University of Massachusetts Occasional Papers in Linguistics

Volume 9 *University of Massachusetts Occasional Papers in Linguistics Volume 8*

Article 4

1983

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0. INTRODUCTION

In the study of syntax, coordinate structures have traditionally drawn linguists' attention for a variety of reasons. For example, the question of how transformations apply in coordinate structures is a topic of considerable current interest (cf. Gazdar 1981 and Williams 1981). Another issue in the study of coordination is the nature of the distribution of conjunctions (e.g. and and or); that is the matter of the optionality and obligatoriness of conjunctions in various positions in coordination. This has posed problems in providing a grammatical analysis that is explanatorily adequate, and it has also stood in the way of developing a descriptively adequate analysis of coordination. In this paper, we are going to propose an analysis of the distribution of conjunctions in coordinate structures, focusing specifically on the conjunction and.[1]

This paper is divided into three sections. The first section will briefly discuss some general properties that any adequate account of coordination must address. We then go on to look at two previous attempts to account for the distribution of the conjunction and, due to Ross (1967) and Gazdar (1981) and consider some problems with these proposals. Before turning to our proposal, we will, in the second sections, summarize Chomsky's (1965) discussion of abbreviatory devices as a method of evaluation in the process of constructing a theory of generative grammar. In section three, we propose an analysis of the distribution of and which requires only the well-known abbreviatory devices parentheses ("()") and the Kleene star ("*").

1. ROSS' AND GAZDAR'S PROPOSALS: ANALYSIS AND CRITICISM

Before considering previous studies of coordination, we want to discuss briefly some of their basic properties. Many , if not all, syntactic categories (e.g. noun phrases, verb phrases, adjectival phrases, and sentences) can be coordinated according to the same general principles, as the following examples show:

(1) John, Paul and Ringo went to Boston.
(2) The child got out of bed, brushed his teeth, and took a shower.
(3) The old, tired, and hungry man ran to the car.
(4) She read the report slowly and carefully.
(5) Mary ran out of the car and into the school.
(6) I opened the door, and the cat came in.

One way of stating this generalization is to provide distinct rules for the coordination of each category and to generalize these rules by providing a coordination schema. For example, the following schema appears quite frequently in the literature (cf. Dougherty (1970)):

(7) $\alpha \rightarrow \alpha \ldots \{\underline{\text{and}}/\underline{\text{or}}\}\ \alpha_n$

This schema abbreviates the following rule

(8) $NP \rightarrow NP_1 \ldots$ and NP_n

(analogously for the other syntactic categories.[2])
The generalized schema in (7) captures the following category-neutral properties of coordination.

(9) Every coordination structure needs at least one conjunction.
(10) Several conjunctions are possible in a coordinate structure.
(11) There can be an infinite number of conjuncts.

For example:

(12) John and Paul and George and Ringo are looking at TV.

We now present two different proposals that are representative[3] of the range of accounts of coordination which extend the basic proposal in (7) in certain ways. Each of these approaches the problem somewhat differently. For example, while Ross (1967) employs transformations, Gazdar (1981) enriches the base rules to attempt to account for the grammar of coordination without using transformations.

We will begin by reviewing Ross' theory in his thesis Constraints on Varibles in Syntax (1967:89-92). Note that in the standard proposal in (7), and fails to form a constituent with any of the conjuncts. Ross challenges this assumption, basing his argument on phonological evidence drawn from intonation patterns assigned to coordinate structures. He claims that "phonological evidence indicates strongly that the bracketing of the subject NP of (4.94) must be shown in (4.95a), and not that shown in (4.95b) or (4.95c),

(4.94) Tom and Dick and Harry all love watermelon.
(4.95) a. ((Tom) (and Dick) (and Harry)) all love watermelon.
(4.95) b. ((Tom) (and) (Dick) (and) (Harry)) all love watermelon.
(4.95) c. ((Tom and) (Dick and) (Harry)) all love watermelon.

