COORDINATION REDUCTION

TAI
COORDINATION REDUCTION

by

James Hau-y Tai, B.A., M.A.

DISERVATION
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DEDICATION

This dissertation is dedicated

to my teacher Gerald A. Sanders
Accepted by the Faculty of the Graduate School, Indiana University, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Committee:

Fred W. Householder (Chairman)
Charles S. Bird
Andreas Koutsoudas
Gerald A. Sanders
Albert Valdman
Richard Chi
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0. INTRODUCTION

0.1. Purpose and Scope

This thesis attempts to provide a transformational theory of coordination. This theory is designed to account for all kinds of structures conjoined with and, as well as most plurals, by derivation from underlying coordinations of sentences.

In this thesis, various transformational processes involving identity deletion in coordinate structures such as Conjunction Reduction, Gapping, Respectively Transformation, and Reciprocal Transformation will be shown to be related to each other under one general process of Coordination Reduction.

This thesis argues against the Phrase Structure Rule Hypothesis advocated by Dougherty (1968), in which most of the surface conjoined structures are directly generated by the phrase structure rules in the base.

0.2. Theoretical Background

General philosophical and methodological foundations are based on those formulated by Noam Chomsky in Syntactic
Structures (1957) and Aspects of the Theory of Syntax (1965). Following Chomsky (1965), we analyze the system of a grammar into three components, namely phonological, syntactic, and semantic components. The syntactic component consists of a base and a set of transformational rules. The base is composed of a set of phrase structure rules and a lexicon. The base generates underlying structures and the transformational rules map them onto surface structures. The semantic component gives the meaning of a sentence according to the information provided by the underlying structure. The phonological component gives the phonetic interpretation of a sentence according to the information provided by the surface structure.

Also following Chomsky (1965), we assume that the phrase structure rules carry out two separate functions: they define the system of grammatical relations, and they determine the ordering of elements in deep structures. Thus, given the following phrase marker

```
S
  NP
    the boy
  VP
    V
    hit
  NP
    the girl
```

the boy bears the relation (NP, S) to the boy hit the girl, hit the girl bears the relation (VP, S) to the boy hit the girl.
the girl bears the relation (NP, VP) to hit the girl, and hit bears the relation (V, VP) to hit the girl. In addition, the boy precedes hit the girl, hit, and the girl. Hit in turn precedes the girl. Thus, we can see that the two NP's in the phrase-marker above differ in grammatical relations as well as ordering of elements.

0.3. The Transformational Hypothesis Versus the Phrase Structure Rule Hypothesis.¹

Since the inception of transformational studies of coordinate structures, it has been assumed that most conjoined phrases are not generated in the deep structure; rather, they are derived from conjoined sentences by a transformation called Coordination Reduction. For example, the b forms in the set of (1)-(4) are derived from the a forms.

(1)a John knows the answer and James knows the answer.
   b John and James know the answer.

(2)a John kicked the girl and John hit the boy.
   b John kicked the girl and hit the boy.

(3)a John kicked Mary and John hit Mary.
   b John kicked and hit Mary.

(4)a John kicked Mary in the garden and John kicked Mary in the room.
   b. John kicked Mary in the garden and in the room.
We will refer to the assumption that conjoined phrases are derived from conjoined sentences as the Transformational Hypothesis.

As is well known, equivalence of meaning and sameness of selectional restrictions have been used as two important criteria for the establishment of an optional transformation. The classical argument for Coordination Reduction transformation is essentially based on these two criteria. That the a form and the b form in each pair of the set (1)-(4) are synonymous is obvious. The fact that the a form and the b form have the same selectional restrictions can be seen, for example, from

\[(5)a^* \text{ John knows the answer and sincerity knows the answer.}\]

\[b^* \text{ John and sincerity know the answer.}\]

In the Transformational Hypothesis, the ungrammaticality of (5)b can be explained as due to the ungrammaticality of (5)a, because the former is derived from the latter. The reason that (5)a is ungrammatical is that it contains an ungrammatical sentence (6).

\[(6)^* \text{ Sincerity knows the answer.}\]

(6) violates the selectional restriction in the deep structure. Thus, the Transformational Hypothesis naturally predicts the ungrammaticality of (5)b directly from (5)a and
indirectly from (6).

However, recent studies of transformational grammars show that equivalence of meaning and sameness of selectional restrictions are not enough to constitute evidence for the transformational analysis of any particular syntactic problem. Chomsky has pointed out that "any argument for the transformational analysis that is based on semantic grounds or on grounds of selectional relations will be very weak. ---- The reason is that an alternative, non-transformational approach can be envisaged if the support for transformations is simply meaning equivalence or sameness of selectional relations. Where the grounds are semantic, an alternative is an enrichment of the rules of semantic interpretation; and the regularities involving only selectional features might in principle be stated as redundancy of the lexicon." (Chomsky 1968 P51). Although the rules of semantic interpretation are still vague to us, it is legitimate to assume that there are rules of semantic interpretation which are not merely inverses of transformations. If Chomsky's argument is correct, equivalence of meaning and sameness of selectional restrictions are not sufficient for the establishment of any transformational rule. Other syntactic evidence for the necessity of a transformational rule must be given, in addition to equivalence of meaning and sameness of selectional restrictions.
In fact, as far as the data of (1)-(6) are concerned, the Phrase Structure Rule Hypothesis (PSR Hypothesis) would be another alternative. The PSR Hypothesis asserts that most of the conjoined phrases, as well as conjoined sentences, are directly generated in the deep structure by a phrase structure rule schema such as (7).^2

(7) X \longrightarrow \begin{cases} \text{and} \\ \text{or} \end{cases} \ X^n, \text{ where } n \geq 2 \quad X = S, \ NP, \ VP, \ ADV, \ V, \ ---

It should be clear that within the PSR Hypothesis, both a forms and b forms in the set of (1)-(4) will be generated in the deep structure by rule (7). Within this hypothesis, the fact that the a form and the b form in each pair of the set (1)-(4) are synonymous can be accounted for by a semantic interpretation rule, which in some way gives the b form the same interpretation as the a form in each pair.^3 The selectional relations between the a form and the b form in each pair can be accounted for by a general lexical redundancy rule in which the selectional restrictions postulated for a single category can be extended to its corresponding conjoined category.

Although in the present case of conjunction, we do not know how to exactly state the semantic interpretation rule (or rules) and the lexical redundancy rule, we will assume that this could be somehow done.

The PSR Hypothesis and the Transformational Hypothesis are also compatible in both "respectively" and reciprocal
constructions. While the Transformational Hypothesis derives "respectively" constructions through a Respectively Transformation, the PSR Hypothesis will generate "respectively" constructions directly in the deep structure with the morpheme "respectively" introduced as an adverb. For example, the Transformational Hypothesis will derive (8)b from (8)a by means of a Respectively Transformation.

(8)a John kicked the dog and Mary kicked the cat.

b John and Mary kicked the dog and the cat respectively.

The PSR Hypothesis will generate both (8)a and (8)b in the deep structure by means of rule (7). In the case of reciprocal constructions, the Transformational Hypothesis derives (9)b from (9)a through Coordination Reduction, and then the rule of Each Other Pronominalization will convert (9)b into (9)c.

(9)a James hit John and John hit James.

b* James and John hit John and James.

c James and John hit each other.

The PSR Hypothesis would generate (9)b directly in the deep structure, then use Each Other Pronominalization to convert (9)b into (9)c.4

The past literature of transformational studies of coordinate structures has witnessed different versions of each of these two alternative hypotheses: the Transformational
Hypothesis versus the PSR Hypothesis. There are three versions of the Transformational Hypothesis known to us. Gleitman (1965) proposes a theory in which all the conjoined phrases are derived from conjoined sentences, no conjoined structures except conjoined sentences are allowed in the deep structure. Lakoff and Peters (1966) propose a theory of Phrasal Conjunction, in which the conjoined noun phrases like those of (10) and (11) are directly generated by the rule schema (12) in the deep structure.

(10) John and Mary went to Chicago (together).
(11) John and Mary are similar.
(12) NP* \rightarrow and NP^n, where n \geq 2

They do not claim that all the conjoined noun phrases are generated by (12). The conjoined noun phrases like those in (13) and (14) are derived through Coordination Reduction.

(13) Both John and Mary went to Chicago.
(14) John and Mary are erudite.

In their theory, (13) and (14) are derived from (15) and (16) respectively.

(15) John went to Chicago and Mary went to Chicago.
(16) John is erudite and Mary is erudite.

It should be noticed that (12) is only for the conjunction and, and not for the conjunction or. It should be also noticed that they do not indicate that the treatment of the conjoined noun
phrases is applicable to other conjoined structures, that is, they do not intend to propose VP*, ADV*, etc. McCawley (1968) argues that it is not necessary to derive (13) and (14) from Coordination Reduction. He proposes that the semantic features [+ joint] and [- joint] can be introduced to distinguish the conjoined noun phrases like those in (10)-(11) from those in (13)-(14). Thus, in his theory, all the conjoined noun phrases are directly generated in the deep structure, and Coordination Reduction is not necessary for the conjoined noun phrases. Again, it should be noticed that McCawley does not intend to say that Coordination Reduction is not necessary also for other conjoined structures. It is interesting to see that these three versions of the Transformational Hypothesis, from Gleitman (1965) through Lakoff and Peters (1966) to McCawley (1968), have restricted the role of Coordination Reduction step by step until there is no necessity of Coordination Reduction for conjoined noun phrases.

On the other hand, there are two versions of the PSR Hypothesis. Dik (1968) has proposed a theory in which all the conjoined structures are directly generated in the base. Thus, in Dik's theory, no function of Coordination Reduction is allowed. Dougherty (1968), however, allows Coordination Reduction to play a very limited role to get conjoined structures which can not be directly generated by rule (7).
Chronologically, Dik's work precedes Dougherty's. Thus, we can see that these two versions of the PSR Hypothesis have moved, from Dik to Dougherty, from the total elimination to the partial allowance of Coordination Reduction.

We have seen that these different versions of each of these two alternative hypotheses seem to have moved from two extremes to a compromising point. However, the demarcation between these two alternative hypotheses can be still clearly cut. If a grammar of coordinate structures contains rule (7), this grammar will give only a very limited role to Coordination Reduction and therefore is within the domain of the PSR Hypothesis. If, on the other hand, a grammar of coordinate structures does not have rule (7), this grammar has to give Coordination Reduction an important role and therefore is within the domain of the Transformational Hypothesis.

A priori, there is no reason to believe any of these two alternative hypotheses or any version of them is correct. The choice of one hypothesis in favor of the other and the choice of one version in favor of the others within each hypothesis are all subject to empirical tests. In 0.4., we will show that there are strong evidences of Coordination Reduction. In 0.5., we will show that it is theoretically inadequate to allow both rule (7) and Coordination Reduction
in a grammar of coordinate structures. As the thesis develops, it will be seen that we have taken the strongest version of the Transformational Hypothesis in that we have derived all conjoined structures and most plurals from deep structure conjoined sentences.

0.4. Evidence of Coordination Reduction

0.41. Derived Conjoined Structures

The existence of a Passive Transformation in English makes it impossible for the PSR Hypothesis to directly generate sentences like (20)b and (20)c by means of rule (7).

(20)a John kicked the girl and John was hit by the girl.

b John kicked the girl and was hit by the girl.

c John kicked and was hit by the girl.

Rule (7) can not generate the conjoined VP in (20)b, nor the conjoined V in (20)c. The deep structure of (20)a is

(21) John kicked the girl and the girl hit John.

We apply the Passive Transformation to (21) to yield (20)a, then apply Coordination Reduction to (20)a to yield (20)b and to (20)b to yield (20)c.

Similarly, the existence of It-Replacement Transformation shows that the PSR Hypothesis can not generate sentences like (22)b through rule (7).
(22) a John kicked the dog and John seems to be unhappy.

b John kicked the dog and seems to be unhappy.

The deep structure of (22)a can be represented as

(23)

The rule of Extraposition will remove the embedded S in S₂ to the end of S₂ and daughter-join it to the VP of S₂. Thus, the application of Extraposition to (23) yields

(24)
The rule of It-Replacement will replace the pronominal it by John in S₂. The convention of Tree Pruning then removes the circled S node in S₂. Thus, the result is

\[(25)\]

```
S₀
  /
-\-
S₁          S₂
  |      /
NP  VP   NP  VP
   |      |
  V   NP  V   VP
John kicked John seems to be unhappy
  the dog
```

(25) is the structure of (22)a. Coordination Reduction then applies to (22)a to yield (22)b. It is impossible to generate the conjoined VP of (22)b in the deep structure through rule (7), because John can never be the deep structure subject of seems to be unhappy, which can never be a deep structure predicate.

We have seen that the conjoined VP's in (20)b and (22)b and the conjoined V in (20)c can not be directly generated by rule (7); rather, they have to be derived through Coordination Reduction. In the following, we would like to present an example in which the conjoined NP has to be derived through a special case of Coordination Reduction, the Respectively Transformation. Consider,
(26) John and James are eager to please and easy to please respectively.

John and James in (26) can not be directly generated by rule (7), because while John is the deep structure subject of please, James is the deep structure object of please. The deep structure of (26) can be represented as

(27)

In S₁, the rule of Equi-NP Deletion will delete the identical subject in the complement sentence. In S₂, Extraposition will apply to get It is easy for Pro to please James; then the rule of Tough Movement,⁹ which replaces the pronominal it by an NP in the predicate of an extraposed complement sentence, will replace it by James to yield James is easy for Pro to please. The Pro in (27) will be spelled
as null in this case. The result of these processes is

\[(28)\]

Now, the Respectively Transformation will turn (28) into (26).

There is another case where the conjoined NP cannot be generated by rule (7). Although in this case, the conjoined NP is not derived through Coordination Reduction, we present it to show that in addition to Coordination Reduction, the conjoined NP can be derived by some other transformations. Consider,

\[(29)\] James and Mary, he hit the dog and she kicked the cat.

The deep structure of (29) is

\[(30)\] James hit the dog and Mary kicked the cat.

The rule of Dislocation,\(^{10}\) which changes the sentence that guy is poor into that guy, he is poor, will change (30) into (29).
0.42. Conjunctions Crossing Constituent Boundaries

Within the present theory of transformational grammar, rule (7) can only generate conjoined constituents, but not conjoined structures of which the conjunctions cross constituent boundaries. However, there are cases where the conjunctions cross constituent boundaries. For example, Gleitman (1965) has noticed that there are counterexamples to the claim that only constituents can be conjoined. The following are some of the counterexamples given by her.

(31) I gave the girl a dime and the boy a nickel.
(32) The soviets rely on military and on political indications of our intentions.
(33) He took John home and Mary to the station.

In addition to Gleitman's examples, most native speakers of English can accept sentences like

(34) John kicked, and James hit, the boy.
(35) John is proud of, and James is confident of, Mary's ability.

(31)-(35) provides another piece of evidence for the necessity of Coordination Reduction.

0.43. The Existence of Gapping

Ross (1967a) derives (36)b from (36)a, and (37)b from (37)a through the rule of Gapping.
(36)a I ate fish, and Bill ate rice.
   b I ate fish, and Bill, rice.

(37)a John is believed to be poor, and Tom is believed to be rich.
   b John is believed to be poor, and Tom, to be rich.

Obviously, the PSR Hypothesis cannot generate (36)b and (37)b through rule (7). To generate (36)b and (37)b, the PSR Hypothesis has to allow the rule of Gapping. However, as we will show in 1.3. and 2.1., Gapping is merely a special case of Coordination Reduction. Therefore, Gapping is compatible with the Transformational Hypothesis, but not with the PSR Hypothesis.

0.5 The Domain of Coordination Reduction

We have shown that Coordination Reduction is somehow necessary in a grammar of coordinate structures. Yet, we have not discussed what kind of role it should play. The crucial issue here is whether we have to postulate both rule (7) in the base component to generate (1)b-(4)b and (8)b-(9)b and Coordination Reduction in the transformational component to generate (20)b, (20)c, (22)b, (26), and (31)-(35). If Coordination Reduction, which we have to use to generate (20)b etc., can also generate (1)b etc., then there is no reason to postulate both rule (7) and Coordination Reduction in a grammar of coordinate structures.
For purpose of discussion, we can use Dougherty's (1968) work for illustration. Dougherty's grammar of coordinate structures has both rule (7) to generate (1)b etc., and a rule of Coordination Reduction, which he calls the Conjunction Rule, to generate (20)b etc.. For example, the deep structure of (20)b can be represented as

\[(40)\]
\[
S_0 \quad \text{and} \quad \underline{\text{S}_0} \\
S_1 \quad \text{NP} \quad \underline{\text{NP}} \\
\quad \text{and} \quad \underline{\text{VP}} \\
\quad \text{VP} \quad \underline{\text{VP}} \\
\quad \text{John} \quad \text{kicked} \quad \text{the} \quad \text{girl} \\
S_2 \quad \text{NP} \quad \underline{\text{NP}} \\
\quad \text{VP} \quad \underline{\text{VP}} \\
\quad \text{the} \quad \text{girl} \quad \text{hit} \quad \underline{\text{John} \quad \text{by} \quad \text{Pass}}
\]

The passive Transformation applies to (40) to yield

\[(41)\]
\[
S_0 \quad \text{and} \quad \underline{\text{S}_0} \\
S_1 \quad \text{NP} \quad \underline{\text{NP}} \\
\quad \text{and} \quad \underline{\text{VP}} \\
\quad \text{VP} \quad \underline{\text{VP}} \\
\quad \text{John} \quad \text{kicked} \quad \text{the} \quad \text{girl} \\
S_2 \quad \text{NP} \quad \underline{\text{NP}} \\
\quad \text{VP} \quad \underline{\text{VP}} \\
\quad \text{John} \quad \text{was} \quad \text{hit} \quad \underline{\text{by} \quad \text{the} \quad \text{girl}}
\]

The Conjunction Rule will delete John in $S_2$ of (41) and replace the dummy symbol by the VP in $S_2$. The result is
(42) is the structure of (20)b. Since Dougherty allows
the dummy symbol to be a conjunct of every conjoined category
generated in the deep structure, he can derive other cases we
have presented in 0.41. in the same way he derives (20)b.

However, once the dummy symbol and the Conjunction
Rule are introduced in a grammar which also allows rule (7),
there are two ways to get (1)b-(4)b and (8)b-(9)b. One is
to generate them directly in the deep structure through rule
(7), the other is to derive them through the Conjunction Rule.
For example, (2)b can either be generated through (7) or be
derived through the Conjunction Rule from the deep structure of

(43)

It is obvious that a base which generates (40) will also
generate (43), and that the Conjunction Rule will apply to
(40) as well as (43). It is hard to see that any non-ad-hoc device can be used to stop (43) from undergoing the Conjunction Rule, while allowing (40) to undergo the same rule.

It is theoretically inadequate for a grammar to derive the same unambiguous sentence by two different routes, while, in fact, one route is enough. The fact that coordinate structures in (1)b–(4)b and (8)b–(9)b can be derived through the Conjunction Rule just like those in (20)b, (20)c, (22)b and (26) shows that the Conjunction Rule is a very general rule. Since the Conjunction Rule is necessary, and since Dougherty has no way to stop this rule from applying generally, his claim is false that the Conjunction Rule plays only a very restricted role in the PSR Hypothesis.

