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ABSTRACT

This paper, based on Rosenbaum's (1967) grammar of adult English, attempts to apply ideas of deep structure and transformations to child grammar. The main rules predicated include phrase structure rules, segment structure rules, contextual features, and transformational rules. In this approach, the role of transformations is to segment and place elements into the string, rather than to change meaning. This process appears similar to what a child does as he learns a language. Lexical entries described by this theory can provide insights into what the child does with new forms. Rules suggested here are given, not as models of what a child has done, but as characterizations of it. By examining the functional load of transformations, a new measure is derived to capture syntactic complexity--that of mean transformations per utterance (mtu). This outline for writing grammars for children can capture generalizations about children's grammatical development that have previously been missed. The technique provides a basis for comparing data from several studies and for breaking down the unreplicable nature of most child language data. (CK)

ROSENBAUM'S IBM GRAMMAR NO. 2: AN ADAPTATION FOR CHILD LANGUAGE

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INTRODUCTION

1.0 There have been various attempts to characterize the grammars of children. The first utterances usually are discussed in terms of pivot-open classes (Braine, 1963), and those beyond in terms of distribution classes (Miller and Ervin, 1964; Brown and Fraser, 1964). One of the first attempts to use a transformational model was that of McNeill (1966). Others have included the work of Menyuk (1963) and Klima and Bellugi (1966).

In recent years the trend has been to question the notion "pivot-open" and include more contextual and semantic information (Kelley, 1967; Bloom, 1970; Ingram, 1969). Little, however, has been altered in discussing the nature of utterances beyond the two-word stage. Many studies still use the notions established by Chomsky in 1957; e.g., Menyuk (1969). At the same time, however, the theory of generative grammar has undergone numerous changes, many initiated by Chomsky (1965). Few attempts have been made which look at the child's grammar in terms of these advances save recent work by Brown, Cazden and Bellugi (1968), and Bloom (1970).

This paper is an attempt to apply some recent notions of deep structure and the nature of transformations to the child's grammar. It is based on Rosenbaum's grammar of adult English (1967) which extends many of Chomsky's early suggestions. The grammar consists of the rules in (1).

(1) i. main rules (phrase structure rules)
ii. segment structure rules
iii. contextual features (strict subcategorization)
iv. transformational rules

The format will be to discuss briefly the rules as given by Rosenbaum, then discuss how they may be adapted to explain the child's grammar. In the appendix, 41 utterances are listed which were taken from Hills (1914). They average 3.41 words per utterance; the adapted grammar will be used to characterize these sentences.

There are several reasons why the Rosenbaum adaptation of Chomsky has been chosen. First of all, it provides a systematic way of looking at the child's language. The four sets of rules in (1) can be used to separate various aspects of the child's linguistic acquisition. Often one of the shortcomings of child language research is the inability to compare one person's work and findings with another's. Perhaps a more consistent technique of grammar writing can help to make comparisons possible.

A second reason for selecting an adaptation of Chomsky's approach concerns the recent suggestions on the nature of transformations. Rather than change meaning, they primarily segment and place elements into the string. This process of segmentalizing and placing elements is similar to what the child appears to be doing in learning a language. Thus, instead of stating that the child rewrites NP into det + n to account for the occurrence of articles, we state that the segment marked (+ noun) now has acquired a

feature of marking that is segmented by the article segmentalization transformation. As a result, the process where sentences of nouns and verbs are marked by more and more function words can be characterized in terms of a series of segmentalization transformations.

Thirdly, the nature of lexical entries as described by this theory can provide insights into what the child does with new forms. Pronouns are a good example. As will be seen in our data, one child used the third person neuter pronoun "it", but only in the object position. Whenever "it" would have appeared as subject, there was nothing; i.e., zero. This distinction can be shown in the following lexical entries:

(2)

⟨+ pronoun ⟩	⟨+ pronoun ⟩
⟨- demonstrative⟩	⟨- demonstrative⟩
⟨- speaker ⟩	⟨- speaker ⟩
⟨- hearer ⟩	⟨- hearer ⟩
⟨+ object ⟩	⟨- object ⟩
"it"	"Ø"

An alternative would be to have a deletion transformation, since "it" never occurred in the subject position. However, such a characterization would be misleading. One of our conditions will be to operate against such examples of 'absolute neutralization'. Our data does show one case of such a deletion transformation. With the first person pronoun "me", there are occurrences as subject and object. As subject, it is occasionally dropped. The lexical entry for "me" then would be unmarked for subject, with a deletion T rule.