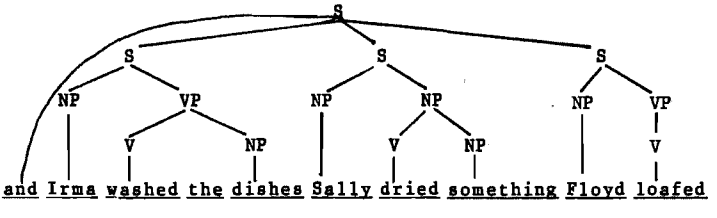
for intonational pauses come before coordinating conjunctions, not after them or equally on both sides of them." (p. 91)

On this assumption, he proposes the following phrase structure rule:

(13) $S \rightarrow \{\underline{\text{and}}, \underline{\text{or}}\}\ S^n$, where $n \geq 2$

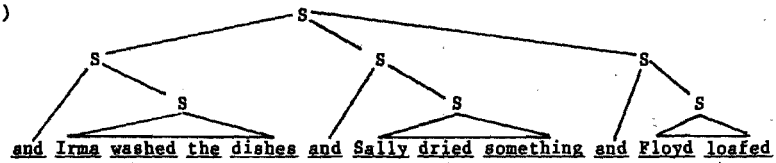
thus generating:

(14)



Then he applies to this structure a transformational rule of conjunction copying to each S introduced by (13), rendering:

(15)



Thirdly, Ross proposes, but fails to explicitly provide, a rule which deletes the first and obligatorily[4]. Note that this rule does not account for the distribution of and in sentences such as:

(16) John, Paul, and Mary went to the store.

because it does not mention the possibility of deleting the and between John and Paul.

Even if we expanded Ross' rule to delete the first and obligatorily and each following and optionally, we would then generate such ungrammatical sentences as:

(17) *John, Paul, Mary went to the store.

The sentence in (17) is ungrammatical because the last two NPs are not conjoined by and.

To account for the ungrammaticality of (17) while still generating (16), the analysis must undergo a further adjustment. We must add a condition to the effect that the last and is obligatory and may not be deleted. At this point, we note that the rule of and-deletion requires a three-part condition:

(18) Obligatorily delete the first and.
(19) Optionally delete all other occurrences of and, except...
(20) Do not delete the last and.

Even though now the rule has been sufficiently expanded to approach descriptive adequacy, it is, nevertheless, an extremely inelegant proposal which, we feel, fails to account for the distribution of and in a straightforward way.[6]

We now turn to the account of the distribution of and due to Gazdar (1981). In order to clarify Gazdar's proposal on coordinate structure, we will briefly review the basic points of his Generalized Phrase Structure Grammar (G.P.S.G.).

In G.P.S.G. there are no transformational rules, and phrase structure rules are interpreted, following McCawley (1968), as Node Admissibility Conditions. The characteristic of this approach is that Node Admissibility Conditions do not generate phrase structure trees, but, also rather, serve to check for admissible constituent structure. Also, the notation changes, and a phrase structure rule such as:

(21) S → NP VP

becomes in Gazdar's notation:

(22) $[_{s}$NP VP]

and analogously for all other rules.

Consider, now, Gazdar's proposal on coordination. As he notes in his "Unbounded Dependencies and Coordinate Structure", (1981) the schema traditionally used to describe coordination:

(23) $\alpha \rightarrow \alpha_1 \ldots \{\underline{\text{and}}_{\underline{\text{or}}}\} \alpha_n$

does not suffice to account for coordination of sentences such as (24) on the assumption that such passive sentences require the application of transformational rules in addition to a rule compatible with the schema.

(24) The Dodgers beat the Red Sox and were beaten by the Giants.

Because he eliminates from his grammar the use of transformational rules - coordination reduction in this case -, Gazdar has to propose a new analysis of sentences such as (24). We will not pursue these issues here (cf. Gazdar (1981) for discussion). Following Ross, Gazdar argues that coordinating morphemes form a constituent with the immediately following conjunct and, thus, he replaces (23) with the node admissibility condition in (25):

(25) $\left[_{\alpha\ [\beta]}\ \beta\ \alpha\right]$

where β is $\{\underline{\text{or}}_{\underline{\text{and}}}\}$

and α is any syntactic category.

With this rule and the following revision of the schema (23),

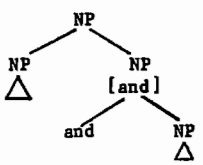
(26) $\left[_{\alpha}\ \alpha_1 \ldots \alpha_n\right]_{[\beta]}$

where β is $\{\underline{\text{and}}_{\underline{\text{or}}}\}$

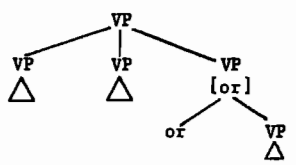
and α is any syntactic category.

the rules admit phrase structure subtrees such as:

(27) a.