To account for the data (1)–(37), the PSR Hypothesis needs several mechanisms. It needs rule (7) in the base component, semantic interpretation rules in the semantic component to account for the synonymity between the a form and the b form in each pair of (1)–(4) and (8)–(9), lexical redundancy rules in the lexicon to account for the selectional relations between the a form and the b form in each of these pairs, the Conjunction Rule in the transformational component to account for (20)b, (20)c, (22)b and (26), a rule of reduction to account for (31)–(35), and finally the rule of Gapping for (36)–(37). But, to account for the same set of
data, the Transformational Hypothesis needs only a general rule of Coordination Reduction which can incorporate the Respectively Transformation and Gapping. It will be seen in this thesis that such kind of a general rule of Coordination Reduction is motivated and can be formulated.
Footnotes

1. We adopt these two terms from Dougherty's (1968) dissertation.

2. Dougherty has used the term "Phrase Structure Rule Hypothesis" to refer to his own theory of coordinate structures. Here, we use it to refer to any theory which is based on the same hypothesis as Dougherty's theory is based on. Thus, the rule schema (7), which we use for discussion, is more general than Dougherty's rule schema, which he states as:

   \[ X \rightarrow \rightarrow (Q) X^3 \text{ (ADV)} \]

   where \( X \) = major categories (\( S, NP, VP \))
   
   \( Q \) = distributive quantifiers (each, all, either, neither, both)
   
   \( ADV \) = distributive adverbs (en masse, simultaneously)

3. Perhaps, this interpretation rule is merely an inverse of Coordination Reduction, and it reconstructs the \( a \) form from the \( b \) form.

4. Again, here, we are not referring to Dougherty's theory in particular. Dougherty has a detailed treatment of "each other."

5. However, in his dissertation, Peters indicates the possibility of postulating \( VP^* \) in the deep structure in order to distinguish \textbf{John sang and danced} (simultaneously) from
John sang and danced (separately).

6. See Rosenbaum (1965) and Lakoff (1966) for detailed discussion.

7. In general, the question is not settled to which node the extraposed S should be attached. Our analysis is motivated for Coordination Reduction.

8. See Ross (1966) for the usage of this convention.

9. We adopt the term from Postal (1968). Tough Movement is essentially a subcase of It-Replacement except that it replaces "it" by an NP which is not a subject of the complement sentence and that it applies only for certain adjectives such as tough, easy --- etc.

10. See Ross (1967b) for a detailed discussion of this rule.

11. It is generally assumed that if a sentence has two different deep structures, it must be two ways ambiguous. Although whether or not this assumption is correct is an empirical question, it has never been shown to be false. If the assumption is correct, Dougherty has a false claim that sentences like (1)b-(4)b and (8)b-(9)b are two ways ambiguous.
I. PREPARATIONS FOR A FORMULATION OF COORDINATION REDUCTION

1.1. The Input Phrase-marker for Coordination Reduction

In this section, we will discuss (A) how the phrase-marker of a coordinate sentence is generated; (B) what is the proper phrase-marker for Coordination Reduction to apply.

In Chomsky's *Syntactic Structures*, the deep structure has only Simple Phrase-markers, all the Generalized Phrase-markers are introduced by transformations. Thus, coordinate sentences are derived through a Conjunction Transformation. Chomsky did not consider the problem of proper derived structures of coordinate sentences. In his text-book, Koutsoudas (1966) follows Chomsky's idea of deriving coordinate sentences through Conjunction Transformation. However, he gives a convention which attempts to yield proper phrase-markers of coordinate sentences. His convention says:

When two constituents are first conjoined by a transformation, they are attached to a node with the same label these constituents had in the source P-markers; i.e. a new node is created. After that, conjoined constituents are attached to the newly created node in accordance with the convention for attachment by adjunction. (Koutsoudas 1966 P253)

According to this convention, the phrase-marker of a coordinate sentence with *and* is
Katz and Postal (1964), and Chomsky (1965) advance to a new stage in the theory of transformational grammars in which embedded sentences are not introduced by transformations, but rather directly generated in the categorical component. Although they have not covered the problem of coordinate sentences, it is understood that coordinate sentences should be also generated in the base.

Schane (1966) has tried to formulate a rule schema in the base for coordinate sentences. His rule schema is

\[(2) \quad S \longrightarrow \#S\# \begin{cases} \text{and} \\ \text{or} \end{cases} \#S\#\]

The * in (2) stands for any number of repetitions of the symbol S. According to Schane, (2) will generate

\[(3a) \quad S \quad \text{and} \quad S \quad \text{and} \quad S\]

\[(3b) \quad S \quad \text{and} \quad S \quad \text{and} \quad S\]

\[(3c) \quad S \quad \text{and} \quad S \quad \text{and} \quad S\]
Schane explains that if (2) applies only once, (3)a is generated; if (2) reapply to the first S of (2), (3)b is generated; and if (2) reapply to the second S of (2), (3)c is generated. He argues that (3) correctly accounts for the fact that sentences like

(4) John and Mary and Charlie are here.

have three possible meanings in accordance with (3).

(5)a (John, Mary and Charlie) are here.

b Both (John and Mary) and Charlie are here.

c Both John and (Mary and Charlie) are here.

It is not always agreed among linguists that (4) is really ambiguous. Furthermore, if (3) can give (4) the three readings in (5), we should expect that

(6) Americans are kind and happy and generous.

also has three readings in accordance with (3). Unfortunately, this is not the situation.

Ross (1967b Pl65) proposes a rule schema for conjunction. It is

(7) \[ S \rightarrow \left\{ \begin{array}{c} \text{and} \\ \text{or} \end{array} \right\} S^n, \text{ where } n \geq 2 \]

(7) will first generate

(8) \[ \begin{array}{c} \text{and} \\ S \end{array} \]

Then through a universal principle, Conjunction Copying, (8)
becomes

\[(9)a\]

\[
\begin{array}{c}
\text{S} \\
\text{S} \quad \text{and} \quad \text{S} \\
\text{S} \quad \text{and} \quad \text{S} \\
\text{S} \quad \text{and} \quad \text{S} \\
\text{S} \quad \text{and} \quad \text{S}
\end{array}
\]

In languages like English, the first instance of conjunctions in (9)a will be deleted and the circled S get pruned by the convention of Tree Pruning. The result is

\[(9)b\]

\[
\begin{array}{c}
\text{S} \\
\text{S} \quad \text{and} \quad \text{S} \\
\text{S} \quad \text{and} \quad \text{S} \\
\text{S} \quad \text{and} \quad \text{S}
\end{array}
\]

We will label the process which converts (9)a into (9)b as First Conjunction Deletion.

Ross (1967b PP163-165) gives four reasons for the phrase-marker in (9)b. The first reason is that if a conjoined sentence is broken up into two sentences, the conjunction always goes with the second sentence.

(10) John left, and he didn't even say goodbye.

(11)a John left. And he didn't even say goodbye.

b* John left and. He didn't even say goodbye.

The second reason is that in languages in which coordinate conjunctions can become enclitics, these enclitics are always associated with the following conjunct, and never with the preceding one.

(12) Sie will tanzen, aber ich will nach Hause gehen.
(13)a Sie will tanzen; ich will aber nach Hause gehen.
   
   b* Sie will aber tanzen; ich will nach Hause gehen.

The third reason is that the Appositive Clause Formation must convert sentences like (14)a into (14)b.

(14)a Even Harold failed, and he is the smartest boy in our class.

   b Even Harold, \{ who and he \} is the smartest boy in our class, failed.

The fourth reason is that the phonological evidence indicates that the bracketing of the subject NP of (15) must be that shown in (16)a, and not that shown in (16)b and (16)c.

(15) Tom, and Dick, and Harry all love watermelon.

(16)a ( (Tom) (and Dick) (and Harry) ) all love watermelon.

   b ( (Tom) (and) (Dick) (and) (Harry) ) all love watermelon.

   c ( (Tom and) (Dick and) (Harry) ) all love watermelon.

Although (9)b seems to be the correct surface phrase-marker for a coordinate sentence, (8) is in fact more useful than (9)b for Coordination Reduction. In the present work, we will assume that Coordination Reduction applies to (8) and the processes of Conjunction Copying and First Conjunction Deletion apply after Coordination Reduction. We will discuss
the detailed operations in 2.2.

1.2. Pair Application of Coordination Reduction

In Ross' (1967a, 1967b) framework, identity deletion in coordinate structures has to apply simultaneously to delete indefinitely many occurrences of an identical constituent in a coordinate structure. He terms this kind of rule application "across-the-board." The example which he uses to support the claim that Conjunction Reduction, which converts (20)a into (20)b, has to apply "across-the-board" is

(20)a  Tom picked these grapes, and I washed these grapes, and Suzie will prepare these grapes.

b  Tom picked, and I washed, and Suzie will prepare, these grapes.

(21)a  Tom picked these grapes, and I washed some turnips, and Suzie will prepare these grapes.

b* Tom picked, and I washed some turnips, and Suzie will prepare, these grapes.

We can also observe the same situation with respect to Gapping, which converts (22)a into (22)b.

(22)a  James hit the dog, and Tom hit the cat, and Suzie hit the rabbit.

b  James hit the dog, and Tom, the cat, and Suzie, the rabbit.
(23)a James hit the dog, and Tom kicked the cat, and Suzie hit the rabbit.

b* James hit the dog, and Tom kicked the cat, and Suzie, the rabbit.

However, there is some evidence which can show that Coordination Reduction in general applies only to two consecutive conjuncts at a time. Consider,

(24)a James ate peaches, and Suzie ate peaches, and John ate peaches.

b James and Suzie ate peaches, and John ate peaches.

c James ate peaches, and Suzie and John ate peaches.

d James and Suzie and John ate peaches.

(25)a James ate peaches, and Suzie ate apples, and John ate plums.

b James ate peaches, and Suzie ate apples, and John, plums.

c James ate peaches, and Suzie, apples, and John ate plums.

d James ate peaches, and Suzie, apples, and John, plums.

(26)a James ate peaches, and Suzie ate apples, and John ate plums.

b James and Suzie ate peaches and apples respectively, and John ate plums.

c James ate peaches, and Suzie and John ate apples and
plums respectively.
d James and Suzie and John ate peaches and apples and plums respectively.
(27)a James ate peaches, and Suzie ate peaches, and John ate plums.
 b James and Suzie ate peaches, and John ate plums.
 c James and Suzie ate peaches, and John, plums.
(28)a James ate peaches, and Suzie ate plums, and John ate plums.
 b James ate peaches, and Suzie and John ate plums.
 c James ate peaches, and Suzie and John, plums.
(29)a James hit the boy, and John hit the boy, and Suzie kicked the boy.
 b James and John hit the boy, and Suzie kicked the boy.
 c James and John hit, and Suzie kicked, the boy.

As a matter of fact, if we assume that Coordination Reduction applies only to two continuous conjuncts at each time, we can also explain why (21)b and (23)b are ungrammatical. Therefore, (21)-(29) provides a unitary phenomenon that Coordination Reduction applies only two continuous conjuncts at each time and that it works successively pair by pair.

It should be noticed that our assumption of pair application of Coordination Reduction is not in conflict with the claim that (8) is the proper input for Coordination
Reduction.

1.3. Ross' Gapping Hypothesis and Coordination Reduction

In his *Gapping and the Order of Constituents*, Ross observes that while the rule of Gapping operates forward in English to convert (30)a to (30)b, it operates backward in Japanese to convert (31)a to (31)b.

(30)a  I ate fish, and Bill ate rice.

b  I ate fish, and Bill, rice.

(31)a  watakushi wa sakana o tabete, Biru wa

I               fish ate Bill

    gohan o tabeta.
    rice ate

(I ate fish, and Bill ate rice)

b  watakushi wa sakana o, Biru wa gohan o tabeta

(I ate fish, and Bill, rice.)

Obviously, the difference between (30) and (31) in the direction of gapping can be explained by the fact that while (30) has SVO order, (31) has SOV. Based on this observation, Ross (1967a) proposes his Gapping Hypothesis, which he states as:

The order in which Gapping operates depends on the order of elements at the time that the rule applies: if the identical elements are left branches, Gapping operates forward; if they are on right branches, it operates backward.  (Ross 1967a P5)

Ross finds further supports for his Gapping Hypo-
thesis in other languages like Hindi and Russian, where word order is freer than it is in English or Japanese. He proposes that Gapping is a universal rule. Although we have found that there is no Gapping in languages like Chinese, we have not found exceptions to the direction of Gapping as stated in (32) in languages where there is Gapping. We will therefore assume that (32) is essentially correct.

Sanders (1969) notices that the directionality of deletion stated in (32) is in fact true for all coordination reductions. He gives the following examples to show this generality.

(33)

(S Pred) and (S Pred): (Nicholas (drank water)) and (Vodka poured)

(S (V Ø)) and (S (V Ø)): (Nicholas (poured Vodka)) and (Alexander (drank Vodka)).

(Det N) and (N): (The king) and (queen) are similar.

(Adj N) and (Adj N): (Old men) and (women) danced.

We can thus extend (32) to a general directionality condition of identity deletion in coordinate structures. This extension can be stated as:

(34) the order in which identity deletions apply in coordinate structures depends on the order of
elements at the time deletion applies; if the identical elements are on left branches, deletion operates forward; if they are on right branches, it operates backward.

Any formulation of Coordination Reduction which is based on the order of elements, yet which fails to incorporate (34) can not be correct.

1.4. A Universal Hierarchical Condition on Coordination Reduction

In this section, we will propose the Highest Identical Constituent Condition (HICC) as a universal condition on Coordination Reduction. HICC says that only the highest identical constituent can be deleted in each application of Coordination Reduction.

Consider first

(40)a Old men like sunshine and old women like sunshine.

b Old men and old women like sunshine.

c Old men and women like sunshine.

d* Old men like sunshine and women like sunshine.

(40) shows that old, the lower identical constituent in (40)a, can be deleted only when like sunshine, the higher identical constituent in (40)a, has been deleted. If we assume that Coordination Reduction each time applies only to the highest identical constituent, we can first convert (40)a
into (40)b, and then (40)b into (40)c. Since in (40)a like sunshine is the highest identical constituent, but not old, (40)a can be only turned into (40)b, and never into (40)d. However, old in (40)b is the highest identical constituent. (40)b thus can be turned into (40)c.

Consider also

(41)a The boy hit the dog and the girl hit the cat.
    b The boy hit the dog and the girl, the cat.

(42)a The boy hit the dog and the boy hit the cat.
    b The boy hit the dog and hit the cat.
    c The boy hit the dog and the cat.
    c* The boy hit the dog and the boy, the cat.

(43)a The boy hit the dog and the girl hit the dog.
    b The boy and the girl hit the dog.
    c? The boy hit and the girl hit the dog.
    d* The boy hit the dog and the girl, the dog.

(44)a The boy hit the dog and the boy kicked the dog.
    b The boy hit the dog and kicked the dog.
    c The boy hit and kicked the dog.
    d? The boy hit and the boy kicked the dog.

(42)d and (43)d show that Gapping is impossible when the subjects or the objects in each conjunct are identical. In the case of (43)d, this means that the identical verb can not be deleted without the identical subject NP, which is the
highest identical constituent in (42)a, being first deleted. In the case of (43)d, this means that the identical verb can not be deleted without the identical VP, which is the highest identical constituent in (43)a, being first deleted.

The fact that (43)c and (44)d are questionable for most of our informants can be also explained as due to the violation of HICC. In (43)c, the dog is deleted without hit the dog being first deleted. In (44)d, the dog is deleted without the boy being first deleted. Gerald Sanders has pointed out to me that (43)c and (44)d are quite acceptable. However, most of our informants consistently consider (45)b as much better than (43)c and (44)d.

(45)a The boy hit the dog, and the girl kicked the dog.
(45)b The boy hit, and the girl kicked, the dog.

Since the dog is the highest identical constituent in (45)a, (45)b does not violate HICC, and therefore is better than (43)c and (44)d, which violate HICC.

According to HICC, (41)a can be reduced into (41)b, because hit is the highest identical constituent and thus subject to identity deletion, HICC thus explains why Gapping in (41)b is okay, but not in (42)d and (43)d. In (42)a, the highest identical constituent is the boy, therefore (42)a has to be converted into (42)b. Now, in (42)b, hit is the highest identical constituent, therefore Coordination Reduction
will optionally apply to (42)b to yield (42)c. In (43)a, the highest identical constituent is the VP hit the dog. (43)a therefore can be converted to (43)b. In (44)a, the highest identical constituent is the boy, therefore, Coordination Reduction applies to (44)a to yield (44)b. Now, in (44)b, the dog is highest identical constituent, so Coordination Reduction can apply to (44)b to yield (44)c.

HICC can also cover cases like

(46)a  Yesterday I saw the boy and yesterday I saw the girl.
b  Yesterday I saw the boy and I saw the girl.
c  Yesterday I saw the boy and saw the girl.
d  Yesterday I saw the boy and the girl.
e* Yesterday I saw the boy and yesterday saw the girl.
f* Yesterday I saw the boy and yesterday, the girl.

(47)a  Yesterday I saw the boy and today I saw the girl.
b  Yesterday I saw the boy and today, saw the girl.
c  Yesterday I saw the boy and today, the girl.
d* Yesterday I saw the boy and today I, the girl.

From (46)a to (46)d, we have successively deleted the highest identical constituents. (46)e is ungrammatical, because I is deleted without the highest identical constituent yesterday being first deleted. (46)f is ungrammatical for the same reason. Although I in (46)a is not the highest identical constituent, it is in (47)a. (47)a therefore can be converted
into (47)b, which in turn can be converted into (47)c. (47)d is ungrammatical, because saw is deleted without I, the highest identical constituent in (47)a, being first deleted. HICC therefore can explain why I can not be deleted in (46)e, but can be deleted in (47)b, and why I saw can not be deleted in (46)f, but can be deleted in (47)c.

HICC does not only apply to the reduction of coordinate sentences, but also to the reduction of other coordinate structures. For example,6

(48)a Some big dogs and some big cats are running around.
   b Some big dogs and big cats are running around.
   c Some big dogs and cats are running around.
   d* Some big dogs and some cats are running around.

(49)a The young boy and the young girl are running around.
   b The young boy and young girl are running around.
   c The young boy and girl are running around.
   d* The young boy and the girl are running around.

From (48)a to (48)c, we have successively deleted the highest identical constituents. In (48)d, big is deleted without the highest identical constituent some being first deleted. The same explanation applies to (49).

1.5. Previous Formulations of Coordination Reduction
1.51. Chomsky's Principles

In *Syntactic Structures*, Chomsky gives a general principle of Coordination Reduction.

(50) If $S_1$ and $S_2$ are grammatical sentences, and $S_1$ differs from $S_2$ only in that $X$ appears in $S_1$ where $Y$ appears in $S_2$ (i.e., $S_1=\text{---X---}$ and $S_2=\text{---Y---}$), and $X$ and $Y$ are constituents of the same type in $S_1$ and $S_2$ respectively, then $S_3$ is a sentence, where $S_3$ is the result of replacing $X$ by $X+\text{and}+Y$ in $S_3$ (i.e., $S_3=\text{---X+and+Y---}$). (P36)

Although (50) is just a general statement of Coordination Reduction, it should be pointed out that the condition that $X$ and $Y$ must be constituents of the same type is falsified by Gleitman's (1965) examples which we have cited in 0.42.7

In his *Aspects of the Theory of Syntax*, Chomsky restates (50) as

(51) The general rule for conjunction seems to be roughly this: If $XZY$ and $XZ'Y$ are two strings such that for some category $A$, $Z$ is an $A$ and $Z'$ is an $A$, then we may form the string $X+Z+\text{and}+Z'+Y$, where $Z+\text{and}+Z'$ is an $A$. But, clearly, $A$ must be a category of a special type; in fact, we come much closer to characterizing the actual range of possibility if we limited $A$ to major categories. (P212, fn. 9)

In (51), we find two features which are not stated in (50). Firstly, Coordination Reduction is not limited to conjoined sentences any more. Secondly, only major categories can be conjoined.