(3)

⟨+ pronoun ⟩
⟨- demonstrative⟩
⟨+ speaker ⟩
⟨- hearer ⟩
"me"

The use of lexical entries such as those in (2) indicates that children's speech can be characterized by what appears to be a small set of "zero" elements that arise consistently. Some of these will be given below. The regularity of their behavior suggests that perhaps such occurrences exist even at the one-word stage (Ingram, 1969).

One last comment should be made concerning the psychological reality of writing grammars for children. Most of the earlier studies have evaded this issue, yet assume a certain psychological reality to the rules they suggest. For adults, however, Chomsky has not formulated the notions of generative grammar in terms of what the speaker-hearer does, but rather as a characterization of what his language abilities are.

> "To avoid what has been a continuing misunderstanding, it is perhaps worthwhile to reiterate that a generative grammar is not a model for a speaker or a hearer. It attempts to characterize in the most neutral

possible terms the knowledge of the language that provides the basis for actual use of language by a speaker-hearer." (Chomsky, 1965, p.9).

A similar posture is taken here regarding child language. The rules that are suggested are not given as models of what the child has done, but rather as characterizations of it. Thus, when we say that the child has segmented an article, this will be strictly in terms of labelling an observable acquisition rather than exploring the internal process whereby it occurred. In this sense then, we can say things about the child's language that others have avoided saying because of concerns for psychological reality. For example, one can say that the occurrence of pronouns is in terms of a pronoun segmentalization and a subsequent noun deletion. A concern with the psychological reality of the grammar would most likely discuss the above example in terms of substitution. The most powerful descriptive technique at this point is the characterization of competence rather than performance. Therefore, when we say that the child "has" a particular rule, it is in this neutral sense.

2.0 Main Rules. The main rules (or phrase structure rules) are the simplified version of the earlier phrase structure rules. Rosenbaum gives the rules in (4) as the main rules for English (1967, p.1).

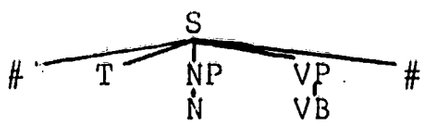
(4) i. $S \longrightarrow \#T \frown NP \frown VP\#$ (T=type) e.g. declarative, question, negative, etc.

ii. $VP \longrightarrow VB \frown (NP) \left(\left\{\begin{matrix} NP \\ S \end{matrix}\right\}\right)$

iii. $NP \longrightarrow \left\{\begin{matrix} NP \frown S \\ N \frown (S) \end{matrix}\right\}$

A sample deviation of these rules where only obligatory symbols are given is shown in (5).

(5)



Certain adaptations can be made on these in discussing the child's language. First, (6) gives the main rules for the utterances in the appendix.

(6) i. $S \longrightarrow \#T \frown NP \frown VP \frown (time) \quad \#$

ii. $VP \longrightarrow VB \frown (NP)$

iii. $NP \longrightarrow N \frown (S)$

Condition #1: $(S) = \left\{\begin{matrix} \left[\begin{matrix} +VB \\ -V \end{matrix}\right] \\ \left[\begin{matrix} +N \\ +Gen \end{matrix}\right] \end{matrix}\right\} \left(\langle +gen \rangle = +genitive \right)$

Note #1: $VP \longrightarrow VB \frown NP \frown NP$ in #32, with condition: NP=N

One of the difficulties with earlier models of phrase structure rules was that the grammar of the child was shown to be more complex than it probably was. An example of this dilemma is the child that uses the constructions in (7).

(7) i. $N_1 \frown VB$

ii. $VB \frown N_2$

Here, N_1 is a subject noun and N_2 is an object. Yet, the rules in (8) do not capture this because they generate $N \frown VB \frown N$ construction which has not yet occurred. Various ad hoc devices are needed to characterize this.

(8) i. $S \rightarrow NP \frown VP$

ii. $VP \rightarrow VB \frown NP$

iii. $NP \rightarrow N$

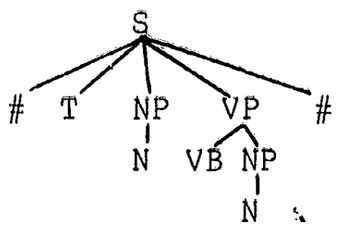
As the complexity of the data increases, however, such devices become bulky and hard to follow. This difficulty has motivated the alternatives shown with the rules in (6). The rule (6 iii) shows that embedding occurs, but such a rule will generate several constructions that have not yet occurred. To overcome this, the use of conditions is suggested. Here, condition #1 states that embedded sentences are only adjectives or possessive nouns or pronouns. The way children embed sentences can be observed by the easing of condition #1 over time.