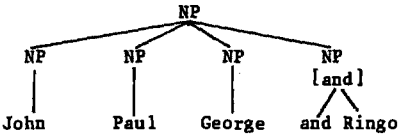
b.



Note that Gazdar's schema sanctions rules which admit an NP like (28), analyzing it with the flat-structured subtree (29).

(28) John, Paul, George, and Ringo

(29)

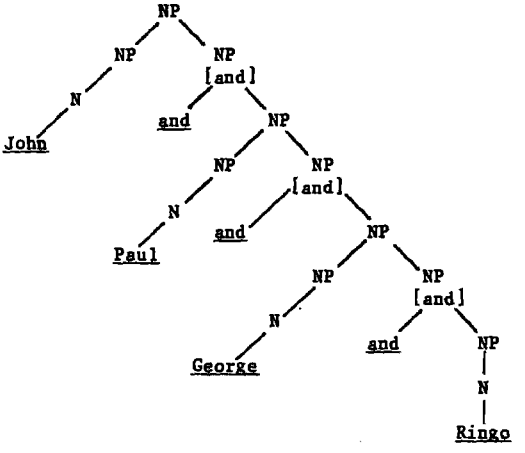


According to this structure, however, the coordinating conjunction is allowed to precede only the last NP conjunct. Thus,

(30) John and Paul and George and Ringo

can only be generated with a branching structure such as:

(31)



There are good reasons to believe that it should be possible to analyze the coordinate NP in (30) with a flat structure similar to the one in (29). For example, there is evidence for a flat structure found by examining the intonation patterns assigned to (30). (See Ross and p. 3 above; Gazdar refers to this in his proposal too.) Furthermore, we find that not only is (30) parsable with varying breath groupings, these groupings alter its meaning.

(32) a. (John) (and Paul) (and George) (and Ringo)
b. (John and Paul) (and George and Ringo)
c. (John and Paul) (and George) (and Ringo)

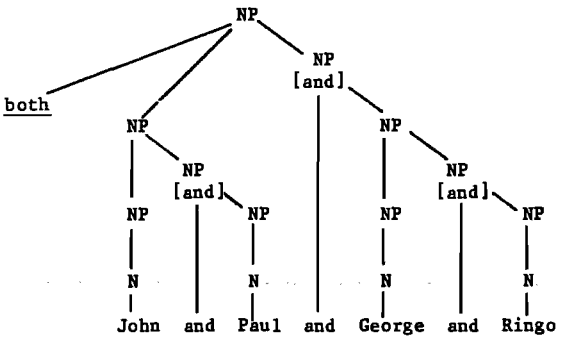
Imagine, for example, the question: "Name a couple and two individuals that participated in the game." Only (32c) would be the appropriate answer to it. (32a) and (32b) can be considered as two different answers to the question "Who carried the pianos?". (32b) would imply that two couples carried the pianos, while in (32a) every individual carried the pianos separately.

To make it more clear that intonation reflects a very important difference in meaning, we refer to a point made by Edwin Williams (personal communication) that the distribution of conjuncts can, in some cases, determine the grammaticality of a sentence. Consider, for example:

(33) Both John and Paul and George and Ringo went to the store.

This sentences can only be analyzed as:

(34)



The characteristic of both is that it is obligatorily followed by a phrase that involves two semantic elements. We observe this in phrases like:

(35) both the women

where tbe plural necessarily implies two women, and:

(36) both John and Mary

which has two conjuncts following both. Therefore, the NP in (33) must be factored into two further NPs dominating couples, as (34) shows, and cannot be factored into four equal NPs. This, however, suggests that both does not tolerate a flat structure, thus motivating the difference between the flat and branching structures.

2. CHOMSKY'S ARGUMENT ON ABBREVIATORY DEVICES

We want, in this section, to summarize Chomsky's comments on abbreviatory devices as he explains them in Aspects of the Theory of Syntax (1965), since it is crucial to showing the value of our proposal concerning the distribution of conjunctions in coordinate structures. The fact that our schema is expressible with well-known abbreviatory conventions can be best understood after a consideration of Chomsky's theory.