In discussing the notion of introducing generalized phrase-markers in the base and the notion of "filter function" of transformations in chapter 3 of *Aspects*, Chomsky touches
the problem of extending these two notions for conjunction in a note:

(52) We are discussing only embedding transformations here, but should extend the discussion to various generalized transformations that form coordinate constructions (e.g., conjunction). There are certain problems concerning these, but I believe that they can be incorporated quite readily in the present scheme by permitting rule schemata introducing coordinated elements that are then modified, rearranged, and appropriately inter-related by singulary transformations. If the suggestion of note 9, Chapter 2, (e.g., 51) is workable, then such rule schemata need not be stated in grammar at all. Rather, by a general convention we can associate such a schema with each major category. This approach to coordination relies heavily on the filtering effect of transformations. Thus, whenever we have coordination, some category is coordinated n times in matrix sentence, and n occurrences of matched sentences are independently generated by the base rules. (Chomsky 1965 p224 fn.7)

Dougherty's (1968) Conjunction Rule, which we have discussed in 0.5., is essentially based on the suggestion Chomsky has made in (52).

1.52. Schane's Formulation

Schane (1966) gives a general principle of Coordination Reduction which is essentially very close to (51). He states this principle as

(53) Two (or more) sentences can be conjoined into a simple sentence if their total tree structure is identical except for the structure dominated by one grammatical node; this node must be a major grammatical category which is not also a lexical category.
Based on (44), Schane analyzes Coordination Reduction into four steps:

(54)a To mark the non-identical nodes

```
          S
         /\  
        /   
NP      VP       NP     VP
   John       came and James       came
```

b To draw a new tree for identical parts

```
        S
       /   
      NP   VP
     /     
John   came
```

c To conjoin non-identical parts under the blank subtree of the new tree

```
        S
       /   
      NP   VP
     /     
NP     NP
  John    James
     /   
    VP  came
```

d To erase the old tree

None of the four steps in (54) is an elementary transformation. In his *Aspects*, Chomsky points out that the set of elementary transformations contains substitutions, deletions, and adjunctions. (54) are certainly not easy to be interpreted in terms of these three elementary transformations. Based on
this criterion, Schane's formulation is inferior to other formulations we will discuss.

Another important feature of Schane's theory of Coordination Reduction lies in the distinction between Primary Conjunction Rules, which are universal, and Secondary Conjunction Rules, which are language-specific. (54) is the Primary Conjunction Rule and applies only to coordinate sentences. The Secondary Conjunction Rules consist of a set of deletion rules which may optionally delete repeated elements of the coordinate structures derived by the Primary Conjunction Rules. For example,

(55)a The old man is (be) here and the old woman is (be) here.

b The old man and the old woman are here.

c The old man and old woman are here.

d The old man and woman are here.

According to Schane, the Primary Conjunction Rule will convert (55)a into (55)b. Then a Secondary Conjunction Rule which he states as

(56) $\text{Det}_1 \cdots (\text{Adj})_1 \cdots N_1$ and $\text{Det}_2 \cdots (\text{Adj})_2 \cdots N_2 \Rightarrow 1 \ 2 \ 3 \ 4 \ 6$ \ 7

case: $l=5$

would change (55)b into (55)c. Then another Secondary Conjunction Rule which he states as
(57) \[ \text{Adj}_1 \rightarrow N_1 \text{ and Adj}_2 \rightarrow N_2 \rightarrow 1 \ 2 \ 3 \ \emptyset \ 5 \]
\[
1 \quad 2 \quad 3 \quad 4 \quad 5
\]
condition: \( l=4 \)

would turn (55)c into (55)d.

It can be seen that there are two main differences between Primary Conjunction Rules and Secondary Conjunction Rules. One is that the former are not elementary transformations, whereas the latter are elementary transformations.

The other difference is that the former apply to coordinate sentences, and the latter apply to other coordinate structures. Obviously, the distinction amounts to a loss of the generalization that (55)b, (55)c, and (55)d can be derived in the same way through the general process of Coordination Reduction.

Perhaps, Secondary Conjunction Rules should be restricted to some languages-specific deletion phenomena in some special coordinate structures which can not be accounted for by the general process of Coordination Reduction. ⁸

1.53. Wang's Formulation

Wang (1967) attempts to analyze Coordination Reduction in terms of elementary transformations, mainly deletions and adjunctions.

Wang's formulation is based on a general principle concerning the directionality of deletion. He states:
(58) In Mandarin, as in English, each basic sentence may be regarded as consisting of two parts—a noun phrase (NP) followed by a verb phrase (VP). Two major types of conjoining are therefore possible. If the VPs in constituent sentence match each other (i.e. are the same), we may delete all of these but the last one. The NPs which were originally separated by VPs, can now be grouped together. I refer to such cases as NP conjunction. On the other hand, there may be a match among the NPs of the constituent sentences, and we have VP conjunction. Here we delete all of the matched NPs but the first one. (Wang 1967 PP. 3-4)

Wang's principle is strikingly similar to Ross' (1967a) Gapping Hypothesis both in that the directionality of deletion depends on the order of constituents and in that they have exactly the same directionality of deletion, namely, if the identical elements are left branches, deletion operates forwards; if identical elements are right branches, deletion operates backwards.

Based on the principle mentioned above, Wang formulates Coordination Reduction in terms of three steps. For example, in (59), VP's in the constituent sentences are the same.

(59)
Through Reattachment, (59) is converted into

\[ (60) \]

\[ S \rightarrow \text{NP}_1 \rightarrow \text{VP} \rightarrow S \rightarrow \text{cjn} \rightarrow \text{VP} \rightarrow \text{NP}_2 \]

Through Deletion and Relabeling, (60) becomes

\[ (61) \]

\[ S \rightarrow \text{NP} \rightarrow \text{cjn} \rightarrow \text{VP} \rightarrow \text{NP} \rightarrow \text{NP}_1 \rightarrow \text{NP}_2 \]

Finally, through Grouping, (61) is converted into

\[ (62) \]

\[ S \rightarrow \text{cjn} \rightarrow \text{VP} \rightarrow \text{NP} \rightarrow \text{NP}_1 \rightarrow \text{NP}_2 \]

VP conjunction can be handled essentially as NP conjunction except that Reattachment will attach the first NP to the coordinate S node. Since NP conjunction and VP conjunction in English and Mandarin are representative of the two types of reduction in coordinate structures corresponding to the two possible directions of identity deletion, Wang's formulation, as he himself has shown, can in fact apply not only to coordinate sentences but also to all other coordinate structures.
1.54. Ross' Node Raising Proposal

This proposal is formulated in Ross' (1967b) dissertation as

\[(63)\]

\[
\begin{align*}
\text{a} & \quad \left[ \begin{array}{c}
\text{and} \quad \begin{array}{c}
\text{---}
\end{array} \\
\text{X} & \quad \text{--A}
\end{array} \right] \quad \left[ \begin{array}{c}
\text{n} \\
\text{B} \quad \text{B}
\end{array} \right] \\
\text{1} & \quad \text{2} & \quad \text{3}
\implies \\
\begin{array}{c}
\text{1} & \quad \text{2} & \quad \emptyset
\end{array} \quad \# \quad \text{3}
\end{align*}
\]

\[
\begin{align*}
\text{b} & \quad \left[ \begin{array}{c}
\text{and} \quad \begin{array}{c}
\text{---}
\end{array} \\
\text{A} & \quad \text{--X}
\end{array} \right] \quad \left[ \begin{array}{c}
\text{n} \\
\text{B} \quad \text{B}
\end{array} \right] \\
\text{1} & \quad \text{2} & \quad \text{3}
\implies \\
\begin{array}{c}
\text{2} & \quad \emptyset
\end{array} \quad \# \quad \left[ \begin{array}{c}
\text{1} & \quad \emptyset & \quad \text{3}
\end{array} \right]
\end{align*}
\]

condition: all occurrences of A are identical.

Ross explains that "this notation should be interpreted to mean that in any coordinate node of the category B, which dominates any number of conjuncts which are also of category B, and each of which either ends or begins with a constituent of category A, where all occurrence of A are identical, all of these occurrences of A are superimposed, and adjoined to the conjoined node B." (Ross 1967b P402). The symbol \# is interpreted by Ross as a notation for Chomsky-adjoining, which is a process of adjoining a node X to another node Y with the creation of a new node Y dominating both X and the original Y. (65) in the following is an example of Chomsky-adjoining.

Ross' Node Raising Proposal can be illustrated in the following way. Given
(64)

(63)b will apply to (64), since each constituent sentence begins with a category NP dominating James. Now, (63)b can be analyzed as consisting of four steps. First, Node Raising changes (64) into

(65)

Second, Identity Deletion converts (65) into

(66)

Third, Tree Pruning, a convention which deletes S nodes which do not branch, changes (66) into
Finally, through Relabeling, a convention which relabels a node with the same labeling of the constituents dominated by it, when these constituents have the same labeling, (67) is converted to

It can be seen that there are two essential features shared by Wang's formulation and Ross' Node Raising Proposal. Firstly, both of them are based on the same principle of directionality of deletion, which is similar to Ross' Gapping Hypothesis. Secondly, Wang's Reattachment has the same function as Ross' Node Raising except that the former is daughter-adjunction, while the latter is Chomsky-adjunction. It is interesting to see that while Ross' formulation creates a new node in the very first step, namely, Node Raising, Wang's formulation creates a new node through Grouping.
1.55. Postal's Respectively Approach

Postal (1968a) analyzes Coordination Reduction into two ordered processes. They are

\[ X, A_0, Y \rightarrow X, A_0, Y \]
\[ A_1 \quad A_n \]
\[ B_1 \quad C_1 \quad B_n \quad C_n \]

(70) Identity Deletion (obligatory)

\[ X, A_0, Y \rightarrow X, A_x, Y \]
\[ A_x_1 \quad A_x_n \]

For example, if the given sentence is

(71)

Through Coordination Reduction (in Postal's terms), (71) becomes
(72)

Through Identity Deletion, (72) becomes

(73)

Since Postal's Coordination Reduction does not require identity, it can also turn (74) into (75).

(74)

(75)
Since there is no identity in (75), Identity Deletion will not apply to (75). According to Postal, we will get (76) from (75).

(76) James and John sang and danced respectively.

Similarly, if the given sentence is

(77)

through Postal's Coordination Reduction, we get

(78)

Then through Identity Deletion, (78) is converted into
From (79), we can get

(80) James and John hit the dog and the cat respectively.

We can see that the essential feature of Postal's approach is to treat the Respectively Transformation as a subcase of Coordination Reduction. Obviously, with this feature, Postal's approach is superior to any other previous formulation of Coordination Reduction, because it has collapsed the Respectively Transformation and Coordination Reduction. Furthermore, as Postal himself has pointed out, in this approach we do not need the deep structure constraint to prevent identical sentences from being conjoined, since Identity Deletion in this approach is obligatory and conjoined sentences with identical conjuncts will be obligatorily reduced into one sentence. For example, (81)a will be obligatorily reduced into (81)b.

(81)a* The boy like the girl and the boy like the girl.
   b The boy like the girl.
In fact, Postal's approach can be extended to derive reciprocal constructions. For example, given

\[(82)\]

Through Postal's Coordination Reduction, we turn (82) into

\[(83)\]

Identity Deletion then converts (83) into (84).

\[(84)* \text{James} \text{ and } \text{John} \text{ hit } \text{John} \text{ and } \text{James}.\]

Then Each Other Pronominalization will apply to (84) to yield (85).

\[(85) \text{James and John hit each other.}\]

There are, however, several cases of reduction in coordinate structures which can not be handled by Postal's approach. For example, gapping sentences such as

\[(86) \text{James hit the dog, and John, the cat.}\]
and sentences such as

(87) James hit, and Tom kicked, the dog.

For another example, (88) also presents this approach with a problem.

(88)

Through Postal's Coordination Reduction, (88) becomes

(89)

Identity Deletion then converts (89) into

(90)
From (90), we will get

(91) I gave the boy and the girl a dime and a nickel respectively.

But, have no way to get (92) from (88).

(92) I gave the boy a dime and the girl a nickel.

Postal also has not shown how to predict the morpheme "respectively." Consider

(93)a Sonia likes peaches and Sonia likes apples and Betty likes peaches and Betty likes apples.

b Sonia likes peaches and apples and Betty likes peaches and apples.

c Sonia and Betty like peaches and apples.

(94)a Sonia likes peaches and Betty likes apples.

b Sonia and Betty like peaches and apples respectively.

After Coordination Reduction and Identity Deletion, both (93)b and (94)a will yield the same result (95).

(95)
Since in (95), the distinction between (93)b and (94)a has been neutralized already, it is impossible for us to predict the occurrence of the morpheme "respectively" for (94)b, but not for (93)c. Obviously, the morpheme "respectively" should be introduced before we get (95). We don’t see how this can be done in Postal’s approach without any ad-hoc device.

1.56. Conclusion

We have reviewed Schane (1966), Wang (1967), Ross (1967), and Postal (1968), concerning their formulations of Coordination Reduction. We have shown that Postal’s formulation is the most explanatory one among these four formulations in that it is able to relate explicitly the conjoined structures in "respectively" constructions and those in "each other" constructions with the plain conjoined structures. We have also shown that although Postal’s approach is the best among the previous formulations, it still can not take care of reductions in cases like (86), (87), and (92), in addition to the fact that it is impossible in his approach to predict the morpheme "respectively" in the right place.
Footnotes

1. Even granting that it is ambiguous, though, (5) can still be explained as due to different combinations of Sentence Conjunction and Phrasal Conjunction.

2. It should be noticed that in this thesis, the term Conjunction Reduction is not equivalent to the term Coordination Reduction. While it is generally assumed in Ross' framework that Conjunction Reduction and Gapping are two different processes, in our framework, they are the same process under the term Coordination Reduction. From this point of view, Conjunction Reduction as well as Gapping is a subcase of Coordination Reduction. In Ross' framework, Conjunction Reduction is in fact equivalent to his Node-Raising Proposal, which we discuss in 1.54.

3. Langacker (1969) also notices that Gapping can apply to just two conjuncts at a time. However, (25)c, which we consider as grammatical, is ungrammatical to him. The difference in this particular case should not effect the argument we have.

4. In 4.1., we will give an explanation for it.

5. The fact that Gapping can not take place if the subjects or the objects are identical in both conjuncts is also noticed by Langacker (1969). His examples are:
Bruce shot a lion, and Bruce an elephant.

Bruce shot a lion, Harvey a lion, and my grandmother a lion.

6. I borrow this example from Sanders (1969).

7. Gerald A. Sanders has informed me that Chomsky's condition can be modified as "X and Y must be sequences of constituents of the same type."

8. Although Dingwall (1969) has argued the necessity of Secondary Conjunction Rules in various languages, it seems that these cases he presents involve not only coordinate structures, but also other factors of which we don't have control yet. For example, A-not-A question form in Mandarin Chinese does not involve only coordinate structures, but also a particular question construction. Wang (1967) has also noticed that A-not-A question form is an exception to his approach because of the dual deletibility in this kind of construction. For example, (100a) can be converted into (100)b or (100)c.

(100)a 他要买书, 他不想要买书.
(He wants to buy book, he doesn't want to buy book)

b 他要不想要买书.
(Does he like to buy books)

c 他要买书不想要.
(Does he like to buy books)
II. A NEW FORMULATION OF COORDINATION REDUCTION

2.1. The Present Formulation

In this section, we will propose a formulation of Coordination Reduction which is essentially based on these observations we have made in 1.1.-1.5. It will be seen that the present formulation explicitly relates the following four types of identity deletion in and conjoined sentences.

Type A:  (1)a James sang and James danced.

b James sang and danced.

(2)a James came and John came.

b James and John came.

Type B:  (3)a James loves the dog and Suzie loves the cat.

b James loves the dog and Suzie, the cat.

(4)a James hit the dog and John kicked the dog.

b James hit, and John kicked, the dog.

Type C:  (5)a James loves the dog and Suzie loves the cat.

b James and Suzie love the dog and the cat respectively.

(6)a James hit the dog and John kicked the dog.

b James and John hit and kicked the dog respectively.

Type D:  (7)a James hit John and John hit James.

b James and John hit each other.
In type A, the identity deletion in conjoined sentences results in conjoined constituents, for example, the conjoined verb phrase in (1)b and the conjoined noun phrase in (2)b. In type B, the identity deletion in conjoined sentences does not result in conjoined constituents. In type C, the result is the respectively construction. In type D, the result is the reciprocal construction. In 1.5., we have seen that Postal's formulation is the most explanatory one among these four formulations we have discussed. We have also seen that Postal's formulation can not handle type B deletion, although it can handle type A, type C, and type D deletions. If we can show that the present formulation can handle all four types of deletions, then we can show that the present formulation is more explanatory than Postal's, and consequently more explanatory than other previous formulations we have discussed in 1.5.

The present formulation contains two ordered steps: Identity Deletion and Regrouping. The process of Identity Deletion can be stated as:

(8) Delete one of the two highest identical constituents in the pair of conjuncts under consideration according to the following principle: If these two identical constituents are left branches, deletion operates forward; if they are right branches, it
operates backward.

The process of Regrouping can be stated as:

(9) Chomsky-adjoin the remaining highest constituents of the reduced conjunct (except the conjunct itself) onto the corresponding constituents of the unreduced conjunct. This process is optional, if the reduced conjunct is still branching; it is obligatory, if the reduced conjunct is no longer branching.

Before we go on to illustrate how Identity Deletion and Regrouping can work to generate (1)-(7), we have to say something about the terms used in (8) and (9). In (8), the phrase highest identical constituents is incorporated because of these observations we have made in 1.4.; The pair of conjuncts is incorporated because of these observations in 1.2.; the directionality principle is based on these observations in 1.3. In Regrouping, the term Chomsky-adjoin is used. When a node labelled as X is Chomsky-adjoined to another node labelled as Y, the result is the creation of a new node labelled as Y which dominates both the two node adjoined. For example, if node X is Chomsky-adjoined to node Y, the result is

```
  Y
 / \
X   Y
```
Under this convention, if two nodes with the same labelling are Chomsky-adjointed, the result is the structure with all the three nodes labelled in the same way. Thus, if node X is Chomsky-adjointed to another node X, the result is

\[ X \rightarrow X \]

According to 1.1., the input of (1)a for Coordination Reduction can be represented as

(10)

\[ \text{and} \rightarrow S_0 \]

\[ S_1 \]

\[ \text{NP} \]

James

\[ \text{VP} \]

sang

\[ S_2 \]

\[ \text{NP} \]

James

\[ \text{VP} \]

danced

Through Identity Deletion, we get

(11)

\[ \text{and} \rightarrow S_0 \]

\[ S_1 \]

\[ \text{NP} \]

James

\[ \text{VP} \]

sang

\[ S_2 \]

\[ \text{VP} \]

danced

Tree Pruning convention, which deletes nodes which are no longer branching after deletion transformation, will delete the \( S_2 \) in (11) to yield
(12)

\[
(12) \quad \text{and} \quad S_0 \quad \text{VP}
\]

\[
S_1 \quad \text{NP} \quad \text{VP} \quad \text{danced}
\]

Regrouping then applies to (12) to yield

(13)

\[
(13) \quad \text{and} \quad S_0 \quad \text{VP}
\]

\[
S_1 \quad \text{NP} \quad \text{VP} \quad \text{VP} \quad \text{danced}
\]

Through a set of universal conventions, which we will present in 2.2., (13) will be converted into the correct derived structure. In this section, we will assume that when we have converted structures like (10) into structures like (13), we have converted sentences like (1)a into (1)b.