A second problem related to the one discussed above concerns the frequency of certain constructions. One or two utterances in a corpus can force a grammar to look much more complex than it actually is. A device to overcome this is the use of notes. Note #1 in (6) states one case where rule (6 ii) was expanded beyond what is given. To incorporate note #1, however, would be misleading in terms of what the child typically uses. With the use of notes, the grammar can retain a characterization that accounts for most of the utterances, and a series of notes can show aspects that are on the verge of appearing. While conditions are restrictive, notes are expansive.

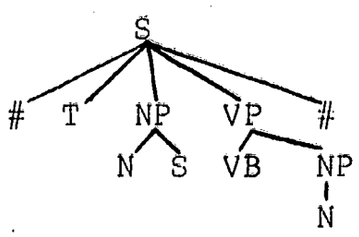
A final aspect of main rules is to look at the most frequent structures generated. While this information is not a significant part of adult grammar, it yields insights into the child's development. The hierarchical structures can be a subsidiary part of the child's grammar that across children will show how constructions evolve. The structures in terms of our data are shown in (9). Though not done here, each can be further subclassified according to the features of the terminal symbols.

(9)

1.



2.



1. (Cont.)

22 times

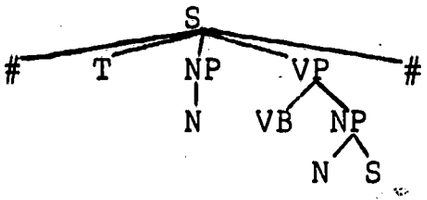
7, 8, 10, 11, 12, 15, 16, 17, 20, 22, 26, 27, 28, 30, 31, 33, 34, 35, 36, 37, 38, 39

2. (Cont.)

7 times

4, 5, 13, 14, 19, 24, 40

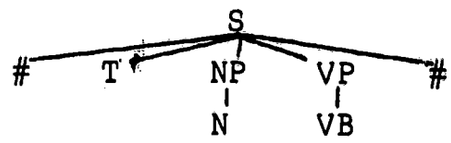
3.



5 times

6, 9, 18, 21, 29

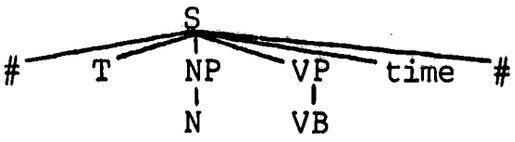
4.



4 times

1, 2, 3, 25

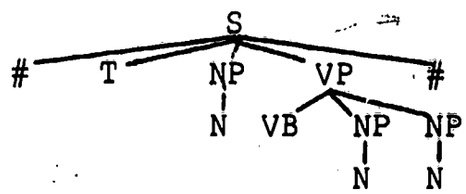
5.



2 times

23, 41

6.



1 time

32

More simply, these can be represented linearly as in (10).

(10)

	Tree Types	No.
a)	T⌒N⌒VB⌒N	22
b)	T⌒N⌒S⌒VB⌒N	7
c)	T⌒N⌒VB⌒N⌒S	5
d)	T⌒N⌒VB	4
e)	T⌒N⌒VB⌒time	2
f)	T⌒N⌒VB⌒N⌒N	1

3.0 Contextual Features. This entails the principle of strict local subcategorization. These features specify the environment for the terminal symbols N and VB. Rosenbaum gives two contextual features for nouns and five for verbs, along with expanded examples (pp.5-6).

(11) i. Contextual features for nouns

1.	<+ ____ >	NP ⟶ N	the book fell
2.	<+ ____ S>	NP ⟶ N S	the fact that John is late is obvious

(11) Continued:

ii. Contextual features for verbs

1. ⟨+ ___⟩	VP → VB	we slept
2. ⟨+ ___S⟩	VP → VB ⌢ S	they condescended to go
3. ⟨+ ___NP S⟩	VP → VB ⌢ NP ⌢ S	she defied me to climb the hill
4. ⟨+ ___NP NP⟩	VP → VB ⌢ NP ⌢ NP	she pushed Mary through the wall
5. ⟨+ ___NP⟩	VP → VB ⌢ NP	the boy hit the ball

These also constitute features on certain lexical entries in the lexicon. This way distinguishes, for example, transitive from intransitive verbs; i.e., feature (ii-5 from ii-1).