A linguistic theory, according to Chomsky, is an attempt to formalize a restrictive definition of a grammar; as such a linguistic theory may contain certain parameters which determine the form of individual grammars. A theory of grammar must, to justify itself, attain two levels of adequacy; it must

explain the intrinsic linguistic competence of the speaker-hearer, thus being descriptively adequate, and it must also approach an explanatory adequacy, a topic to which we now turn.

At the basis of explanatory adequacy is the construction of a theory of linguistic (i.e. formal and substantive) universals that defines the initial assumptions about the nature of language that learners of any language are innately disposed to make. These universals constitute a set of principles that clarify the nature of language and, at the same time, account for an explanation of language acquisition. When introduced as conditions in the linguistic theory, they restrict the definition of a grammar, thus limiting the range of possible grammars that the language learner will entertain.

This restriction, together with the further one applied by the use of evaluation measures, is the condition that a theory must meet to be explanatorily adequate. Evaluation measures, as they capture the nature of dependency between data and grammar and are devised to favor generalizations that are significant in language, help us in determining the explanatory adequacy of a grammar and of its rules.

Chomsky suggests that the number and the types of symbols that a grammar needs to express its rules - namely the notation it uses - is an aspect that we (and the child) should consider when evaluating a grammar. This means that the notation must be devised so that all the significant generalizations (e.g. schemata) can be rendered in a concise and simple way, whereas non-occurring generalizations will be difficult to express within it.

As we notice, the relation between abbreviatory devices and rules of generative grammar is one of the reciprocal dependency; descriptively adequate rules that can be expressed by abbreviatory devices give evidence of the appropriateness of the devices. On the other hand, abbreviatory devices are used as evaluation measures in ranking grammars on a scale of adequacy.

Chomsky claims that this theory of notational devices as evaluation measures is the rationale behind the convention for the use of parentheses and Kleene stars as adopted in a generative grammar.

3. DISTRIBUTION OF CONJUNCTIONS

We now turn to the presentation of our proposal for a schema concerning the distribution of conjunctions in coordinate structures:

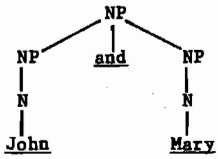
(37) x → x ((and) x)* and x
where x is NP, VP, AP, PP, or S

This schema abbreviates specific rules for each of the categories.

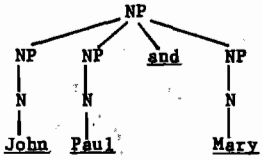
We now would like to show how the schema accounts for any variation of coordination; in our examples we will use NPs coordinated with and, according to the rule (38), derived from the general schema (37).

(38) NP → NP ((and) NP)* and NP

(39)



(40)



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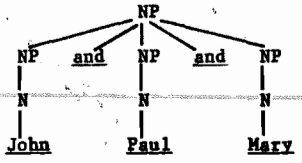

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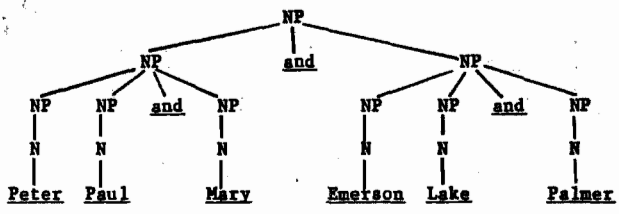
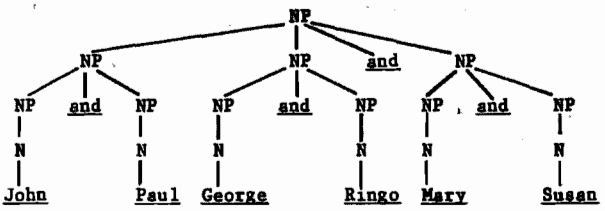


(43)