(2)a can be represented as

(14)

\[
(14) \quad \text{and} \quad S_0 \quad S_2
\]

\[
S_1 \quad \text{NP} \quad \text{VP} \quad \text{NP} \quad \text{VP}
\]

\[
\text{James} \quad \text{came} \quad \text{John} \quad \text{came}
\]
Through Identity Deletion, (14) becomes

(15)

Through Tree Pruning, (15) becomes

(16)

Through Regrouping, (16) becomes

(17)

Now, (3)a can be represented as
Through Identity Deletion, (18) becomes

Through Tree Pruning, (19) becomes

Since in our present theory, elements of a sentence are ordered, after Coordination Reduction, we still have the information of ordering of elements. Therefore, we know that
Suzie has to be Chomsky-adjointed to James, because they are in the corresponding order. For the same reason, we know that the cat has to be Chomsky-adjointed to the dog. In (20), $S_2$ is still branching, therefore Regrouping can only apply optionally. This is different from (12) in which $S_2$ is no longer branching and in which Regrouping has to apply obligatorily. If Regrouping does not apply to (20), then we have converted (3)a into (3)b. If Regrouping does apply, then we will convert (20) into (21)

```
  S0 = S1
     \   / \\
    NP  NP  V  NP  NP
   /    \  |    |  |    |  |
  James Suzie love the dog the cat
```

In converting (12) to (13), Chomsky-adjunction occurs with respect to only one node, but in converting (20) into (21), it occurs with respect to more than one node. We require that the morpheme "respectively" be introduced when Chomsky-adjunction occurs with respect to more than one node. We then remove $S_2$ in (21) to yield
In converting (20) into (22) we have converted (3)b into (5)b.

Similarly, if we have a Japanese conjoined sentence (23) as the input

(I ate fish, and Bill ate rice)

Through Identity Deletion and Tree Pruning, we get
$S_1$ in (24) is still branching, therefore Regrouping is optional. If Regrouping does not apply, then (24) is a gapping sentence in Japanese. If Regrouping applies to (25), we get

\[ S \]

\[ \text{soresore (respectively)} \]

\[ \text{watakushi wa Biru wa sakana o Biru o tabeta} \]

Through a set of universal conventions, which we will discuss in 2.2., (25) will turn into a Japanese \textit{respectively} sentence.

\[ \text{(26) watakushi wa to Biru wa soresore sakana o to gohan o tabeta} \]

(I and Bill ate fish and rice respectively)

In our formulation, we have thus converted (3)a into (3)b, and then (3)b optionally to (5)b. Similarly, we can convert (4)a first into (4)b, and then (4)b into (6)b. (4)a can be represented as

\[ S \]

\[ S_1 \]

\[ S_2 \]

\[ \text{James hit the dog John kicked the dog} \]
We apply Identity Deletion and Tree Pruning convention to yield

\[(28)\]

\[
\begin{array}{c}
\text{and} \\
S_0 \\
S_1 \\
NP \quad V \\
\text{James} \quad \text{hit} \\
S_2 \\
NP \quad V \\
\text{John} \quad \text{kicked} \\
\text{NP} \\
\text{the boy}
\end{array}
\]

Since \(S_1\) in (28) is still branching, Regrouping can apply only optionally. If it does not apply, we have converted (4)a into (4)b; if it does apply, we will convert (28) first into

\[(29)\]

\[
\begin{array}{c}
\text{and} \\
S_0 \\
S_1 \\
NP \quad \text{respectively} \\
S_2 \\
\text{NP} \\
\text{NP} \\
\text{NP} \quad V \\
\text{James} \quad \text{John} \quad \text{hit} \quad \text{kicked} \\
\text{V} \\
\text{V} \\
\text{NP} \\
\text{the boy}
\end{array}
\]

We then remove \(S_1\) and get

\[(30)\]

\[
\begin{array}{c}
\text{and} \\
S \\
S \\
\text{respectively} \\
NP \quad \text{NP} \\
\text{NP} \quad \text{NP} \\
\text{NP} \quad V \\
\text{James} \quad \text{John} \quad \text{hit} \quad \text{kicked} \\
\text{V} \\
\text{V} \\
\text{NP} \\
\text{the boy}
\end{array}
\]
In converting (28) to (30), we have converted (4)b into (6)b.

Now, (7)a can be represented as

(31)

We apply Identity Deletion to (31) to yield

(32)

$S_2$ in (32) is still branching, therefore Regrouping is optional. If Regrouping does not apply, we get a gapping sentence.

(33) *James hit John and John, James.

If Regrouping does apply, we first turn (33) into

(34)* James and John hit John and James respectively.

Then Each Other Pronominalization will apply to (34) to yield

(35)* James and John hit each other respectively.
Then Respectively Deletion will delete respectively in (35) to yield (7)b. The rule of Each Other Pronominalization can be stated as

(36) \[ X \text{ NP}_1 \text{ and } \text{NP}_2 \text{ Y } \text{NP}_2 \text{ and } \text{NP}_1 \text{ Z } \rightarrow \text{ (obligatory) } \]

\[ X \text{ NP}_1 \text{ and } \text{NP}_2 \text{ Y each other Z} \]

The rule of Respectively Deletion can be stated as

(37) \[ X \text{ each other respectively Y } \rightarrow \text{ (obligatory) } \]

\[ X \text{ each other Y} \]

We have shown that the present formulation can handle all of the four types of reductions in coordinate structures. The question should be raised concerning the introduction of the morpheme "respectively" in our present approach. In 1.55., we have seen that Postal's approach is unable to predict the morpheme "respectively." In our present approach, we have introduced the morpheme "respectively" at the time we apply Regrouping, rather than after we have applied Regrouping. The reason is that after Regrouping has applied, there will be no information left for the prediction of the morpheme "respectively." Consider

(38) \text{James loves the dog and Suzie loves the dog and James loves the cat and Suzie loves the cat.}

(38) can be first reduced to
(39) **James** and **Suzie** love the dog and **James** and **Suzie** love the cat.

(39) then can be reduced to

(40) James and Suzie love the dog and love the cat.

Finally, (40) can be reduced to

(41) James and Suzie love the dog and the cat.

If we introduce the morpheme "respectively" after we have done Regrouping, we have no way to predict that in (21) we need the morpheme "respectively," but not in (41), because their derived structures are exactly the same except for the morpheme "respectively." On the other hand, if we introduce the morpheme "respectively" every time we have Chomsky-adjointed more than one node, we can predict that "respectively" has to be introduced to (21), but not to (41), because from (38) to (41), all the three applications of Identity Deletion result in non-branching conjuncts and Chomsky-adjunction occurs with respect to only one node in each of these three applications of Regrouping, which follows Identity Deletion.

Since in our formulation, Regrouping can apply only after Identity Deletion has applied, the question should be raised: how "respectively" constructions are derived from coordinate structures in which there is no identity at all. For example,

(42)a James kicked the dog and Suzie hit the cat.

b James and Suzie kicked the dog and hit the cat respectively.
Perhaps, the answer is that Regrouping can be independent of Identity Deletion in English. However, since we don't know whether (42) is grammatical for all languages which have type C reduction, we will merely leave the question open.

Type A reduction does not apply only to conjoined sentences, but also to other conjoined structures.

(43)a  James hit the dog and James hit the cat.

b  James hit the dog and hit the cat.

c  James hit the dog and the cat.

(43)b can be derived from (43)a just like (1)b can be derived from (1)a. (43)b can be now represented as

(44)

Through Identity Deletion, (44) is converted to
(45)

```
S
  |  S
NP | VP0  VP1  VP2
   | NP   NP
James hit the dog the cat
```

Through Regrouping and Tree Pruning, (45) is converted to

(46)

```
S
  |  S
NP | VP
   | VP
James hit the dog the cat
```

For another example,

(47)a James hit the dog and James kicked the dog.

b James hit the dog and kicked the dog.

c James hit and kicked the dog.

(47)b can be represented as

(48)

```
S
  |  S
NP | VP0  VP1
   | VP2
James hit the dog kicked the dog
```
Through Identity Deletion, (48) becomes

(49)

Through Regrouping and Tree Pruning, we get

(50)

The above two examples show that type A reduction applies to coordinate verb phrases. The following example will show that type A reduction also applies to noun phrases. Consider

(51)a Old men and old women came.
    b Old men and women came.

(51)a can be represented as
Through Identity Deletion, we get

Through Regrouping and Tree Pruning, we get

Type B and type C reduction also apply to coordinate verb phrases in double object constructions.
Consider

(55)a I gave the boy a dime and gave the girl a nickel.

b I gave the boy a dime and the girl a nickel.

c I gave the boy and the girl a dime and a nickel respectively.

Recent transformational studies on the double object constructions have suggested two different representations for (55)a. Following Fillmore (1965), (55)a can be represented as (56)

Through Identity Deletion, we get

(57)
Tree Prune has removed the circled MV in (57), we get (58)

Since in (58), VP\textsubscript{2} are still branching, therefore Regrouping is optional. If Regrouping does not apply, then we have converted (55)a to (55)b. If Regrouping does apply, then we convert (58) into (59).

In converting (58) into (59), we have converted (55)b into (55)c.

In their recent works, Lakoff and Ross have often represented double object constructions like (55)a as
With (60), we still can apply Identity Deletion to convert (55)a into (55)b. But, we would have to define the directionality condition on Identity Deletion so that the beginning constituent of an n-ary is left-branching, and the ending constituent is right-branching. The result of applying Identity Deletion to (60) is

(61)

Since VP is still branching, we can therefore only apply Regrouping optionally. If Regrouping does not apply, we get (55)b; if it does apply, we get (55)c with the structure like
Type B and type C reductions do not apply to conjoined noun phrases. For example, (63)a can not be converted into (63)b, and (63)a can not be converted into (63)c either.

(63)a Old rich men and young rich women came.

b* Old rich men and young women came.

c* Old and young rich men and women respectively came.

In 3.1., we will provide an explanation for the impossibility of type B and type C reduction in conjoined noun phrases. Type D reduction only applies to conjoined sentences because of the special requirement of Each Other Pronominalization.

2.2. Conjunction Distribution

In 2.1., we have seen that Identity Deletion and Regrouping render structures like (10) into structures like (13). In this section, we will deal with the problem of deriving from structures like (13) the correct surface structures for reduced conjoined sentences like (1)b. In 1.1., we have granted that (9)b of 1.1. is the correct surface
structure for a conjoined sentence. It is reasonable to assume that the surface structures for other kinds of conjoined structures are similar to that of (9)b in 1.1. Therefore, we will assume that the surface structure for (1)b is

(70)b

To get (70)b from (13), we first apply Conjunction Copying, which converts (8) of 1.1. into (9)a of 1.1., to (13) to yield

(70)a

First Conjunction Deletion, which deletes the first instance of conjunction in (9)a of 1.1., will apply to (70)a to take away the circled and in (70)a, and the Tree Pruning convention will remove $S_0$ and $VP_1$ in (70)a to yield (70)b. We will call
the process which converts (13) into (70)b Conjunction Distribution. Therefore, Conjunction Distribution in fact contains Conjunction Copying as the first step and First Conjunction Deletion as the second step.

It must be noticed that although Coordination Reduction applies to a pair of conjuncts at a time, the phrase-marker of a conjoined structure can contain more than two conjuncts. Thus, the input for Coordination Reduction could be (71), which has one more conjunct than (1)a.

(71) James sang and James danced and John kicked the dog. After Identity Deletion and Regrouping, the structure of (71) can be represented as

(72) 

Conjunction Copying will convert (72) into

(73)a
First Conjunction Deletion will delete the circled and's in (73)a. Tree Pruning will remove the circled S and VP to yield (73)b

(73)b is the derived structure for James sang and danced and John kicked the dog.

Similarly, Conjunction Copying and First Conjunction Deletion will turn (20) into

(74)

(74) is the derived structure for (3)b. If the result of Identity Deletion and Regrouping is (22), Conjunction Copying will apply to (22) to yield
(75)a

S

respectively

NP

and

NP

James

NP

and

NP

Suzie

V

love

NP

and

NP

the dog

NP

and

NP

the cat

First Conjunction Deletion will apply to delete the circled and's in (75)a to yield

(75)b

S

respectively

NP

and

NP

James

NP

Suzie

V

love

NP

and

NP

the dog

NP

and

NP

the cat

(75)b is the derived structure for (5)b.

In our present theory, Coordination Reduction applies before Conjunction Distribution, and it will not apply to any conjoined structures in which Conjunction Distribution has already applied. For example, (10) is the input of (1)a for Coordination Reduction, but not (76), in which Conjunction Distribution has already applied.
Similarly, the input of (43)b for Coordination Reduction is (44) and not (77)

This means that Conjunction Reduction, even in its reapplication, always precedes Conjunction Distribution. We have seen that we get (46) by applying Identity Deletion and Regrouping to (44). We now can apply Conjunction Distribution to (46) to get

(78)
(78) is the derived structure for (43)c.

Thus, we have seen that through Conjunction Distribution, we can turn the outputs of Identity Deletion and Regrouping into correct derived structures.²
Footnotes

1. The question concerning the information of "corresponding constituents" should be raised. In (12) and (16), obviously, we have no problem in finding the corresponding constituents. But, if the input is (80), rather than (14), (80)

Through Identity Deletion and Tree Pruning, we get (81)

Now, we can ask the question: how do we know we have to Chomsky-adjoin James in (81) to John and not to the dog. The answer is that (81) can only result from the identity deletion of VP. Furthermore, in English, the subject NP is always in left branch, while the object is always in right branch; two constituents can be corresponding, only when they have the same branching. Since structures like
(81) can result only from identity deletion of VP, even in languages where the subject and the object have the same branching, we still have information of "corresponding constituents." For example, if the input is a Japanese sentence like

(82)  
\[
S_0 \quad \text{to} \quad S_1 \quad \text{NP} \quad S_2 \quad \text{NP}
\]
\[
\text{syonen ga} \quad \text{ki o} \quad \text{mite} \quad \text{syozyo ga} \quad \text{ki o} \quad \text{mita}
\]

the boy tree saw the girl

(The boy saw the tree and the girl saw the tree)

Through Identity Deletion and Tree Pruning, (82) becomes

(83)  
\[
S_0 \quad \text{to} \quad S_2 \quad \text{NP} \quad \text{NP}
\]
\[
\text{syonen ga} \quad \text{syozyo ga} \quad \text{ki o} \quad \text{mita}
\]

Since (83) can be only the result of deleting identical VP, \text{syonen ga} will not be Chomsky-adjoined to \text{ki o}. In addition, languages like Japanese have case markers (\text{ga} as the subject marker and \text{o} as the object marker) for
us to tell the subject from the object. As a matter of fact, if the deep structure also incorporates case markers in some way, there is a simple way to find out what are the corresponding NP's.

2. Through Conjunction Distribution, (28) will be turned into

\[
(84)
\]

\[
S \quad S
\]

\[
NP \quad V \quad S \quad S \quad NP \quad V \quad NP
\]

James hit and John kicked the boy

Assuming that the sentence boundary plays a role in the assignment of intonation, (84) would give (85) and not (86), which is more acceptable than (85) for most of our informants.

(85)? James hit, and John kicked the boy.

(86) James hit, and John kicked, the boy.

In our approach, certain adjustment on intonation has to be done to change (85) into (86). However, Ross' Node Raising Proposal can naturally give (86) without any adjustment. If we apply Node Raising Proposal to (27), the result is
Conjunction Distribution will turn (87) into

(88) can give the intonation of (86).

It seems, however, that intonation assignment has something to do with factors which can not be predicted merely from the derived structures. Consider a Japanese sentence like

(89) watakushi wa sakana o tabeta, Biru wa gohan o tabeta

If we apply Node Raising Proposal to (89), the result will be
(90) would assign the intonation of (92), while both of our Japanese informants consistently accept (91) and not (92).

(91) watakushi wa sakana o, Biru wa gohan o tabeta.

(92)* watakushi wa sakana o, Biru wa gohan o, tabeta.

Obviously, (91) can be properly derived by applying Gapping to (89). But, the question is that: how can we explain the contrast between (85) and (86) on one hand, and (91) and (92) on the other hand?

3. Postal has ordered Regrouping before Identity Deletion.

We have reversed the order of these two steps so that we can properly incorporate the directionality principle of Gapping into the present formulation. In 4.1., we will see that our approach can account for languages like Chinese where there is no "respectively" construction. Postal's approach certainly has no way to account for languages like Chinese.
III. FURTHER CONDITIONS ON COORDINATION REDUCTION

To ensure that Coordination Reduction will always yield grammatical coordinate structures, we have to impose two further conditions on the formulation of Coordination Reduction we have proposed in Chapter II.

3.1. Anti-ambiguity Condition

Consider

(1)a Old men like peaches and old women hate apples.

b* Old men like peaches and women hate apples.

Since in (1)a, the highest identical constituent is old, our formulation, which has incorporated the Highest identical Constituent Condition as stated in 1.4., as well as Ross' Node Raising Proposal and Postal's approach, would turn (1)a into (1)b. One might argue that if we require that the highest identical constituents can be deleted only when they are immediately dominated by the conjuncts,\(^1\) we can block (1)b. However, this requirement is too strong for English, because of sentences like

(2) James ate fish, and Bill, chicken.

(3) James kicked, and John hit, the boy.

(4) I am confident of, and my boss depends on, a successful outing at the track.\(^3\)
Nor can counting the numbers of the nodes from the conjuncts to identical elements help us solve the problem. Obviously, old in (1)a is the second node from the S conjuncts just as ate and the boy are the second node from the S conjuncts underlying (2) and (3) respectively. In (4), a successful outing at the track is the third node from the conjuncts.  

Before we can present our explanation for (1)-(4), let us consider another case where identity deletion should not be allowed. Ross (1967b PP230-232) notices that (5)a can not be converted into (5)b.

(5)a The university's students are intelligent and the university's faculty is committed to freedom.

b* The university's students are intelligent and faculty is committed to freedom.

Ross analyses the structure of (5)a as

(6)

He argues that the Left Branching Condition which says "no NP which is the leftmost constituent of a larger NP can be re-
ordered out of this NP by a transformational rule" (Ross 1967b p207) can account for (5)b. That is, the Left Branching Condition would prevent the university's in (6) from being raised out, and therefore Coordination Reduction is blocked for (5)a.

However, Ross immediately sees the trouble with this kind of explanation. Obviously, the Left Branching Condition should not prevent (7)a from being converted into (7)b.

(7)a The boy's uncle and the boy's aunt were kissing.
   b The boy's uncle and aunt were kissing.
In fact, the contrast between (5) and (7) is parallel to that between (1) and (8).

(8)a Old men and old women both like peaches.
   b Old men and women both like peaches.
A hypothesis which is proposed to account for the contrast between (5) and (7) should be able to explain the contrast between (1) and (8) as well.