For the child we are observing, the features in (12) are required.

(12) i. noun

1. ⟨+ ___⟩
2. ⟨+ ___S⟩

ii. verb

1. ⟨+ ___⟩
2. ⟨+ ___NP⟩
(3. ⟨+ ___NP NP⟩) one instance

The third feature under verb is emerging. In #32, the verb "tell" would have the specification ⟨+ ___NP NP⟩.

There is a second aspect of contextual features that could help in writing grammars in child language. This concerns showing items where the child has acquired incorrect features. For example, take the item "he all wet me" (not from our data). Here the item "wet" is not only specified for the feature ⟨+ ___⟩, but also ⟨+ ___NP⟩. Irregularities such as this can be shown below the features in (12).

4.0 Segment Structure Rules. These rules specify the terminal symbols of the main rules with features that are eventually segmented by the segmentalization transformations. These are more or less the eventual function words in language. By looking at the growth of such items as features, we can very neatly observe the child's acquisition of these function words as a gradual growth of these features. Rosenbaum (pp.6-9) gives these features for English. They are extensive and need not be so involved for the child. Rather than give Rosenbaum's features, I will give those necessary for our data and discuss the simplifications made. The concern is not as much for formal precision as an insightful view into the child's language. The rules are given in (13) for nouns.

(13) ia. N------→segment

(By convention this assigns ⟨+N⟩, ⟨± subject⟩, and either ⟨+ ___⟩ or ⟨+ ___S⟩)

(13) Continued:

ib. $\langle +N \rangle \longrightarrow \langle \pm \text{pro} \rangle \; \langle \pm \text{num} \rangle$

ic. $\langle +\text{pro} \rangle \longrightarrow \langle \pm \text{dem} \rangle$
$\langle +\text{dem} \rangle \longrightarrow \langle \pm \text{place} \rangle$
$\langle -\text{dem} \rangle \longrightarrow \langle \pm \text{speaker} \rangle$
$\langle -\text{SP} \rangle \longrightarrow \langle \pm \text{hearer} \rangle$

id. $\langle +\text{num} \rangle \longrightarrow \{ \langle +\text{any} \rangle, \langle +\text{some} \rangle, \langle +\text{more another} \rangle, \langle +\text{many} \rangle \}$

ie. $\langle -\text{subj} \rangle \longrightarrow \langle \pm \text{prep} \rangle$
$\langle +\text{prep} \rangle \longrightarrow \{ \langle +\text{up} \rangle, \langle +\text{on} \rangle, \langle +\text{off} \rangle, \langle +\text{out} \rangle, \langle +\text{in} \rangle, \langle +\text{by} \rangle \}$ -dem

The features are grouped together to distinguish the hierarchal arrangement. In section (ia), the feature $\langle +\text{subject} \rangle$ is assigned, by convention, to the leftmost NP in the sentence. In (ib), the noun segment is marked for pronoun ($\langle \pm \text{pro} \rangle$) and articles ($\langle \pm \text{def} \rangle$). In this case, no definite articles have yet occurred. The features in (ic) will expand as more demonstratives and personal pronouns are acquired. The items in (ie) will reveal, across children, the order of acquisition of prepositions.

Below each set of segment structure rules there should be a list of the lexical entries that exhaust the possibilities. For the above, it means a list of the personal pronouns and the demonstratives. These are given in (14).

(14) Lexical Entries

i. Personal pronouns

$$\begin{bmatrix} \langle +\text{pro} \rangle \\ \langle -\text{dem} \rangle \\ \langle +\text{speaker} \rangle \\ \langle -\text{hearer} \rangle \end{bmatrix} \quad \begin{bmatrix} \langle +\text{pro} \rangle \\ \langle -\text{dem} \rangle \\ \langle -\text{SP} \rangle \\ \langle +\text{HR} \rangle \end{bmatrix} \quad \begin{bmatrix} \langle +\text{pro} \rangle \\ \langle -\text{dem} \rangle \\ \langle -\text{SP} \rangle \\ \langle -\text{HR} \rangle \\ \langle -\text{subj} \rangle \end{bmatrix} \quad \begin{bmatrix} \langle +\text{pro} \rangle \\ \langle -\text{dem} \rangle \\ \langle -\text{SP} \rangle \\ \langle -\text{HR} \rangle \\ \langle +\text{subj} \rangle \end{bmatrix}$$

"me" "ø" "it" "ø"

(14) Continued:

ii. Demonstratives

$$\begin{bmatrix} \langle + \text{ pro} \rangle \\ \langle + \text{ dem} \rangle \\ \langle - \text{ place} \rangle \end{bmatrix} \quad \text{"that"} \qquad \begin{bmatrix} \langle + \text{ pro} \rangle \\ \langle + \text{ dem} \rangle \\ \langle + \text{ place} \rangle \end{bmatrix} \quad \text{"there"}$$

As mentioned earlier, children at various stages use silence very efficiently, and systematically.

