personal communication; Kerri, M. Carty, personal communication; Mary, Ka. Nelson, personal communication; Rebecca, Anne Erreich, pilot data.

[7]The children who appear to have an optional SAI rules for both yes-no and wh-questions are Naomi, J. Sachs, personal communication; Kerri, M. Carty, personal communication; Rebecca, Anne Erreich, pilot data.

[8]The argument also holds for a do deletion analysis such as Culicover's (1976).

[9]Klima & Bellugi (1966) also cite the following utterance: why he don't know how to pretend? This sentence indicates that, in addition to the interaction between SAI and do insertion, the child also controls the relation between negative placement and do insertion, adding plausibility to the proposed account of the data in terms of rules interacting with one another.

[10]T. Langendoen (personal communication) has suggested an alternative analysis in which embedded questions are derived so that they do not contain the abstract Q marker which is assumed to be a necessary trigger to SAI. This analysis fits nicely with the present view that embedded wh-questions may not be the data set which misleads the child into formulating SAI as optional, whereas yes-no questions, which do contain Q, can potentially serve this function (assuming the child correctly analyzes embedded questions as containing no Q).

[11]Although an assessment of the first elicitation session for each child was intended to disqualify children who already had the adult form of the inversion rule, Lauren did not initially appear to be in that category. Even after two elicitation sessions, she appeared to use inversion in wh-questions and non-inversion in yes-no questions.

However, Lauren had produced three inverted yes-no questions by then, and given the criteria for determining the numbers of hours of data to be collected for each child, it was necessary to have a third elicitation session. The data from this session indicated that she had an optional rule in yes-no questions, and an inversion rule in wh-questions.

[12]This result is not an artifact; there were enough elicited inverted wh-questions to allow a greater variety of wh-terms in that category.

[13]Note, however, that the finding that one group appears to be more advanced than the other would not allow one to conclude that the two groups represent successive points along the same developmental continuum; despite differing levels of sophistication, the two response patterns could still represent distinct paths of evolution toward the adult rule.

[14]Given this account of the occurrence of optional rules in general, what might account for the optional use of auxiliaries in particular? (Brown, 1973, has specifically reported the optional use of the auxiliary _be_.) Evidence for the optional nature of the rule could come from children's difficulty in sometimes recognizing the presence of auxiliaries in adult sentences; hurried, slurred, or otherwise unintelligible speech may be difficult for the child to process, and auxiliaries, which are phonologically brief and generally carry no substantive meaning, may be difficult for children to detect in many cases. In addition, speakers often omit auxiliaries in utterances such as _chilly in here_, _you coming?_, _you want this?_, etc. (Virginia Valian, personal communication).