To account for these facts, we propose an Anti-ambiguity Condition which can be stated as:

If a conjunct has undergone Identity Deletion and is still branching, it can not have a phrase marker which is generable by the phrase structure rules in the base.
According to this condition, if the result of Identity Deletion is a still branching reduced conjunct which has phrase
marker generable by the phrase structure rules in the base, Identity Deletion should not have applied in the very beginning. Thus, according to this hypothesis, Identity Deletion should not apply to (1)a, because the result of applying Identity Deletion to (1)a is

\[(9)\]

\[
\begin{array}{c}
S_0 \\
\downarrow \\
S_1 \\
\downarrow \\
\text{NP} \\
\downarrow \\
\text{Adj} \\
\text{old} \\
\downarrow \\
\text{N} \\
\text{men} \\
\downarrow \\
\text{V} \\
\text{like} \\
\downarrow \\
\text{VP} \\
\end{array} \\
\begin{array}{c}
\downarrow \\
\text{S_2} \\
\downarrow \\
\text{NP} \\
\downarrow \\
\text{N} \\
\text{peaches} \\
\downarrow \\
\text{V} \\
\text{women} \\
\downarrow \\
\text{hate} \\
\end{array} \\
\begin{array}{c}
\downarrow \\
\text{VP} \\
\end{array}
\]

\[\text{apples}\]

\(S_2\) in (9) still has a phrase marker which is generable by the phrase structure rules in the base. Therefore, by means of the Anti-ambiguity Condition, we can prevent (1)a from being converted into (1)b. Similarly, the Anti-ambiguity Condition does not allow Identity Deletion to apply to (5)a to yield (5)b, because after Identity Deletion, (5)a becomes

\[(10)\]

\[
\begin{array}{c}
S_0 \\
\downarrow \\
S_1 \\
\downarrow \\
\text{NP} \\
\downarrow \\
\text{NP} \\
\downarrow \\
\text{the university's} \\
\downarrow \\
\text{students} \\
\downarrow \\
\text{are} \\
\downarrow \\
\text{intelligent} \\
\downarrow \\
\text{VP} \\
\end{array} \\
\begin{array}{c}
\downarrow \\
\text{S_2} \\
\downarrow \\
\text{NP} \\
\downarrow \\
\text{N} \\
\text{faculty} \\
\downarrow \\
\text{is committed to} \\
\downarrow \\
\text{freedom} \\
\end{array} \\
\begin{array}{c}
\downarrow \\
\text{VP} \\
\end{array}
\]

\(S_2\), which has undergone Identity Deletion, is still branching
and has a phrase marker which is generable by the phrase structure rules in the base.\textsuperscript{6}

The Anti-ambiguity Condition, which prevents (1)a from being converted into (1)b, does not apply to (8), for after Identity Deletion, (8)a has the structure of

\begin{align*}
(11) & \quad S \\
& \quad \text{and} \\
& \quad NP_0 \\
& \quad \text{Adj} \quad N \quad NP_1 \\
& \quad \text{old} \quad \text{men} \\
& \quad NP_2 \\
& \quad \text{N} \quad \text{women} \\
& \quad VP \\
& \quad \text{like peaches}
\end{align*}

Since NP\textsubscript{2} in (11) is not branching any more, the Anti-Ambiguity Condition will not apply to cases like (8). (8)a therefore can be converted into (8)b. Similarly, the Anti-ambiguity Condition, which prevents (5)a from being converted into (5)b, does not apply to (7). After Identity Deletion, (7)a is converted into

\begin{align*}
(12) & \quad S \\
& \quad \text{and} \\
& \quad NP_0 \\
& \quad \text{NP}_1 \\
& \quad \text{the boy's} \quad N \\
& \quad \text{uncle} \\
& \quad \text{NP}_2 \\
& \quad \text{N} \quad \text{aunt} \\
& \quad VP \\
& \quad \text{were kissing}
\end{align*}

NP\textsubscript{2} in (12) is not branching any more, therefore the Anti-
ambiguity Condition does not apply to (7). (7)a therefore can be converted into (7)b.

We have seen that the condition we propose is able to account for the contrast between (5) and (7) and that between (1) and (8) in the same way.

We have seen that the Anti-ambiguity Condition prevents Coordination Reduction from applying to (1)a and (5)a. Now, we want to show that this condition allows Coordination Reduction to apply to yield (2)-(4). After Identity Deletion has applied to its unreduced source, (2) has the structure of (13)

```
NP  VP  NP  NP
James ate fish John chicken
```

Obviously, the phrase marker of $S_2$ in (13) is not generable by the phrase structure rules. Thus, Coordination Reduction in the case of (2) is not subjected to the constraint of the Anti-ambiguity Condition. After Identity Deletion has applied to its unreduced source, (3) has the structure of
(14) presents us with a problem, because the phrase marker of $S_1$, which is still branching, can be generated by the phrase structure rules. According to our hypothesis, Coordination Reduction should not apply to yield (3). However, notice that $S_1$ can be a well-formed structure only when $V$ is dominating an intransitive verb. Thus, we really can modify our statement of the Anti-ambiguity Condition in such a way so that we can allow Coordination Reduction to apply to yield (3). However, the modification is not necessary, if we assume that the phrase structure rules contain (15).

\[
(15) \quad VP \longrightarrow \begin{cases} Vtr + NP \\ Vin \end{cases}
\]

With (15), $S_1$ in (14) can be represented as

(16)
Since $S_1$ in (16) has a phrase structure which is not generable by the phrase structure rules, Coordination Reduction can apply to yield (3). The explanation we have given to (3) can apply to (4), and we will not repeat.

Now, we will show that the Anti-ambiguity Condition can apply to many other cases of Coordination Reduction. Consider the contrast between (17) and (18).

(17)a Old men and old women are similar.
    b Old men and women are similar.

(18)a These old men and those old women are similar.
    b* These old men and those women are similar.

The Anti-ambiguity Condition does not allow Coordination Reduction to apply to (18)a, because the result of Identity Deletion in (18)a is

(19)

\[ S \rightarrow \text{and} \rightarrow \text{NP}_0 \rightarrow \text{NP}_1 \rightarrow \text{Det} \rightarrow \text{these} \rightarrow \text{Adj} \rightarrow \text{old} \rightarrow \text{N} \rightarrow \text{men} \rightarrow \text{NP}_2 \rightarrow \text{Det} \rightarrow \text{those} \rightarrow \text{N} \rightarrow \text{women} \rightarrow \text{VP} \rightarrow \text{are similar} \]

$NP_2$, which has undergone Identity Deletion, is still branching and has a phrase marker which is generable by the phrase structure rules in the base. Thus, the Anti-ambiguity Condition explains why (18)a can not be converted into (18)b.
However, our hypothesis does not apply to the case of (17). For after Identity Deletion, (17)a has the structure of (20)

NP₂, which has undergone Identity Deletion, is not branching any more, therefore the Anti-ambiguity Condition does not apply to (17). Thus, Coordination Reduction can apply to (17)a to yield (17)b.

Consider also the contrast between (21) and (22)

(21)a I **usually** like peaches and Mary **usually** hates apples.
   b* I usually like peaches and Mary hates apples.

(22)a **Usually**, I like peaches and **usually**, Mary hates apples.
   b Usually, I like peaches and Mary hates apples.

The structure of (21)a can be represented as (23)
The rule of Adverb Preposing will convert (21)a into (22)a with the structure of (24)\(^4\)

\[(24)\]

\[\text{and} \quad S_0 \quad \text{S} \quad S_1 \quad \text{Adv} \quad S_2 \quad \text{Adv} \quad S \quad \text{NP} \quad \text{VP} \quad \text{NP} \quad \text{VP} \quad \text{NP} \quad \text{NP} \]

\[\text{usually I} \quad \text{like} \quad \text{peaches} \quad \text{usually Mary hates apples}\]

First, it should be noticed that it is useless to explain the contrast between (21) and (22) by ordering Adverb Preposing before Coordination Reduction. For Adverb Preposing is optional, and even if we order Adverb Preposing before Coordination Reduction, (21)a still can be an input for Coordination Reduction. Now, we will see that the Anti-ambiguity Condition can explain the contrast between (21) and (22). If we apply Identity Deletion to (23) and (24), we get (25) and (26) respectively.

\[(25)\]

\[\text{and} \quad S_0 \quad \text{S} \quad S_1 \quad \text{Adv} \quad S_2 \quad \text{Adv} \quad S \quad \text{NP} \quad \text{Pred} \quad \text{VP} \quad \text{NP} \quad \text{Pred} \quad \text{VP} \quad \text{NP} \quad \text{NP} \]

\[\text{I} \quad \text{usually} \quad \text{like} \quad \text{peaches} \quad \text{Mary hates} \quad \text{apples}\]
We can see that in (25), $S_2$ is still branching and has a phrase structure which is generable by the phrase structure rules. According to the Anti-ambiguity Condition, Coordination Reduction should not apply to (21)a to yield (21)b. However, $S_2$ in (26) is not branching any more, the Anti-ambiguity Condition therefore does not apply to (22), Coordination Reduction therefore can convert (22)a to (22)b. The explanation which we have given to (21) and (22) can also apply to (27) and (28).

(27)a James kicked the girl *yesterday* and Mary hit the boy *yesterday*.

b ??James kicked the girl and Mary hit the boy yesterday.

(28)a *Yesterday*, James kicked the girl and *yesterday*, Mary hit the boy.

b *Yesterday*, James kicked the girl and Mary hit the boy.

In conclusion, the Anti-ambiguity Condition is essentially a condition on recoverability of deletion in coordinate structures. It prevents multiple derivations of the same
structure once by phrase structure rules and once by transformational rules.

3.2. Parallelism Condition

Consider

(30)a  I like to swim and I like dancing.
       b  I like to swim and like dancing.
       c* I like to swim and dancing.

(31)a  I want to go and I want a book.
       b  I want to go and want a book.
       c* I want to go and a book.

(32)a  I believe John and I believe that the earth is flat.
       b  I believe John and believe that the earth is flat.
       c* I believe John and that the earth is flat.

To prevent c forms in (30)-(32), we can require that Regrouping can only adjoin two constituents with the same labelling. Thus, for example, after Identity Deletion, (30)b can be represented as

(33)

```
S
  /\  and
 /   \    
V     VP0
|     |    
V like VP
|     |    
I     to swim
      |    
      NP dancing
```
Since $VP_2$ in (33) is not branching, Regrouping must obligatorily apply. But, it can not apply, because \textit{to swim} and \textit{dancing} do not have the same labelling. (30)c thus can be marked as ungrammatical. (31)c and (32)c can be accounted for in the same way.

However, consider also

(34)a I \textit{like} to swim and you \textit{like} dancing.

b* I like to swim and you, dancing.

(35)a I \textit{want} to go and you \textit{want} a book.

b* I want to go and you, a book.

(36)a I \textit{believe} John and you \textit{believe} that the earth is flat.

b* I believe John and you, that the earth is flat.

The explanation we have given to (30)-(32) can not be used to account for (34)-(36), since b forms in (34)-(36) involve only Identity Deletion, but not Regrouping. (34)-(36) shows that Identity Deletion can apply only when the corresponding nodes of the two conjuncts have the same labelling. Thus, for example, the two corresponding nodes \textit{to swim} and \textit{dancing} do not have the same labelling, therefore Identity Deletion can not apply to (34)a to yield (34)b. The fact that (35)a and (36)a can not be converted into (35)b and (36)b respectively can be accounted for in the same way.

To provide a unitary explanation for (30)-(36), we
propose that Identity Deletion can apply only when it meets a Parallelism Condition, which can be stated as:

Identity Deletion can apply to a pair of conjuncts with identical constituents, if and only if the highest constituents preceding or following the highest identical constituent in one conjunct have the same labelling as the corresponding constituents in the other conjunct.

According to this Parallelism Condition, (30)a can be converted into (30)b, but (30)b can not be converted into (30)c. In (30)a, the highest identical constituent is I. The highest constituent which follows I in the first conjunct is like to swim, and the highest constituent which follows I in the second conjunct is like dancing. Now, we can see that like to swim and like dancing both have the labelling VP. (30)a therefore meets the Parallelism Condition. Identity Deletion thus can apply to (30)a, and therefore Coordination Reduction can apply to (30)a to yield (30)b with the structure

(37)

(37) is the structure of (30)b. We can see that the highest identical constituent in VP₀ is like. To swim is the highest
constituent following I in VP₁, and dancing is the highest constituent following I in VP₂. Now, to swim and dancing do not have the same labelling, therefore VP₀ does not meet the Parallelism Condition. Thus, Identity Deletion will not apply to VP₀ of (37). Therefore, Coordination Reduction can not convert (30)b into (30)c. The explanation we have given to (30) also apply to (31) and (32).

The Parallelism Condition also explains why (34)a can not be converted into (34)b. In (34)a, the highest identical constituent is like. In the first conjunct, the highest constituent preceding like is I, and the highest constituent following like is to swim. Corresponding to I and to swim are you and dancing in the second conjunct. Although I and you have the same labelling, to swim and dancing have different labellings. Thus, (34)a does not meet the Parallelism Condition. Therefore, (34)a can not be converted into (34)b. The same explanation applies to (35) and (36).

We have shown that the Parallelism Condition enables us to account for (30)-(36). At this point, one might argue that if we require that Coordination Reduction can only apply to coordinate structures in which each conjunct has the identical tree structure, we can account for (30)-(36). However, it is obvious that this kind of condition is too strong. It can be seen from the following examples.
(38)a  I like to swim and like to walk in the morning.
       b  I like to swim and to walk in the morning.

(39)a  I am healthy and I eat four meals a day.
       b  I am healthy and eat four meals a day.

(40)a  I like the girl and you like the boy who has big eyes.
       b  I like the girl and you, the boy who has big eyes.

(38)-(40) can only be accounted for by the Parallelism Condition.

The Parallelism Condition, however, can not account for

(41)a  The book is sad and the boy is sad.
       b  The book and the boy are sad.

(42)a  The key opened the door and the janitor opened the door.
       b  The key and the janitor opened the door.

(43)a  Mary used a knife to make salad and Mary used salt to make salad.
       b  Mary used a knife and salt to make salad.

(44)a  John received a gift and John received a blow.
       b  John received a gift and a blow.

It seems that to account for (41) and (44), we can simply say that there are two lexical entries with phonological identity for each verb in (41)-(44). However, to explain (41) to
(44) by means of two lexical entries is too simple to be an explanation.\textsuperscript{5}

As a matter of fact, it is also possible to account for (30)-(36) by the two lexical entry proposal. For example, Bach and Peters (1968) argue that (45) and (46) have different verbs as well as different direct object noun phrases.

(45) I believe John.

(46) I believe that John is intelligent.

Their argument is based on the following fact.

(47)* I believe John and that John is intelligent.

(48)* I believe John and they, that John is intelligent.

(49)* I and they believe John and that John is intelligent respectively.

If their argument is correct, we can also argue that sentences like (50) and (51) have different verbs as well as different direct object noun phrases.

(50) I want to go.

(51) I want a book.

Since (50) and (51) have different verbs, we can account for why (31)c and (35)b are ungrammatical. However, it seems counter-intuitive to say that (52) and (53) have different verbs.

(52) I like to swim.

(53) I like dancing.
Besides, intuitively, (30)c seems to involve the same problem as (54).

(30)c* I like to swim and dancing.

(54)* To swim and dancing are healthy.

If we explain the ungrammaticality of (30)c by postulating two lexical entries for like, we also have to account for (54) by postulating two lexical entries for healthy, which seems to be counter-intuitive.

In conclusion, although it is possible to eliminate the Parallelism Condition by postulating two lexical entries for verbs like believe and want, etc., the proposal of two lexical entries in general seems to be counter-intuitive and too simple as an explanation.
Footnotes

1. In 4.1., we will refer to this requirement as the Immediate Dominance Condition. Although this condition is too strong for English, languages like Chinese have this condition. It should be noticed that if a language has the Immediate Dominance Condition, it doesn't need the Anti-ambiguity Condition.

2. I borrow this example from Ross (1967b P229).

3. As a matter of fact, we can make a successful outing at the track lower than it is in (4). For example,

   (60) John knows that I am confident of, and Mary believes that my boss depends on, a successful outing at the track.

(60), again, shows that it doesn't help us to count the numbers of the nodes from the conjuncts to identical elements.

4. Following Ross (1967b), we assume that in the process of Adverb Preposing, the adjunction of an adverb to the original S node is a Chomsky-adjunction.

5. Perhaps, Fillmore's (1968) case grammar can explain the fact that b forms in (41)-(42) are unnatural as due to a general constraint that noun phrases with different cases can not be conjoined.

6. However, since "faculty" is a countless noun, the NP dominating it must have Det. If so, $S_2$ in (10) does not have a phrase-marker generable by the deep structure.
IV. LANGUAGE TYPOLOGY IN COORDINATION REDUCTION

We have proposed that the present formulation is universal. However, it is expected that languages can differ from each other in coordination. Within the framework of our present formulation, these differences will be explained as due to language-particular conditions either on Identity Deletion or on Regrouping.

4.1. Immediate Dominance Condition in Languages Like Chinese

There are languages like Chinese where there is no Gapping. For example,

(1a) wǒ chīle lǐ, nǐ chīle píngguǒ.
    I ate peach you ate apple

(I ate the peach and you ate the apple.)

b* wǒ chīle lǐ, nǐ, píngguǒ.

(I ate the peach and you, the apple.)

(2a) wǒ dāle Chāngsān, nǐ dāle Līshì

(I hit Chāngsān and you hit Līshì.)

b* wǒ dāle Chāngsān, nǐ, Līshì.

(I hit Chāngsān and you, Līshì.)

Interestingly enough, identity deletion of the object NP in a coordinate sentence is also impossible. For example,
(3a) "wo maile li, ni chile li.
   bought

   (I bought the peach and you ate the peach.)

b* "wo maile, ni chile, li.

   (I bought, and you ate, the peach.)

(4a) "wo tile Changsan, ni dale Changsan.
   kicked

   (I kicked Changsan and you hit Changsan.)

b* "wo tile, ni dale, Changsan.

   (I kicked, and you hit, Changsan.)

Obviously HICC, which we propose in 1.4., can not account for the b forms of (1)-(4). It cannot be the case that Mandarin has no Coordination Reduction. For subject NP's and VP's can undergo Coordination Reduction. For example,

(5a) "wo dale Changsan, wo tile Lishi.

   (I hit Changsan, and I kicked Lishi.)

b "wo dale Changsan, tile Lishi.

   (I hit Changsan and kicked Lishi.)

(6a) "wo dale Changsan, ni dale Changsan.

   (I hit Changsan and you hit Changsan.)

b "wo gen ni dale Changsan.

   and

   (I and you hit Changsan.)

Furthermore, just like English, derived subject NP's and VP's can undergo Coordination Reduction. For example,
(7)a  

(7)b

Since sentence with bei constructions are derivable in a very general way by means of a Passive Transformation, coordinations like (7)b cannot plausibly be accounted for except by reduction.

To account for (1)-(7), a stronger condition than HICC is necessary. For languages like Chinese, we propose the Immediate Dominance Condition (IDC), which can be stated as:

In a coordinate structure, only constituents which are immediately dominated by conjuncts can undergo identity deletion.

It should be noticed that IDC is not in contradiction with HICC, but rather, that the former is a special case of the latter. We have proposed in 1.4 that HICC is a universal condition for Coordination Reduction; here we claim that in languages like Chinese, this universal condition HICC has an extra condition, namely, that the highest identical nodes must be immediately dominated by conjuncts when they undergo Coordination Reduction.

Since we have assumed that Coordination Reduction can reapply, we predict that in Chinese, there are object coordina-
tions and verb coordinations if and only if there is prior reduction of subjects.

(8)a  wódale Changsăn, wódale Lishi.
      (I hit Changsan and I hit Lishi.)

b  wódale Changsăn, dale Lishi.
     (I hit Changsan and hit Lishi.)

c  wódale Changsăn gên lishi.
     (I hit Changsan and Lishi.)

It can be easily seen that although dale is not immediately dominated by the S conjuncts in (8)a, it is immediately dominated by the VP conjuncts in (8)b. Therefore, Coordination Reduction will apply to (8)b to yield (8)c.

(9)a  wódale Changsăn, wódile Changsăn.
      (I hit Changsan and I kicked Changsan.)

b  wódale Changsăn, tile Changsăn.
     (I hit Changsan and kicked Changsan.)

c  wódile, tile Changsăn.²
     (I hit and kicked Changsan.)

Again, it can be seen that Changsan is not immediately dominated by conjuncts in (9)a, but it is in (9)b, therefore we get (9)c.