The segment structure rules for verbs are given in (15).

(15) ia. VB ------> segment

(By convention this rule assigns to verbal segment the feature $\langle +VB \rangle$, and either $\langle + \_\_\_ \rangle$, $\langle + \_\_\_ NP \rangle$)

ib. $\langle +VB \rangle \rightarrow CS/[\alpha \_\_\_\_ \beta]$ where α , β , are noun segments

$\langle \pm V \rangle$

$\langle \pm part \rangle$

ic. $\langle -V \rangle \rightarrow \langle \pm comp \rangle$

id. $\langle + part \rangle \ \langle \pm comp \rangle$

$$\left\{ \begin{array}{l} \langle + \text{ up} \rangle \\ \langle + \text{ off} \rangle \\ \langle + \text{ on} \rangle \\ \langle + \text{ over} \rangle \\ \langle + \text{ out} \rangle \\ \langle + \text{ in} \rangle \\ \langle + \text{ down} \rangle \end{array} \right\}$$

The CS in (ib) is an adaptation of Rosenbaum's rule. Actually, it is simply a convention that matches semantic features of the verbs with those of the nouns. For example, the verb "go" would have the semantic feature [animate subject] that would match the animateness feature of the subject noun. The use of semantic features was suggested by McCawley (1968). Despite relevant criticisms of such an approach by Kuroda (1969), it still holds basically for English and particularly for child language.

The feature ($\pm$ part) marks verb particles that will be segmented by a subsequent transformation. The feature ($\pm$ comp) marks the "all" in items such as "all done". Some lexical entries for verbs are given in (16).

(16) i. [⟨± comp⟩]
"all"

ii. [⟨+ VB ⟩ ⟨- V ⟩ [+ exist]]
"ø"

iii. [⟨+ VB ⟩ ⟨- V ⟩ ⟨+ ___ ⟩ ⟨- part⟩]
"gone"

The item (16) 'ii' is the verb "to be" in the adult language. This verb entry can be inserted in sentences such as exemplified in (17).

(17) i. two big book over there - #16 ⟨+ part⟩ "There are two big books over there"

ii. many towel up there - #17 ⟨+ part⟩ "There are many towels up there"

iii. mine own bed - #21 ⟨- part⟩ "It is my own bed"

The item in (16) 'iii' shows the use of contextual features in the lexicon.

The segment structure rules for the type are in (18).

(18) ia. T ------> segment

ib. ⟨+T⟩ ——> ⟨± neg ⟩ ⟨± modal⟩

ic. ⟨+M⟩ ——> { ⟨+ can ⟩ ⟨+ want⟩ }

The lexical entries are interesting for these forms. Since they are few and seem to operate as one kind of formative, the lexical entries mark both ⟨± neg⟩ and ⟨± modal⟩ . They are shown in (19).

(19) i. [⟨- neg ⟩ ⟨- can ⟩ ⟨- want⟩]
"ø"

ii. [⟨+ neg ⟩ ⟨- can ⟩ ⟨- want⟩]
"any"

iii. [⟨+ neg ⟩ ⟨+ can ⟩ ⟨- want⟩]
"could"

(19) Continued:

iv. [⟨+ neg⟩ ⟨- can⟩ ⟨+ want⟩] "any"

v. [⟨- neg⟩ ⟨+ can⟩ ⟨- want⟩] "ø"

vi. [⟨- neg⟩ ⟨- can⟩ ⟨+ want⟩] "ø"

The entry (19) 'i' is the unmarked type, making the sentence a statement. Examples of the other entries are given in (20).