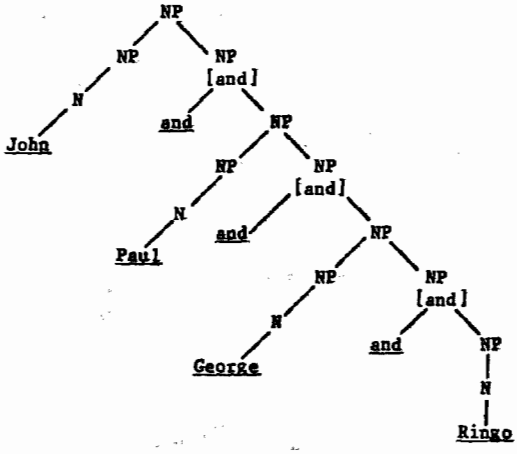
The rule seems to be more descriptively adequate, as the examples (39)-(43) show. Note, in particular, (40), which Ross' original approach failed to account for, poses no problem for the rule in (38). We recall that the modification of Ross' proposal needed to account for examples such as (40) requires a much more complicated rule consisting of three separate parts ((18)-(20)).

As is evident in the previous examples, our rule solves the problem we indicated to be crucial in Gazdar's proposal, namely the distinction between flat and branching structures. In fact, whereas for:

(30) John and Paul and George and Ringo

Gazdar admits only the branched structure

(31)

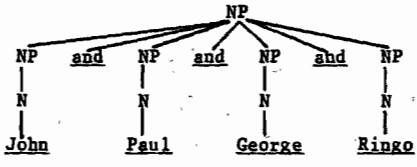


we can provide the branched, flat, and mixed structures.

In this way, the differences in analyzing the NP in (32) are fully accounted for by our rule.

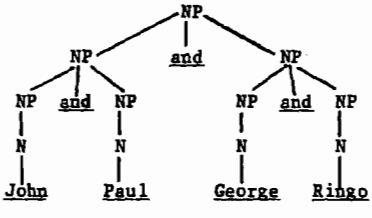
(32) a. (John) (and Paul) (and George) (and Ringo)

(44)



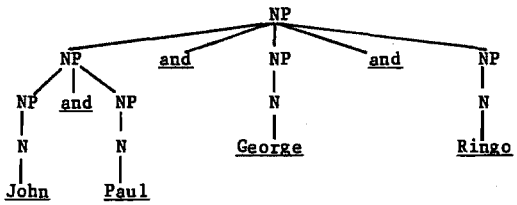
(32) b. (John and Paul) (and George and Ringo)

(45)



(32) c. (John and Paul) (and George) (and Ringo)

(46)



Virtually any kind of grouping can be captured by our rule, as examples (39)-(43) show. Thus, without introducing any new notational devices and without relying on transformations, our schema meets the basic conditions cited in (9), (10), and (11).

We acknowledge possible objections (as Edwin Williams expressed) to the predicted grammaticality of phrases generated by our rule, such as:

(47) a. NP and NP, NP, NP and NP and NP ...
b. John and Paul, Fred, Sue and George and Max ...

We believe, however, that these sentences are not ungrammatical; rather, they seem lower in acceptability because they pose problems in processing, probably because the listener is expecting a grouping pattern that may not be intended. Consider, for example, a long list of team players being recited where the form of (47) is entirely conceivable.

As we have seen in section two, Chomsky's theory grants to evaluation measures and, in particular, abbreviatory devices, crucial power in the construction of an explanatorily adequate generative grammar. When considered from this point of view, our schema, as it uses only parentheses and Kleene star by way of abbreviatory notations, can be considered as evidence for the claim that these notational devices are appropriate to describe even such complicated distributions as that of conjunctions in coordinate structures. Furthermore, we feel that this aspect of our proposal makes it clearly preferable to Ross' earlier proposal, to which it seems comparable on descriptive grounds, on the basis of its surpassing simplicity.

FOOTNOTES

*We are specially thankful to Steven Weisler for his guidance, encouragement and patience. We are also indebted to Edwin Williams for his comments and criticism.

[1]Throughout the paper, we will mainly consider the conjunct and. As far as we have experimented, we see that everything we say that concerns and holds true for or as well.

[2]For simplicity and clarity, we will mainly use examples with noun phrase conjunctions. Keep in mind that they can be expanded to various syntactic categories.

[3]However, consider also Dougherty (1970-71), Gleitman (1969), etc.

[4]On the assumption that all transformations are optional, the fact that *and*-deletion is obligatory is a weak point in his theory.

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