As a matter of fact, IDC is supported by other aspects of coordination reduction in Chinese. Consider

(10)a  wód zuótIan dale Changsăn, ni jîntian dale Changsăn.
       yesterday                       today
      (Yesterday, I hit Changsan and today you hit Changsan.)
b* wǒ zuótiān, nǐ jiàntiān, dāle Chāngsān.
(Yesterday I, and today you, hit Chāngsān.)

(11)a wǒ zuótiān dāle Chāngsān, nǐ zuótiān dāle Chāngsān.
(Yesterday I hit Chāngsān and yesterday you hit Chāngsān.)

b wǒ gēn nǐ zuótiān dāle Chāngsān.
(Yesterday, I and you hit Chāngsān.)

In (10)a and (11)a, the node which is immediately dominated by conjuncts is Pred, and not VP. Therefore dāle Chāngsān as VP can not undergo Coordination Reduction in (10)a, although it can undergo Coordination Reduction is (6)a. Yet, zuòtiān dāle Chāngsān as a Pred can undergo Coordination Reduction, since it is immediately dominated by conjuncts. (11)b therefore is grammatical. The same explanation is applicable for

(12)a wǒ yào dā Chāngsān, nǐ bù yào dā Chāngsān.
(I want to hit Chāngsān, and you don't want to hit Chāngsān.)

b* wǒ yào, nǐ bù yào, dā Chāngsān.
(I want, and you don't want, to hit Chāngsān.)

(13)a wǒ yào dā Chāngsān, nǐ yào dā Chāngsān.
(I want to hit Chāngsān, and you want to hit Chāngsān.)
b wǒ gēn nǐ yào da Changsàn.
(I and you want to hit Changsan.)

The relativity of the IDC can be seen again in the context in which yào da Changsàn, which can undergo identity deletion in (13)a, can not undergo identity deletion. For example, in (14)a, yào da Changsàn can not undergo identity deletion, because it is not immediately dominated by the conjuncts.

(14)a wǒ jīntiān yào da Changsàn, nǐ mǐntiān yào da Changsàn.
(Today I want to hit Changsan, and tomorrow you want to hit Changsan.)

b* wǒ jīntiān, nǐ mǐntiān, yào da Changsàn.
(Today I, and tomorrow you, want to hit Changsan.)

In (15)a, jīntiēn yào da Changsàn is immediately dominated by the conjuncts, therefore (15)a can be converted into (15)b.

(15)a wǒ jīntiān yào da Changsàn, nǐ jīntiān yào da Changsàn.
(Today I want to hit Changsan, and today you want to hit Changsan.)

b wǒ gēn nǐ jīntiān yào da Changsàn.
(Today you and I want to hit Changsan.)

IDC also explains the contrast between

(4)a wǒ tīle Changsàn, nǐ dāle Changsàn.
(I kicked Changsan, and you hit Changsan.)

b* 你 tile, 你 dale, Changsan

(I kicked, and you hit, Changsan.)

(16)a Changsan, 你 tile, Changsan 你 dale.

(Changsan, I kicked, and Changsan, you hit.)

b Changsan, you tile, you dale.

(Changsan, I kicked, and you hit.)

Although Changsan in (4)a is not immediately dominated by the conjuncts, it is in (16)a as can be seen in

(17)

Similarly, Changsan in (18)a is immediately dominated by the conjuncts.

(18)a Changsan beǐ you tile, Changsan beǐ you dale.

(Changsan was kicked by me, and Changsan was hit by you.)

b Changsan beǐ you tile, beǐ you dale.

(Changsan was kicked by me, and was hit by you.)
It should be noted, however, that the particle *bei* in (18)b can not undergo identity deletion to yield
(18)c* Changsan *bei* wo tile, ni dale.

(Changsan was kicked by me and hit by you.)

(18)c can be explained, if *bei* is attached to NP, and not to VP in (18)b. Namely, the structure of (18)b is

(19)

Thus, although the two *bei*'s are identical, they are not immediately dominated by conjuncts and thus not subject to deletion.

We have seen that Chinese has no type B coordinations because of the IDC Condition. In the present formulation, we have derived optionally type C and type D coordinations from type-B coordinations. Our theory should predict that in Chinese there is no type C and type D coordinations. In fact, our prediction is correct. There are no "respectively" constructions in Chinese, and no "each-other" constructions. The reason is that because of IDC, after Identity Deletion, Chinese always ends up with non-branching conjuncts, Regrouping there-
fore always has to obligatorily apply to Chomsky-adjoin only one node. The result is that Chinese has only type A coor-
dination.

One might argue that it is often seen that in Chinese-English dictionaries the morpheme "respectively" is translated as corresponding to "ge-zi" or "fen-bie." It is however clear that the translation is not precise at all. For example,

(20) Changsan gen Lishi ge-zi chile li gen pinguo. and ate peach apple
can only be translated as

(21) Changsan and Lishi ate the peach and the apple separately.

Similarly, sentences like

(22) Changsan gen Lishi fenbie chile li gen pinguo
can only be translated as

(23) Changsan and Lishi, one ate the peach, and the other ate the apple.

In (20), Changsan can have eaten the peach or the apple or both; the same is true for Lishi. In (22), Changsan can have eaten the peach or the apple but not both; the same is true for Lishi. Neither in (20) nor in (22), can Changsan and Lishi be paired off with the peach and the apple in the same way as conjoined subjects can be paired off with conjoined objects in English "respectively" constructions. To express the
meaning of "respectively", Chinese just uses unreduced conjoined sentences.

Although it is true that in English-Chinese dictionaries, "each other" is translated as "hū-xīāng" in Chinese. There is evidence that Chinese has no genuine "each other" constructions. First, "hū-xīāng" has no formal appearance of being a pronoun like "each-other" in English. Second, we can use Ross' Coordinate Structure Constraint (CSC) as a test to show that Chinese has no "each other" constructions.

Ross has proposed a Coordinate Structure Constraint to the effect that "In a coordinate structure, no conjunct may be moved, nor may any element contained in a conjunct be moved out of that conjunct." (Ross 1967b P161).

This constraint explains why sentences resulting from question or relative shifting of a conjunct are ungrammatical in English.

(24)a James likes peaches and apples.
     b* What does James like and apples?

(25)a The boy whom you kicked and hit is my brother.
     b* The boy whom you kicked and hit the girl is my brother.

Assuming that Relative Clause Rormation follows Conjunct Movement, Ross is also able to explain the contrast.
(26) a* Who and Bill left together?
   b  Who left together with Bill?
(27) a* The boy who and the girl left together is my brother.
   b  The boy who left together with the girl is my brother.

The application of CSC to Chinese requires some explanation. First, it must be pointed out that there is no Wh Q Movement in Chinese.\(^5\) CSC is a movement constraint, we therefore expect that it does not apply to Question Formation in Chinese.

(29) 你 xièhuān shènme gēn lǐ?
you like what and peach

(*What do you like and the peach?)

However, CSC applies to Relative Clause Formation in Chinese. Superficially, Relative Clause Formation in Chinese does not involve reordering as in English, but only involves deleting the identical NP in the embedded sentence. For the purpose of present argument, we will assume that Relative Clause Formation in Chinese does involve reordering. This assumption enables us to explain

(30) a 你 tiě, dāle de nánhái zì shì wǒ gēge.
you kicked hit boy is my older brother

(The boy whom you kicked and hit is my brother.)
b* nǐ tīle, dāle nühaizi de nánhai zi shì wǒ gēge.
you kicked hit girl boy is my older brother

(*The boy whom you kicked and hit the girl is my brother.)

(30)b can only be blocked by means of CSC.

Based on the observation that CSC applies both to Chinese and English, we can show that gen (31) in fact involves a different structure from and of (32).

(31) nánhai zi gēn nühaizi huxiāng xīhuān.
boy and girl reciprocally like

(The boy and the girl like each other.)

(32) The boy and the girl like each other.

Neither the boy nor the girl in (32) can be relativized as seen in

(33)a* The boy who and the girl like each other is my brother.

b* The girl who and the boy like each other is my sister.

However, both nánhai zi and nühaizi in (31) can be relativized as seen by

(34)a gēn nühaizi huxiāng xīhuān de nánhai zi shì wǒ and girl reciprocally like boy is my

gege.
older brother

(*The boy who and the girl like each other is my older brother.)
b) gēn nánhaizi hūxiāng xǐhuan de nūhaizi shì
   wǒ mèimei.
   younger sister

(*The girl who and the boy like each other is
my younger sister.)

We can explain the difference between (33) and (34), if
we assume that structure of (31) is something like

(35)

If (35) is the correct structure of (31), then we have
very strong evidence that Chinese has no genuine "each-
other" construction.6

We have shown that the fact that Chinese has
only type A coordination reduction can be well explained
by the IDC hypothesis. We predict that any language which
has IDC, and which has no other special condition either on
Identity Deletion or on Regrouping has also only Type A
coordination reduction.
4.2. Split Conjuncts in Hungarian

In 4.1., we have seen that IDC as special condition on Identity Deletion makes Chinese different from other languages in coordination reduction. In this section, we will argue that Hungarian has a special condition on Re-grouping. This special condition is that Regrouping in Hungarian is always optional, no matter whether the conjuncts which have undergone Identity Deletion are still branching or not.

Koutsoudas (1968) observes that in Hungarian,7 when two objects are conjoined, the objects may be split, and if the object is split, the verbs agree in definiteness with the noun on the left, and not on the right. If the conjoined object is not split, then the verb always agrees in definiteness with the closest noun of the conjoined object, before or after the verb.

(41) a fiuu laat ed' laañåt.
the boy sees a girl
(The boy sees a girl.)

(42) a fiuu ed' laañåt laat.
(The boy sees a girl.)

(43) a fiuu laatja a laañåt.
(The boy sees the girl.)

(44) a fiuu a laañåt laatja
(The boy sees the girl.)
(45)* a fiuu a laaŋt laat.

(46)* a fiuu laatja ed' laaŋt.

(41)-(46) shows that the verb agrees with the object in definiteness.

(47) a tanaar laatja a fiuu ees ed' laaŋt.

(The teacher sees the boy and a girl.)

(48) a tanaar ed' laaŋt ees a fiuu laatja.

(The teacher sees the boy and a girl.)

(49)* a tanaar laatja ed' laaŋt ees a fiuu.

(50)* a tanaar a fiuu ees ed' laaŋt laatja.

(47)-(50) shows that the verb agrees with the closest noun when both nouns are on the same side.

(51) a tanaar a fiuu laatja ees ed laaŋt.

(The teacher sees the boy and a girl.)

(52) a tanaar ed' laaŋt laat ees a fiuu.

(The teacher sees the boy and a girl.)

(53)* a tanaar a fiuu laat ees ed' laaŋt.

(54)* a tanaar ed' laaŋt laatja ees a fiuu.

(51)-(54) shows that the verb agrees with the left object when two objects are split.

Koutsoudas argues that to account for (41) to (54), we need to apply Coordination Reduction, Agreement, and Permutation in this order. Now, if after Coordination Reduction and Agreement, we have,
we would run into trouble. Ross' CSC would require that the Object Permutation rule, which changes (41) into (42), take to the front the coordinate NP and not any of the two conjunct NP's in (55). But, then, we would have no way to get (51) and (52) where the conjuncts are separated by the verb.

Generally speaking, the existence of split conjuncts in languages like Hungarian constitutes a counter-example either to CSC, or to the directionality of deletion stated in Identity Deletion. With the problem of agreement involved, it seems to help little to say that Hungarian has a special deletion rule which works in a way opposite to that stated in Identity Deletion (as well as that stated in Ross' Gapping Hypothesis). Thus, the alternative is to say that CSC does not apply for Object Permutation in Hungarian, which is of course equal to saying that CSC is incorrect as a universal principle of grammar. Thus, any choice of these
two alternatives entails undesirable consequences. We can avoid these consequences, however, by imposing a special condition on Regrouping for Hungarian. This special condition is that in Hungarian, Regrouping is always optional, no matter whether the reduced conjuncts are still branching or not. In the following, we will show that this special condition on Regrouping in Hungarian provides a reasonable explanation for the phenomenon of split conjuncts in Hungarian.

If Regrouping is always optional in Hungarian, we have (56) and (57) after Coordination Reduction.

(56)

```
S
  /\       \      \     /\       \  
NP   VP     N     V   NP_0   NP_2
  /\   /\     /\    /\   /\      /\  
Det N  Det N  Det N  Det N
 a  tanaar  a  laat  ed'  laant
```

the teacher see the boy a girl
Now, we can order Object Permutation before Agreement. The rule of Object Permutation in Hungarian can be stated as

Object Permutation (optional)

\[ X \rightarrow [V-NP] \rightarrow Y \quad \text{-----} \quad X \rightarrow [NP-V] \rightarrow Y \]

Because of CSC, (58) is the only possible result of applying Object Permutation to (56)

(58)

When Object Permutation applies to (57), the result is
Object Permutation will not reapply to (59); the V and the
circled NP are not sister-adjoined to each other to the same
VP node, therefore (59) does not meet the structural descrip-
tion of Object Permutation.

The grammar which generates (58) and (59) will
also generate (60) and (61).
(61)

The rule of Agreement can be stated as

Agreement (obligatory)

\[
\begin{align*}
\begin{bmatrix} +V \end{bmatrix} & \longrightarrow \begin{bmatrix} \lambda \text{ Def} \end{bmatrix} \\
\end{align*}
\]

(a)

(b)

(a precedes b and they are disjunctively ordered)

Agreement (a) will apply to (59) and (61) to yield (51) and (52) respectively. Since (a) and (b) are in disjunctive order, (b) will not apply to (59) and (61). In this way, we account for the fact that in Hungarian, if the object is split, the verbs agree in definiteness with the object on the left, and not on the right. (a) will also apply to (60) to yield (48), and to (58) yield another grammatical sentence a tanaar a fiuu ees ed' laant laat (The teacher sees the boy and a girl). (b) will apply to (56) and (57) to yield (47). In this way, we account for the fact that in Hungarian, if the conjoined object is not split, the verbs agree in indefiniteness with the closest
noun of the conjoined objects.

Thus, in our theory, we distinguish typologically two kinds of languages in accordance with the existence and non-existence of split conjuncts. If Regrouping always applies optionally, no matter whether the reduced conjuncts are still branching or not, the result is the occurrence of split conjuncts. If the optionality of Regrouping depends on the branching informations after Identity Deletion has applied, the result is the non-occurrence of split conjuncts. In this way, we save CSC and the directionality principle stated in Gapping Hypothesis.

4.3. Conclusion:

Although we claim that our present formulation of Coordination Reduction is universal, we also admit the fact that languages can differ from each other in types of coordination reductions, and consequently in types of coordinations. In fact, we have designed our present formulation in such a way that typological differences between languages can be accounted for either as due to a special condition on Identity Deletion, or as a special condition on Regrouping. We have shown that according to our present formulation of Coordination Reduction, the particular restrictions on coordinations in Chinese can be explained as due to a special condition on Identity Deletion. We have also seen that the phenomenon of split conjuncts in Hungarian can be explained as due to a spec-
ial condition on Regrouping. There are other logical possibilities implied in our present formulation. For example, if a language which has no IDC on Identity Deletion, yet which requires that Regrouping must always obligatorily apply, no matter whether the reduced conjuncts are still branching or not (a situation opposite to that of Hungarian), then this language must have type A, type C, and type D, but not type B coordination reduction. For another example, if a language has no IDC, but has a special condition on Regrouping which says that only non-branching reduced conjuncts can undergo Regrouping, then this language has only type A and type B coordination reduction. In our present theory, we claim that every language has type A coordination reduction, and that languages which have type C coordination reduction must also have type D coordination reduction, if they have Each Other pronominalization.
Footnotes

1. In Gerald A. Sanders and James H-Y. Tai (1969), the Immediate Dominance Condition has been extended to the effect that "identical constituents can be deleted only if they are either immediately dominated by conjuncts of a coordination or by a subordinate clause." This condition does not only explain the hierarchical restrictions on Coordination Reduction in languages like Chinese, but also provides a unitary explanation of the hitherto unexplained pattern of pronominalization in relative clauses in Chinese and, possibly, various other IDC languages.

2. However, it must be noticed that some native speakers of Chinese do not like (9)c. For these people, (70) seems to be more acceptable than (9)c.

   (70) wǒ bā Chāngsān dāle, tīle.
       I      hit     kicked

       I hit and kicked Changsan.

3. Following Ross (1967b), we assume that in the process of Topicalization, the topicalized NP is Chomsky-adjoined to the original S node.

4. For a detailed discussion of the theory of Conjunct Movement, see Lakoff and Peters (1968). See also 5.1 in the present dissertation.
5. The evidence is that an NP in relative clause can be questioned.

For example,

(71) shèi xǐhuān de nèi-ge háizǐ méi-yǒu lái?
who like that child has not come

(*The child whom who likes has not come?)

The ungrammaticality of (71) in English can be explained by Ross' Complex NP Constraint (see Ross 1967b). Ross' constraint is a movement constraint, yet there is no question fronting in Chinese, therefore (71) in Chinese is grammatical.

6. One might feel like to argue that although CSC does apply to Chinese as (30) shows, it is still possible that CSC does not apply to "gen" constructions in Chinese. Even granting that this kind of argument is valid, we still can show that in cases where "gen" constructions are genuine coordinate structures, CSC does apply. For example,

(72)* gēn wǒ dōu lái de nángháizi shì wǒ gēgē.
and I all come boy is my older brother

(*The boy who and I both came is my older brother.)

7. The following data are borrowed from Koutsoudas (1968).
8. Assuming that there is a convention for disjunctive ordered mirror image rules, \( a \) and \( b \) subrules can be collapsed into

\[
[+v] \longrightarrow [\not\text{Def}] / [\text{NP}]
\]
V. THE DERIVATION OF LAKOFF AND PETERS' PHRASAL CONJUNCTION

In this chapter, we will argue that Lakoff and Peters' (1966) Phrasal Conjunction can be derived through Coordination Reduction.

5.1. Inadequacies of Lakoff and Peters' theory of Conjunct Movement.

In Lakoff and Peters' analysis, sentences like

(1)a John and Bill conferred.
   b Bill and John conferred.

(2)a John and Bill are similar.
   b Bill and John are similar.

are not derived from Coordination Reduction, but rather generated by rule schema

(3) NP* \rightarrow \rightarrow \rightarrow NP^n \quad n \geq 2

A transformation called Conjunct Movement then optionally applies to (1) and (2) to yield (4) and (5) respectively

(4)a John conferred with Bill.
   b Bill conferred with John.

(50) John is similar to Bill.
   b Bill is similar to John.

The basic motivation for the distinction between phrasal conjunction and sentence conjunction is based on the fact that sentences like (1) and (2) can not be derived from
Coordination Reduction because of the ungrammaticality of

(6)* Bill conferred.
   * John conferred.
(7)* John is similar.
   * Bill is similar.

Of course, several syntactic arguments are given by Lakoff and Peters to support this distinction in the deep structure. Firstly, they argue that this distinction accounts for the fact that (8) is two ways ambiguous, and can be paraphrased as (9) or (10).

(8) John and Bill left.
(9) John left with Bill.
(10) Both John and Bill left.

Secondly, they claim that this distinction explains the fact that together can occur with with, but not with both

(11)a John and Bill left together.
   b John left together with Bill.
(12)* Both John and Bill left together.

Thirdly, the ungrammaticality of (13) and (14) can be explained by the generality that most stative verbs and adjectives may not take Phrasal Conjunction in the deep structure.

(13)* John and Mary know the answer together.
   * John knows the answer with Mary.
(14)* John and Mary are careful together.
* John is careful with Mary.

Justifications for the postulation of Conjunct Movement are also given by Lakoff and Peters. Firstly, they argue that in (15) Bill is understood as part of the superficial subject of "be killed", while in (16) Bill is understood as having killed someone.

(15) John was killed with Bill.
(16) John killed a man with Bill.