(20)

i.	(19'ii')	a. any papa baby	- "I am not papa's baby"	-#18
ii.	(19'iii')	a. me could turn it off	- "I couldn't turn the light off"	- #8
iii.	(19'iv')	a. bad Justin any me in	- "Bad Justin wouldn't let me in"	-#24
iv.	(19'v')	none observed		
v.	(19'vi')	a. me go	- "Let me go", or (I want to go)	-#25
		b. me do it	- "Let me do it" or (I want to do it)	-#26

There are several examples where Hills (1914) interpreted the sentences as "let me". In every one of them, they can be made to fit the form of the other sentences if "let me" is considered as a modal "want". The development of such a modal, marked by gesture or intonation, is early in acquisition already present in one-word utterances (Ingram, 1969).

The growth of these various features and other ones such as plural marking, progressive, perfect, etc., can be observed by these rules as can their order of appearance. Our data show that articles, for example, have not yet occurred. A comparison across stages of acquisition can give us insights into the natural order the child manifests in acquiring function words, insights more definite than the cliché of function words after nouns and verbs.

5.0 Transformations. The nature of transformations has been re-evaluated over the last ten years. They no longer change meaning but rather 'segment' or 'place' elements already available. Also, there is a trend to state them rather than attempt formal representation since their nature is still somewhat speculative (Jacobs and Rosenbaum, 1968). The kinds of transformations will need to be varied somewhat to account for the child's data. The transformations discussed by Jacobs and Rosenbaum, however, provide a good point of departure. I will first

briefly outline the ones discussed in the literature, making some alternations, then apply them to our data. Only some of the transformations will be applicable in our data and further changes to explain new data will be needed. Thus, much of this outline is heuristic.

Transformations can be considered as treating the areas in (21).

(21) i. noun transformations
ii. verb transformations
iii. question transformations
iv. negative transformations
v. sentence transformations
vi. agreement transformations
vii. embedded sentence transformations

The noun transformations in child language will be basically either segmentalizations or deletions. Some kinds, with examples, are given in (22).

(22) A. Segmentalizations:

i. pronoun segmentalization - dog go fast ⟹ that go fast

ii. demonstrative segmentalization - dog go fast ⟹ that dog go fast

iii. article segmentalization - dog go fast ⟹ the dog go fast

iv. plural affix segmentalization - dog go fast ⟹ dogs go fast

v. preposition segmentalization - dog go daddy ⟹ dog go to daddy

B. Deletions:

i. noun deletion - that dog go fast ⟹ that go fast

ii. prep. deletion - dog go to daddy ⟹ dog go daddy

iii. pron. deletion - it go fast ⟹ go fast

Other transformations will be needed, but these account for some of the basic processes. One variation I have introduced is to distinguish the segmentalization of pronouns from demonstratives and articles. The reason is to be more accurate in specifying what the child has, whereas a cover "article" transformation would overlook this. The deletion transformations will usually be optional. What they do is operate in those cases where the child omits items he usually has. So, we need items such as "that dog" before we can say that "that" by itself results from noun deletion. Otherwise it must be treated as a separate lexical entry.

The verb transformations are given in (23). They are shown as segmentalizations. Cases, for example, where a child will say both "he's going" and "he going" can be accounted for by overtly marking certain transformations as optional. This can only be done with those transformations that are obligatory in the adult system. Since the progressive copula transformation is obligatory, it can be marked as optional. For inherently optional adult rules, deletion transformations will be needed to capture this.

(23) i. copula transformation - boy heavy ⟹ boy is heavy

ii. particle segmentalization - boy pick ball ⟹ boy pick ball up

iii. particle movement transformation - boy pick ball up ⟹ boy pick up ball

iv. (a) progressive copula segmentalization - boy pick ball ⟹ boy is pick ball

(b) progressive affix transformation - boy (is) pick ball ⟹ boy (is) picking ball

v. (a) perfect segmentalization - boy pick ball ⟹ boy has pick ball

(b) perfect affix transformation - boy (has) pick ball ⟹ boy (has) picked ball

The particle transformation usually precedes all the others. The affix transformations tend to precede the co-occurring transformations in iv. and v. Other aspects can be incorporated into the child's grammar as needed.

There are three transformations that basically concern questions. They are exemplified in (24).

(24) i. interrogative transformation - Q: you may go ⟹ may you go?

ii. wh question transformation - Q: he will buy something ⟹ what will he buy?

iii. do placement - Q: you go ⟹ do you go?

Children first use intonation as a question marker. Although not listed above, this will be characterized as the question intonation placement transformation, and would be an early one. The do placement is an informal rule that specifies a "do" segment when there is no modal or auxiliary.

The negative transformation rules are in (25).

(25) i. negative placement transformation - neg you can go ⟹
you cannot go

ii. negative adjunction transformation - you cannot go ⟹
you can't go

iii. do placement - you not go ⟹
you do not go

Others may be necessary depending on the individual child's system. A partial classification of sentence transformations includes the ones in (26).