They argue that the grammatical relation of John to Bill is only predictable when with phrases are derived from Conjunct Movement. Thus, (15) would be derived from

(17) John and Bill were killed.

while (16) would be derived from

(18) John and Bill killed a man.

Their second argument for Conjunct Movement is that the ungrammaticality of

(19)* John left with himself.

can be naturally accounted for, since it is derived from the structure underlying¹

(20)a* John and John left.
  b* John and himself left.

Their third argument is that Conjunct Movement can explain the ungrammaticality of sentences like

(21)* Joe is resembled by Bill.
by ordering Conjunct Movement after the Passive Transformation.

The notion of Conjunct Movement constitutes a counter-example to Perlmutter's hypothesis that the Like-subject Constraint is a deep structure constraint, and not a transformational constraint. To remove this counterexample, Perlmutter argues that Conjunct Movement is not correct, and that sentences like (4) and (5) should be directly generated in the deep structure as with (to) constructions. His first argument is that (1)a is not synonymous with (4)a, nor (4)a with (4)b. He gives examples to show that the meaning difference between (4)a and (4)b becomes apparent in contexts like

(22)a I want Bill and me to confer.
   b I want Bill to confer with me.
   c I want to confer with Bill.

His second argument is that if Conjunct Movement is a transformation, it should be able to preserve well-formedness or ill-formedness of related sentences. But, it does not.

(23) Sam and I agreed to disagree.

(24)* Sam and I agreed for him to disagree with me.

If Sam disagree with me were derived from Sam and I disagree through Conjunct Movement, we would expect (23) and (24) to be equally bad or good. Similarly

(25) Sam and I agreed to protect ourselves.

(26)* Sam agreed with me to protect ourselves.
Having shown that Conjunct Movement can not be justified, Perlmutter proceeds to argue the justifications of introducing (4)a and (4)b as well as (1) in the deep structure. His first argument is that there are with constructions which can not be derived from Phrasal Conjunction. For example,

(27) I agreed with Sam's estimate.
(28)* I and Sam's estimate agreed.

The fact that (27) can not be derived from (28) shows that the with construction has to be generated in the deep structure. His second argument is that imperative sentences can have only you as subject in the deep structure, therefore, the deep structure of

(29) Confer with James.

is

(30) You confer with James.

and not

(31) You and James confer.

Then Perlmutter argues that the evidence for Conjunct Movement given by Lakoff and Peters is not true. Firstly, he shows that not all noun phrases in the with phrase participate in grammatical relations with the verb as Bill does in John left with Bill. For example, in

(32) I ate chicken paprikas with Salvatore.

Salvatore may have not eaten chicken paprikas, but rather
something else, say, hot dogs, or eggs. He also points out that the grammatical relation of noun phrases in *with* phrases in the passive sentences is not always as predictable as in the case of Bill in (15). For example, in

(33) Czechoslovakia will doubtlessly be invaded by the Soviets with the Poles and Hungarians.

the Poles and Hungarians are understood as invading Czechoslovakia with the Soviets and not as being invaded by the Soviets. Secondly, he argues that since the noun phrase in the *with* phrase does not necessarily participate in grammatical relations with the verb as in (164), Lakoff and Peters' second argument for Conjunct Movement vanishes. Thirdly, he argues that there are examples which Lakoff and Peters would derive from Phrasal Conjunction through Conjunct Movement, yet to which Passive Transformation does apply

(34) Peter's intelligence is equalled by his wisdom.

Lakoff and Peters' third argument for Conjunct Movement fails.

It should be noticed that Perlmutter does not argue against Phrasal Conjunction, but only against Conjunct Movement. However, without Conjunct Movement, Lakoff and Peters' theory of Phrasal Conjunction would become weakened. In the following section, we will show that our present formulation can derive Lakoff and Peters' NP* from Coordination Reduction as Gleitman (1965) has attempted to do.
5.2. Coordination Reduction and the Derivation of NP

In our present theory, we generate only coordination-free sentences like (4) and (5) in the deep structure, but not sentences with NP like (1) and (2). Before Coordination Reduction applies, we have only

(40) John conferred with Bill and Bill conferred with John.

After Identity Deletion, (40) becomes

(41) John conferred with Bill and Bill, with John.

Since the reduced conjunct in (41) is still branching, Regrouping therefore will optionally apply to (41) to yield

(42)* John and Bill conferred with Bill and John respectively.

Each Other Pronominalization ther applies to (42) to yield

(43)* John and Bill conferred with each other respectively.

Respectively Deletion then applies to (43) to give

(44) John and Bill conferred with each other.

Prep-Each-Other Deletion then will convert (44) into

(1)a John and Bill conferred.

Similarly, before Coordination Reduction, we have only

(45) John is similar to Bill and Bill is similar to John.

After Identity Deletion, (45) becomes

(46) John is similar to Bill and Bill, to John.

Since the reduced conjunct in (46) is still branching, Regrouping therefore will optionally apply to (46) to yield
(47)* John and Bill are similar to Bill and John respectively.

Each Other Pronominalization then applies to (47) to yield

(48)* John and Bill are similar to each other respectively.

Respectively Deletion then applies to (48) to yield

(49) John and Bill are similar to each other.

Prep-Each-Other Deletion then optionally applies to (49) to yield

(2)a John and Bill are similar.

Notice that we have derived (44) and (49) just like we have derived sentences like

(50) James and John hit each other.

The only difference between (44) and (49) on one side and (50) on the other side is that while the former can optionally undergo Prep-Each-Other Deletion, the latter can not, because it has no preposition before each other, and therefore does not meet the structural description of Prep-Each-Other Deletion.³

In our theory, verbs like confer and similar are treated like transitive verbs and marked in the lexicon with the strict subcategorization context feature +NP. Preposition like with and to are spelled out from the lexical entries of confer (with) and similar (To) before Coordination Reduction applies. The fact that confer and similar are transitive verbs in the deep structure explains why sentences like (6) and (7)
are ungrammatical.

(6)* Bill conferred.

(7)* John is similar.

Verbs like resemble, which have been treated in Lakoff and Peters' theory as taking NP* in the deep structure and obligatorily undergoing Conjunct Movement, now in our theory can be simply treated as transitive verbs. This explains the contrast between (51)a and (51)b.

(51)a John resembles Bill.

b* John resembles.

Thus, before Coordination Reduction, we have

(52) John resembles Bill and Bill resembles John.

Identity Deletion applies to (52) to give

(53) John resembles Bill and Bill, John.

Regrouping optionally applies to (53) to give

(54)* John and Bill resemble Bill and John respectively.

Each Other Pronominalization and Respectively Deletion then turn (54) into

(55) John and Bill resemble each other.

The phrase each other in (55) won't be deleted, since there is no preposition before it. This explains the ungrammaticality of

(56)* John and Bill resemble.

Thus, in our theory, the ungrammaticality of (56) is explained
in the same way as the ungrammaticality of

(57)* James and John hit.

Notice that if there is no Conjunct Movement, Lakoff and Peters' theory can not treat resemble as a verb which can take NP*, since (56) is ungrammatical. And they can no longer use NP* to explain why

(58)* James is resembled by John.

In our present theory, we need to mark transitive verbs like resemble, confer (With), and similar (To) with rule feature [-passive].

In the present theory, the source for

(59) John and Bill left (together).

is

(60) John left with Bill and Bill left with John.

After Identity Deletion and Regrouping, (60) becomes

(61)* John and Bill left with Bill and John respectively.

After Each Other Pronominalization and Respectively Deletion, (60) can be converted into

(62)?? John and Bill left with each other.

We have to obligatorily delete with each other in (62) to get (59). We have treated confer (With) as a transitive verb. If we treat left as an intransitive, we can account for the contrast between (6) and (63).
(6)* John conferred.

(63) John left.

In view of the contrast, we will assume that John left with Bill has the structure of

(64)

```
S
  └── NP
      └── John
  └── Pred
      └── VP
          └── Adv
              └── NP
                  └── P
                      └── NP
                          └── with
                              └── Bill
```

We will also assume that John conferred with Bill has the structure of (65), after the preposition with is spelled out and Chomsky-adjoined to the object noun phrase Bill.

(65)

```
S
  └── NP
      └── John
  └── Pred
      └── VP
          └── P
              └── NP
                  └── with
                      └── Bill
```

If (64) and (65) are correct, (62) can be represented as

(66)

```
S
  └── NP
      └── NP
          └── and
              └── NP
                  └── John
  └── Pred
      └── NP
          └── VP
              └── Adv
                  └── NP
                      └── with
                          └── each other
```

```
S
  └── NP
      └── NP
          └── and
              └── NP
                  └── John
  └── Pred
      └── NP
          └── VP
              └── P
                  └── NP
                      └── with
                          └── each other
```
and (44) can be represented as

(67)

Now, it can be seen that while in (66) with each other is dominated by Adv, in (67) it is dominated by NP. We can specify that Prep-Each-Other Deletion is obligatory when the Prep-Each-Other phrase is dominated by Adv, but is optional when it is dominated by NP. In this way, we account for the difference between sentences like (44) and sentences like (62).

So far, we have only considered the derivation of NP* in the case of the subject. In the following, we will show that our arguments also hold for the derivation of NP* in the case of the object. Consider sentences like

(68) He combined oxygen and hydrogen.

In our present theory, the source for (68) is

(69) He combined oxygen with hydrogen, and he combined hydrogen with oxygen.

After Identity Deletion and Regrouping, we first get

(70)* He combined oxygen and hydrogen with hydrogen and oxygen respectively.
After Each Other Pronominalization and Respectively Deletion, (70) is turned into

(71) He combined oxygen and hydrogen with each other.

Prep-Each-Other Deletion optionally applies to (71) to give

(72) He combined oxygen and hydrogen.

Now, consider sentences like

(73) I ate spaghetti and meatballs (together).

In our present theory, (73) is derived from

(74) I ate spaghetti with meatballs and I ate meatballs with spaghetti.

Through Identity Deletion and Regrouping, (74) is turned into

(75)* I ate spaghetti and meatballs with meatballs and spaghetti respectively.

Through Each Other Pronominalization and Respectively Deletion, (75) is turned into

(76)* I ate spaghetti and meatballs with each other.

Now, Prep-Each-Other Deletion has to obligatorily apply to (76) to yield (73).

Again, we have to explain why in (71) with each other can be optionally deleted, but in (76) it has to be obligatorily deleted. Consider the contrast between (77) and (78).

(77)* He combined oxygen.

(78) I ate spaghetti.

The contrast can be explained, if we treat combine as a transi-
tive verb which can only take double objects. (79) and (80) therefore can be represented as (81) and (82) respectively.

(79) He combined oxygen with hydrogen.

(80) I ate spaghetti with meatballs.

(81)

```
NP
   S
      Pred
         VP
            V
                NP
                oxygen
            with
                NP
                hydrogen
```

(82)

```
NP
   S
      Pred
         VP
            V
                NP
                ate
            with
                NP
                spaghetti
            and
                NP
                meatballs
```

If (81) and (82) are correct, the structures of (71) and (76) will be (83) and (84) respectively.

(83)

```
NP
   S
      Pred
         VP
            V
                NP
                combined
            and
                NP
                oxygen
            with
                NP
                hydrogen
            and
                NP
                each other
```

We have stated that Prep-Each-Other Deletion is obligatory when the Prep-Each-Other phrase is dominated by Adv, but is optional when it is dominated by NP. The same principle can apply to (83) and (84) to account for the difference between (71) and (76).

The question should be raised: why Adv is dominated by Pred in (64), but by VP in (82)? The reason is that while the with phrase in (64) participates in grammatical relations with the verb as the subject does, the with phrase in (82) participates in grammatical relations with the verb as the object does. This distinction is necessary because of the contrast between (85) and (86).

(85) I ate spaghetti with meatballs.

(86) I ate spaghetti with Bill.

While Bill in (86) ate the spaghetti, meatballs in (85) was eaten by I with spaghetti. Note that the contrast between (85) and (86) can not be always predicted by the distinction between animate noun phrases and inanimate noun phrases, for
example,

(87) I sold the cradle with the baby.

in (87), the baby definitely can be understood as having been sold by I or as having sold the cradle. In fact, for most of my informants, sentences like (88) are two ways ambiguous.4

(88) John killed a man with Bill.

For them, Bill can be understood either as having killed a man or as having been killed by John. (85) and (86) therefore have to be distinguished in their phrase-markers. In our present theory, they will be presented as (99) and (100) respectively

(99)

Whenever the with phrase is dominated by Pred, it participates in
grammatical relations as the subject does; whenever it is
dominated by VP, it participates in grammatical relations as
the object does. The ambiguity of (88) can be also account-
ed for by assigning two deep structures.

(101)

```
S
   /\   \
  NP  Pred
    /  \   /
VP  Adv  NP
  /   /   /
John killed a man with Bill
```

(102)

```
S
   /\   \
  NP  Pred
    /  \   /
VP  Adv  NP
  /   /   /
John killed a man with Bill
```

In (101), Bill is interpreted as having killed a man, but
in (102), Bill is interpreted as having been killed by John.
Now, if we apply the Passive Transformation to (88), we get

(103) A man was killed by John with Bill.

Again, for most of my informants, (103) is ambiguous in that
Bill can be either understood as having killed a man or as
having been killed by John. Note that our argument that (88)
and (103) are ambiguous is consistent with Perlmutter's
argument that the noun phrase in the with phrase does not
necessarily participate in grammatical relations with the verb as the subject does. The example which Lakoff and Peters use to support their theory of Conjunct Movement is

(104) John was killed with Bill.

It is true that Bill in (104) can be only understood as having been killed by someone. However, considering the fact that (88) and (103) are ambiguous, we have to explain the unambiguity of (104) in some other way. If we apply Pro-Deletion, which optionally delete someone and something in certain contexts, after the Passive Transformation, the previous stage for (104) then is

(105) John was killed by someone with Bill.

Unlike (104), (105) is ambiguous in that Bill can be understood either as having killed John or as having been killed by someone. We can specify that Pro-Deletion apply to (105) only when with Bill is dominated by Pred, but not when it is dominated by VP. This explains why while (105) is ambiguous, but not (104).

In concluding their theory of postulating NP* in the deep structure, Lakoff and Peters argue that it is impossible to derive NP* from "each other" constructions, because the grammatical relations which the with phrase expresses in sentences like (88) and (103) depends on whether or not the Passive Transformation has applied. We have,
however, shown that this very fact they have based their theory on is not correct for most of our informants. In addition, we have very clear cases like (33) in the passive form and (87) in the active form, which indicate that Lakoff and Peters' basic assumption on the grammatical relations of the with phrase is unreliable. 

Since Lakoff and Peters do not want to derive NP* from "each other" constructions, they have to derive sentences like

(106) John and Bill are similar to each other.

from a source like

(107)

After Conjunct Movement, (107) becomes

(108) John is similar to Bill and Bill is similar to John. (108) then is turned into

(109) John and Bill are similar to each other.

Lakoff and Peters are aware that (107) is redundant, therefore they claim that (109) is also redundant. However, in their treatment, sentences like

(110) John and Bill agreed with each other.
are derived from

(111) John and Bill agreed and Bill and John agreed.

Although (111) is redundant, (110) is not.

Furthermore, in their frame work, we have no explanatory way to account for why (110) is okay, but not

(112) John and Bill left with each other.

since the deep structure for (112) would now be

(113) John and Bill left and Bill and John left.

The structure of (113) is just like (111), to account for the difference between (110) and (112), in their framework, we have to mark lexical entries of left and agree as different with respect to the deletion of "each other" morpheme. In our treatment, the difference is essentially accounted for as the difference between a transitive and intransitive verbs with respect to "each-other" morpheme. It is even harder to see how Lakoff and Peters can derive

(114) He combined oxygen and hydrogen with each other.

from

(115) He combined oxygen and hydrogen and he combined hydrogen and oxygen.

They would have to say that Conjunct Movement applies vacuously to change (115) into

(116) He combined oxygen with hydrogen and he combined hydrogen with oxygen.
then turn (116) into (114).

In our theory, all these troubles can be avoided.

5.3. Conclusion

We have eliminated Lakoff and Peters' NP* in the deep structure, and we have derived it through Coordination Reduction, particularly, from "each other" constructions by either optionally or obligatorily deleting the "each other" phrase. This treatment is essentially similar to Gleitman's (1965), but we have given more justifications for this approach, and more detailed analysis of the relationship between NP* and the "each other" constructions are examined.
Footnotes

1. Gerald Sanders has pointed out to me that (20)a and (20)b are really worse than (19). His feeling is that (20)a and (20)b are not only semantically anomalous as (19) is, but also violate the general constraint that identical constituents can not be conjoined.

2. For the argument that Like-subject Constraint is a deep structure constraint, see Perlmutter (1968). Perlmutter argues that for verbs like try, the subject of complement sentence must be identical with the subject of matrix sentence in the deep structure. If there is a rule of Conjunct Movement, the deep structure of I try to confer with Bill would be I try I and Bill to confer. Since I and I and Bill are not identical, Conjunct Movement constitutes a counterexample to the claim that Like-subject Constraint is a deep structure constraint.

3. However, in order to account for the fact that John and Mary met each other can be optionally converted to John and Mary met, we have to postulate a hypothetical preposition for meet. There are other verbs like meet; perhaps, we need a hypothetical preposition to account for all these verbs.

4. In fact, for most of our informants in English, (88) can be three ways ambiguous. It can have any of the following three interpretations: (1) John and Bill killed a man.
(2) John killed a man and Bill. (3) John killed a man who was with Bill. (3) interpretation is irrelevant to the issue. But (2) interpretation falsifies Lakoff and Peters' claim that Bill in (88) is only understood as having killed a man.
VI. THE DERIVATION OF PLURALS

6.1. Plurals and Coordination Reduction

There are several obvious reasons that plurals have to be derived in the same way as conjoined singulars are derived. First, (1)a can be paraphrased as (1)b just like (2)a can be paraphrased as (2)b.

(1)a These two men read the book.

   b This one man read the book and this other man read the book.

(2)a John and Tom read the book.

   b John read the book and Tom read the book.

We have accounted for the synonymity between (2)a and (2)b by the fact that (2)a is derived from (2)b through Coordination Reduction. If (1)a were not derived from (1)b, we would have to account for the synonymity between (1)a and (1)b by semantic interpretations, which is a loss of generality.

Second, (3) is two ways ambiguous just like (4).

(3) These two men can lift the stone.

(4) John and Tom can lift the stone.

(3) has two readings of (a) John can lift the stone and Tom can lift the stone, and (b) John and Tom together can lift the stone. (4) has the same two parallel readings of (a) This man can lift the stone and this other man can lift the stone, and
(b) this one man and this other man together can lift the stone. The ambiguity of (4), in our theory, can be accounted for by the fact that (4) is derived from two distinct deep structures through Coordination Reduction. If the plural of (3) were in the deep structure, we would have again to account for the ambiguity of (3) through semantic interpretations whose nature is entirely unknown. Again, this is a loss of generality.

Third, plurals occur in "respectively" constructions just like conjoined singulars.

(5) These two men love Suzie and Mary respectively.

(6) John and Tom love Suzie and Mary respectively.

We have derived the morpheme "respectively" in (6) through Coordination Reduction. We have to derive the same morpheme in (5) in the same way; otherwise, there is another loss of generality.

Fourth, plurals occur in "each other" constructions just like conjoined singulars.

(7) These two men hit each other.

(8) John and Mary hit each other.

We have derived "each other" in (8) through Coordination Reduction, therefore we have also to derive "each other" in (7) through Coordination Reduction so that we can derive "each other" in (7) and (8) in the same way.
Fifth, plurals have the same selectional restrictions as conjoined singulacers with respect to adverbs and quantifiers.