(26) i. indirect object inversion - Bill gave a ball to John ⟹
Bill gave John a ball

ii. passive transformation - Bill hit Bob ⟹
Bob was hit by Bill

iii. extraposition - that Mary left worried me ⟹
it worried me that Mary left

The passive can be treated as a feature on the verb that can be segmented. In the last analysis this is probably the best way to account for the passive in children.

There are two agreement transformations.

(27) i. auxiliary agreement - the boys cop tall ⟹
the boys are tall

ii. verbal agreement - the boy run ⟹
the boy run(s)

iii. verb suffix transformation - the boy laugh ⟹
the boy laugh(ed)

The verb suffix transformation supplies the past form "ed" and also the present form "s" when the verbal agreement transformation marks the verb ⟨+iii⟩ ⟨+sg⟩ .

As the child's level of language increases, so will the operation on embedded sentences. Only some basic rules are outlined here.

(28) i. adjective placement - ball big is red ⟹
big ball is red

ii. genitive placement - ball John is red ⟹
John ball is red

(28) Continued:

iii. genitive affix transformation - John ball is red ⟹ John's ball is red

iv. complementizer transformations:

a. clause - "Mulligan is reckless" worries John ⟹ that . . .

b. infinitive ⟹ for Mulligan to be

c. genitive ⟹ Mulligan's being . . .

With the child, the complementizers will be first evident with the modals such as "John wants to go", where the infinitive marker goes between certain modals and the verb. Naturally enough, the complexity of the required complementizer rules will depend on the complexity of the child's speech.

The transformations that account for the utterances in the appendix consist primarily of noun transformations. They are all given, in stated form, in (29).

(29) i. Noun transformations:

a. pronoun segmentalization^{OB} segment ⟨+ pro⟩ ⟨- dem⟩ and delete noun segment.

b. locative segmentalization^{OB} segment ⟨+ pro⟩⟨+ place⟩ and delete noun segment.

c. preposition segmentalization^{OB} segment ⟨+ prep⟩ to leftmost position of NP.

d. demonstrative segmentalization^{OB} segment ⟨+ dem⟩ to left of ⟨+N⟩.

e. number segmentalization^{OB} segment ⟨+ num⟩ to far left of NP, to left of ⟨+ dem⟩ if it occurs.

f. subject pronoun deletion^{OPT} delete ⟨+ pro⟩ ⟨+ subj⟩.

g. noun deletion^{OPT} delete ⟨+ N⟩ segment if ⟨+ dem⟩ occurs to its left.

h. preposition deletion^{OPT} delete ⟨+ prep⟩ segment.

ii. Verb transformations:

a. verb particle segmentalization^{OB} segment ⟨+ part⟩ to left of ⟨+ place⟩, otherwise to left of rightmost boundary marker.

b. complete segmentalization^{OB} segment ⟨+ comp⟩ to left of segment.

iii. Type transformations:

a. type placement^{OB} move ⟨+ T⟩ to immediate left of ⟨+ V⟩.

(29) Continued:

iv. Embedded sentence transformations

a. adjective-genitive placement^{OB} mark embedded (S) <+ gen> if <+ N>, move embedded sentences to immediate left of <+ N> .

It is important not to know just the transformations that account for the data but also their 'functional load' so to speak. There are several ways we will need to look at the data. First, we need to observe the derivational histories of the sentences. These will reveal how many times transformations were necessary. (30) shows a sentence where no transformations applied.

(30) # baby open door # (sentence #15)

baby open door (the boundary erasure t rule, the last to apply, does occur but we shall ignore it here)

In (31) one transformation has applied.

(31) # Mary ride bike # (sentence #10)

Mary ride on bike # (ic) - preposition segmentalization

Mary ride on bike

In (32) two transformations occur.

(32) # Clarence ate apple # (sentence #11)

Clarence ate apple up # (iia) - verb particle segmentalization

Clarence ate apple all up # (iib) - complete segmentalization

Clarence ate apple all up

In (33) three transformations have operated.

(33) # coat papa hang (door) # (sentence #5)

coat papa hang there # (ib) - locative segmentalization

papa coat hang there # (va) - adjective-genitive placement

papa coat hang up there # (iia) - verb particle segmentalization

papa coat hang up there

Finally, four transformations occur in (34).

(34) # could baby turn light # (sentence #8)

(34) Continued:

# could me turn light #	(ia) - pronoun segmentalization
# could me turn it #	(ia) - pronoun segmentalization
# me could turn it #	(iiia) - type placement
# me could turn it off #	(iia) - verb particle segmentalization
me could turn it off	

These cover the range of possibilities in the utterances we are examining. The table in (35) gives the frequencies of each from our sample.

(35)

No. of transformations	Number of sentences
0	8
1	10
2	8
3	10
4	5
	41 sentences

By this method we come by a new measure that can be used in child language that captures syntactic complexity, that of mean transformation per utterance. In our data there were a total of 77 t rules used. (36) shows the three measures with which we can now discuss our data.

(36)

mean words per utterance	3.41	(mwu)
mean morphs per utterance	3.41	(mmu)
mean t rules per utterance	1.87	(mtu)

The mtu score can give us insights into syntactic complexity heretofore largely intuitive. As long as the characterization of the t rules follows standard guidelines across children, this measure can differentiate children with similar word lengths but different levels of complexity (this complexity is grammatical, not necessarily psychological).

A second measure of the use of transformations can be captured by the utilization of a frequency table. (37) comprises such a table for our data.

(37)

t rules	No. of occurrences
1. pronoun segmentalization	19
2. gen-adjective placement	12
3. verb particle segmentalization	11
4. number segmentalization	6

(37) Continued:

	No. of occurrences
5. type placement	5
6. locative segmentalization	5
7. preposition segmentalization	5
8. complete segmentalization	5
9. subj. pron. deletion	3
10. demonstrative segmentalization	2
11. noun deletion	2
12. time shift	1
13. preposition deletion	1

Lists such as these across different stages of development will reveal the order of their acquisition and the individual ranges of variation that might exist between children.

6.0 Summary. The preceding paper is an outline for writing grammars for children. It is based on transformational grammar, particularly the form presented by Rosenbaum (1967). Changes have been introduced which help account for phenomena peculiar to child language. It is hoped that such an approach can capture generalizations about children's grammatical development that have heretofore been missed. A new way to look at transformations in children is suggested, one that stresses segmentalization and placement. A new measure has been introduced, that of mean transformation per utterance (mtu) which can capture formally notions of derivational complexity. Though a first approximation, this technique provides a basis for comparing data from one study to another and breaking down the unreplicable nature of most child language data.

APPENDIX

Ruth Hills 2;0

1.	all broken	"it is all broken"
2.	all gone	"it is all gone"
3.	all done	"I am all done"
4.	bad pin scratch baby	"the bad pin is scratching the baby"
5.	papa coat hang up there	"papa's coat is hanging up there"
6.	stick belong on me wagon	"the stick belongs on my wagon"
7.	could open door	"I couldn't open the door"
8.	me could turn it off	"I couldn't turn the light off"
9.	Clarence step on me finger	"Clarence stepped on my finger"
10.	Mary ride on bike	"Mary rode on the tricycle"
11.	Clarence ate apple all up	"Clarence ate the apple all up"
12.	baby found handkerchief	"baby found the handkerchief"
13.	bad bear eat mama all up	"the bad bear will eat mama all up"
14.	big doggie bite baby	"the big doggie will bite the baby"
15.		
(41)	(now see), baby open door	"now see, the baby will open the door"
16.	two big book over there	"there are two big books over there"
17.	many towel up there	"there are many towels up there"
18.	any papa baby	"I am not papa's baby"
19.	there more another big doggie	"there is another big doggie"
20.	me any milk	"I haven't any milk"
21.	mine own bed	"it is my own bed"
22.	Mary out there	"Mary is out there"
23.	baby down-town today	"the baby was down-town today"
24.	bad Justin any me in	"bad Justin wouldn't let me in"
25.	me go	"let me go"
26.	me do it	"let me do it"
27.	open door	"open the door"
28.	mama carry baby	"let mama carry the baby"
29.	me come on mama bed	"let me come on mama's bed"
30.	go sleep	"go to sleep"
31.	shut eye	"shut your eye"

32.	tell Mary that	"tell Mary that"
33.	help baby down	"help the baby down"
34.	brother have it	"let brother have it"
35.	me in	"let me in"
36.	me some that egg	"let me have some of that egg"
37.	me some spoon	"let me have some spoon"
38.	me by papa	"let me be by papa"
39.	more another	"let me have another"
40.	two baby up Mary	"two babies are up by Mary"
41.	now see	"now see" (the baby will open the door)

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