(9)* James read the book together.
(10)* This man read the book together.
(11) James and Tom read the book together.
(12) These two men read the book together.
(13)* James each read the book.
(14)* This man each read the book.
(15) James and Tom each read the book.
(16) These men each read the book.

The data (1)-(16) show that plurals must receive the same treatment as conjoined singulacers. Since we have derived conjoined singulacers from Coordination Reduction, we have to derive plurals also from Coordination Reduction.

There are two independent reasons that plurals have to be derived from Coordination Reduction. First, if plurals are introduced in the deep structures, numerals have to be introduced in the deep structure too. For two reasons, it is undesirable for a theory of syntax to introduce all the numerals in the deep structure. First, it means that the lexicon is infinite, because the numerals are infinite. Second, the semantic component would have to introduce a system of arithemetic calculus of such processes as 1+1+1=3, and 1+2=3 ---- etc. in order to account for the synonymous
set as


b  I bought two books, and I bought another book.

c  I bought three books.

But, if numerals and plurals are all derived from Coordination Reduction, we need only "one" in the lexicon. Numerals more than "one" will be derived from Coordination Reduction. The fact that (17)a, (17)b and (17)c are synonymous now can be accounted for by deriving (17)b from (17)a, and (17)c from (17)b through Coordination Reduction.

Second, (18) is two ways ambiguous.

(18) James and Tom have three books between them.

(18) can be paraphrased into (19) or (20).

(19) James has two books and Tom has one book.

(20) James has one book and Tom has two books.

If we derive (18) from (19) and (20) through Coordination Reduction, the ambiguity of (18) can be accounted for. But, if numerals and plurals are introduced in the deep structure, the semantic component needs some interpretation rules to account for the ambiguity of (18).

6.2. Plural Formation

Following McCawley (1968), we will assign the
coreferential index to the noun phrase, and not to the head noun only. Thus, before Coordination Reduction applies, the structure of

(21) One man came and another man came.

can be represented as

(22)

\[ S_0 \quad \text{and} \quad S_1 \quad S_2 \]

\[ NP:x \quad VP \quad NP:y \quad VP \]

\[ \text{one man} \quad \text{came} \quad \text{one man} \quad \text{came} \]

It is understood that whenever two NP's are assigned different coreferential indices, they can not be considered as identical. Thus, one man in \( S_1 \) can not be considered as identical with one man in \( S_2 \). However, came in \( S_1 \) is identical with came in \( S_2 \). If Coordination Reduction, which is optional, does not apply to (22), the repeated one in (22) has to be obligatorily replaced by another so that we get grammatical sentence (21). If the Coordination Reduction applies to (22), we would first get

(23)

\[ S \]

\[ NP:x+y \quad NP \quad VP \]

\[ NP:x \quad NP:y \]

\[ \text{one man} \quad \text{and} \quad \text{one man} \quad \text{came} \]

\( x+y \) stands for the union of \( x \) and \( y \). The rule of Plural
Formation will optionally collapse _one man and one man_ in (23) into _two men_. Thus, we convert (23) into

(24) Two men came.

If the Plural Formation does not apply to (23), the repeated one in (23) has to be replaced by _another_. Thus, we get

(25) One man and another man came.

We can also start with

(26) This one man (_x_) _loves_ Suzie and this one man (_y_) _loves_ Mary.

If the Coordination Reduction does not apply to (26), then the repeated _one_ has to be converted into _other_, and _this other_ now has to be stressed. Thus, we have

(27) This one man _loves_ Suzie and this other man _loves_ Mary.

If the Coordination Reduction applies to (26), Identity Deletion would first change (26) into (28)

(28) This one man (_x_) _loves_ Suzie and this one man (_y_) _loves_ Mary.

Since the reduced conjunct in (28) is still branching, Regrouping is optional. If Regrouping does not apply to (28), (28) has to be changed into

(29) This one man loves Suzie and this other man, Mary.

If Regrouping applies to (28), we would first get
(30) This one man (x) and this one man (y) love Suzie and Mary respectively.

The rule of Plural Formation can now optionally apply to change (30) into

(31) These two men love Suzie and Mary respectively.

If Plural Formation does not apply to (30), (30) has to be changed to

(32) This one man and this other man love Suzie and Mary respectively.

We can also start with

(33) One man (x) hit one man (y) and one man (y) hit one man (x).

If Coordination Reduction does not apply to (33), (33) has to be changed into

(34) One man hit another man and the latter hit the former.

If Coordination Reduction applies to (33), we would get

(35)* One man (x) and one man (y) hit one man (y) and one man (x) respectively.

After Each Other Pronominalization and Respectively Deletion, (35) can be turned into

(36)* One man (x) and one man (y) hit each other.

If Plural Formation applies to (36), we get

(37) Two men hit each other.

If Plural Formation does not apply to (36), then (36) has to
be turned into

(38) One man and another man hit each other.

We can also start with

(39) One man (x) talked with one man (y) and one man (y)
talked with one man (x).

If Coordination Reduction does not apply to (39), then (39) has
to be changed into

(40) One man talked with another man and the latter talked
with the former.

If Coordination Reduction applies to (39), we get

(41)* One man (x) and one man (y) talked with one man (y)
one man (x) respectively.

After Each Other Pronominalization and Respectively Deletion,
(41) is changed into

(42)* One man (x) and one man (y) talked with each other.

If Plural Formation applies to (42), we get

(43) Two men talked with each other.

If Plural Formation does not apply to (42), the repeated one
in (42) has to be turned into another. The result is

(44) One man and another man talked with each other.

If we apply Prep-Each-Other Deletion to (43) and (44), we
would get (45) and (46) respectively.

(45) Two men talked.

(46) One man and another man talked.
Therefore, we have seen that plurals can be derived in the same way as conjoined singulars through Coordination Reduction. The only difference between plurals and conjoined singulars is that while the former have undergone the process of Plural Formation, the latter have not.

6.3. Some Discussions on Plurals

It has been argued in several places in the literature of transformational grammar that plurals can not be derived through Coordination Reduction. For example, Wierzbicka (1967) is quite suspicious of the correctness of the claim that (50) has 100,000 underlying sentences.

(50) All the 100,000 soldiers of Frederic the Great were at least 6 feet tall.

Dik (1968) agrees with her in that Coordination Reduction makes a funny claim that (50) has 100,000 underlying sentences. I don't think that Dik and Wierzbicka are right, and I feel that they have forgotten the important distinction between the theory of competence and that of performance. Since the rule schema of conjunction in the deep structure will generate a conjoined sentence containing 100,000 conjunct sentences, the derivation of (50) from 100,000 underlying sentences is totally under the prediction of the theory of Coordination Reduction.

A more serious objection to the proposal of deriving plurals from Coordination Reduction has been raised by Dik
(1968) and McCawley (1968). Consider

(51) The boys will come tomorrow.
(52) All the boys will come tomorrow.
(53) Many of the boys will come tomorrow.
(54) Some of the boys will come tomorrow.

In each of these sentences, the number of the boys is not indicated. Both Dik and McCawley argue that it is impossible to derive the plurals in (51)-(54) from Coordination Reduction, since for each of them, the number of the underlying sentences is unknown. I feel that they are worrying about a notational problem. Notice that the conjunction rule schema as formulated by Ross (see 1.1. (7)) will generate from 2 to infinite number of sentences. The number of the boys in (51) can be in fact interpreted as from 2 to infinite, as long as the context of (51) is unknown. A systematic representation for the notion of "infiniteness" can be used in linguistics as it has been used in mathematics. For the purpose of the derivation of plurals, we propose that the underlying representation for (51) is

(55)² The boy (x) will come tomorrow and the boy (y) will come tomorrow and ............

Coordination Reduction will render (55) into

(56) The boy (x) and the boy (y) and ............. will come tomorrow.
If Plural Formation applies to (56), the result is (51). If Plural Formation does not apply to (56), the result is

(57) The boy and the other boy and ............ will come tomorrow.

Now, the difference between (51) and (53)-(54) can be accounted for by introducing quantifiers all, many, and some as higher predicates of (51). In his English Quantifiers, Carden (1968) proposes that quantifiers can be represented as the verb phrases of the higher sentences. For example, (52), according to his system, can be represented as

(58)

```
    S
   /\  \\
  NP  S
 /  /  \\
the boys NP  VP
       /  \\
      all  will come tomorrow
```

Through a transformational rule called Q-Magic, (58) can be changed into

(59)

```
    S
   /\  \\
  NP  VP
 /  /  \\
all  NP
   /  \\
  the boys will come tomorrow
```

It seems, however, that all, many and some behave like an NP before a: definite NP, because
(60) All of the boys
    Many of the boys
    Some of the boys
    All the boys
    *Many the boys
    *Some the boys

Thus, we propose that the previous stage for (52) is not (58), but

(61)

After Q-Magic, (61) is converted to

(62)

The rule of Preposition Insertion will insert of optionally between two NP's. This rule is optional for all, but obligatory for some and many.

Now, the question is: how do we get (61), if we do not have the plural the boys in the deep structure? In our present theory, the deep structure for (61) is
(63) The boy (x) # the boy (x) will come tomorrow# be all and
      The boy (y) # the boy (y) will come tomorrow# be all and....

We can mark all, some, and many with the feature [+Plural-Formation].³ This feature means that the subjects of these predicates marked with [+Plural-Formation] must undergo Plural Formation. This is a rule feature and is similar to the feature [-Equi-NP-Deletion] for verbs like try. Since all is marked with [+Plural-Formation], we exclude

(64)* All the boy will come tomorrow.

For the same reason, if Coordination Reduction does not apply to (63), Plural Formation will not apply either. Therefore, (63) will be excluded too. But, if Coordination Reduction applies to (63), we get (61) and from (61), we get (52). The treatment of all applies to all other quantifiers like some, many and others.⁴

It should be noticed that we have not claimed that all plurals in the surface structure should be derived from Coordination Reduction. All that we want to show is that it is not necessary to postulate plurals in the deep structure, since they can either be derived through Coordination Reduction or through other independently motivated syntactic features. Consider,
(65) Boys are brave.

(66) All boys are brave.

(67) Many boys are brave.

(68) Some boys are brave.

Obviously, (65)-(68) are all generic statements. It would be meaningless to argue that boys in these sentences is also derived from Coordination Reduction. Similarly, sentences like

(69) The real numbers are fine.

(70) The irrational numbers are divine.

should be also considered as generic assertions. We feel that it is necessary to distinguish sentences (51)-(54) from sentences (65)-(70). We assume that (65)-(70) are not derived from Coordination Reduction, and that the plural form of noun phrases in these sentences is the morphological realization of the postulated syntactic feature [+generic] attached to nouns in the lexicon. This approach accounts for the semantic differences between sentences like (51) and those like (65). At the same time, it also accounts for the semantic and selectional equivalence of (71) and (72).

(71) Dogs are loyal animals.

(72) A dog is a loyal animal.

There is another case where the plural form in the surface structure is not derived from Coordination Reduction. Consider,
(73) These scissors are sharp.

In (73), **these scissors** can mean either this pair of scissors or these pairs of scissors. McCawley (1968) calls the class of nouns such as scissors "pluralia tantum." (73) with the reading of "these pairs of scissors" can be derived from Coordination Reduction, but (73) with the reading of "this pair of scissors" can not. This shows that **scissors** has to be marked, say, as having the feature \(+\)pluralia tantum\). This feature will not give any semantic interpretation of plurality, but only give the plural form in the surface structure.

There are other arguments given by Dougherty (1968) against the deriving of plurals from Coordination Reduction. In general, his arguments are not strong enough to falsify the hypothesis of deriving plurals from the coordination of singulars. Some of his arguments are like that of Wierzbicka which we have shown, or like that given in (51)-(54). Some of his arguments are simply based on the assumption that once one claims that plurals can be derived from Coordination Reduction, he has to derive those plurals in (65)-(73) from Coordination Reduction too. The others of his arguments against the deriving of plurals from Coordination Reduction are not even so serious as that in (51)-(54). For example, one of his arguments is that there are certain predicates which can have a plural noun phrase as subject but cannot have a conjunction of
singular noun phrases as a subject. His examples are

(74)* John, Bill, and Tom are numerous.

(75) The men are numerous.

(76)* John, Bill, and Tom were plentiful.

(77) Soldiers are plentiful.

In our present theory, all that we need to do is again to
mark predicates such as numerous and plentiful with the rule
feature [+Plural-Formation]. With this feature, not only (74)
and (76) are excluded, but also

(78)* The man is numerous.

(79)* John is numerous.

Notice that we have used the same rule feature for all, some,
and many, which are considered as higher predicates. We should
expect a parallelism between these two sets of predicates. The
parallelism becomes clear, if we compare (74)-(77) with the
following set.

(80)* All of John, Bill, and Tom --------------.

* Some of John, Bill, and Tom --------------.

* Many of John, Bill, and Tom --------------.

(81) All of the men --------------.

Some of the men --------------.

Many of the men --------------.

The fact that the rule feature [+Plural-Formation] enables us
to explain (74)-(77), (80)-(81), (64), and (78)-(79) shows
that [+Plural-Formation] is not an ad-hoc device. It also falsifies Dougherty's argument that the predicates numerous, etc. must be subcategorized to occur with only plural subjects in the deep structure. In our treatment, we allow numerous, all, etc. to occur with singular noun phrases, but use the rule feature [+Plural-Formation] to block sentences like (64), (78)-(79), and (74), (76), and (80).

Another argument given by Dougherty against the deriving of plurals from Coordination Reduction is that since a semantic rule is needed to interpret the collective noun subjects in (81)-(84), by deriving both plural noun phrases and conjoined noun phrases from conjoined sentences containing only singular noun phrases does not save this semantic interpretation rule.

(81) The pair perjured themselves.
(82) The couple enjoyed themselves at the ball game.
(83) The trio behaved themselves in public.
(84) The trio died in the fire.

First, it is very hard to understand why a semantic interpretation rule is needed to interpret the collective noun subjects in (81)-(84). Dougherty is assuming that if we postulate plurals in the deep structure, then the same semantic rule needed for (81)-(84) can be also used to interpret plurals. It is also hard to understand why a semantic rule is needed to inter-
pret plurals, if plurals are in the deep structure. Isn't it true that whatever the semantic interpretation component can be, (81)-(84) need only the same set of interpretation rules as (85)?

(85) The boy perjured himself.

Isn't it also true that the differences, both semantic and syntactic, between (81) and (85) can be accounted for simply by a syntactic feature which is somehow motivated in order to distinguish pair, etc. from boy, etc.? Second, Dougherty is suggesting that pair is really parallel to boy's in the deep structure. If so, then that would be parallel to pairs in the deep structure? Consider

(86) These three pairs of scissors are sharp.

Obviously, (86) shows that pair can be pluralized just like boy can be.

Another argument given by Dougherty against the hypothesis of deriving plurals from Coordination Reduction is that a plural noun phrase and a conjunction of singular noun phrases do not have the same range of semantic interpretation. Dougherty's example is that (87) is equivalent to (89), but (88) is not.

(87) The boys in my class have beards.

(88) The boy (x) in my class has a beard and the boy (y) in my class has a beard and ............
(89) All of the boys in my class have beards. He argues that (88) indicates only that the boys and beards are in one-to-one correspondence, but (87), in addition to this, also incorporates the fact that there are no boys in my class without beards. Granting Dougherty’s judgement is correct, we still can argue that (87) is derived from (88) plus some presupposition, or we can just say that (87) is derived from (89) by optionally deleting all and of in (89), which as we have shown can be derived through Coordination Reduction.

We have in fact exhausted all the arguments given by Dougherty against the hypothesis of deriving plurals from Coordination Reduction, and we have shown that none of his arguments can not be explained away. It is our belief that as long as a linguistic entity can be derived by an independently motivated rule, this linguistic entity should not be treated as a primitive term in the deep structure. This belief of ours is essentially no different from the theory of an axiomatic system. In our present theory, we simply use the already motivated rule, that is, Coordination Reduction, to derive plurals as well as numerals from conjoined sentences containing singular noun phrases. In this way, we eliminate the postulation of plurals as well as numerals in the deep structure; at the same time, we save the whole stock of arith-
emetic addition processes from the semantic interpretation component, which would be necessary in order to characterize the synonymity between sentences like (1)a and those like (1)b for a theory in which plurals and numerals are postulated in the deep structure.
Footnotes

1. In Chapter 4 of his dissertation, Sanders (1967) has given a much more detailed and sufficient argument for the necessity of the process of numeration.

2. We don't mean that the phrase-marker of (55) is infinitely long. (55) stands for an infinite set of finite phrase-markers which are not upperbounded for their length.

3. We use this feature as a rule feature. For the usage of rule features, see Lakoff (1965).

4. See 8.22. for more discussion.
VII. RULE ORDERING OF COORDINATION REDUCTION

Within the current theory of syntax, it is assumed that the rule schema of conjunction must apply not only for matrix sentences but also for embedded sentences. In this chapter, we will first show that the rule schema of conjunction does not need to apply for embedded sentences, and then show that under this new assumption, Coordination Reduction is a last-cyclic rule.

7.1. Elimination of Conjoined Embedded Sentences

Within the current theory of syntax, the base will generate not only structures like (1) but also structures like (2).

(1)

```
  S
 /\-
 S  S
  |  |  and
  NP VP NP VP
   |   |   |
   I V S I S
   want I go want I dance
```

(2)

```
  S
 /\-
 S  S
  |  |  and
  NP VP NP VP
   |   |   |
   I V S S
   want I go I dance
```
Through Equi-NP Deletion, (1) and (2) can be converted to (3) and (4) respectively.

(3) I want to go and I want to dance.

(4) I want to go and to dance.

Since (3) and (4) are synonymous, the current theory of syntax needs a semantic interpretation rule to account for the synonymity between (1) and (2). Otherwise, it would make a false claim that (2) is ambiguous, because (2) can be either directly generated by the deep structure or derived from (1) through Coordination Reduction. Notice that the semantic interpretation rule needed to account for the synonymity between (1) and (2) is perhaps the inverse of the rule of Coordination Reduction. However, if the base generates only (1), but not (2), we don't need this unjustified semantic interpretation rule. Either we can apply Coordination Reduction to (1) to get (2) and then apply Equi-NP Deletion to (1) and (2) to get (3) and (4) respectively. Or we can apply Equi-NP Deletion to (1) to yield (3) and then apply Coordination Reduction to (3) to yield (4). In 7.3., we will argue that the latter approach is correct. Here, we merely want to point out that it is not necessary for the base to generate structures like (2).

In fact, in the past literature of transformational syntax, it has never been shown that structures like (1)
and those like (2) must be both generated in the base. Nor
has it been shown that they must be distinct in the deep
structure. However, there is one case argued by Ross (1967b).
He argues that the deep structures for (5) and (6) are (7)
and (8) respectively.

(5) Students who fail the final exam or who do not do
the reading will be executed.

(6) Students who fail the final exam will be executed or
students who do not do the reading will be executed.

(7)

```
NP   S
   /   |
  NP  or S
      /   |
     NP  VP
     /     \
students fail the final exam
```

(8)

```
NP   S   NP   S
   /     /     |
  NP   VP  VP  |
     /     /   |
    NP   NP   VP
      /     |
     NP   |
       /   |
      VP   \
    students fail the final exam
```

Ross observes that while in (5), there is only one group of
students, in (6) there must be two groups of students. Ross argues that the fact that (5) and (6) are not synonymous can be accounted for by the distinction between (7) and (8). Then he argues that Relative Clause Formation has to be "across-the-board" in (7) in order to yield (5).

As Ross notes, to apply Relative Clause Formation "across-the-board" in (7) constitutes a counterexample to his Coordinate Structure Constraint (CSC), because Wh Rel Movement has to move two NP's out of the coordinate sentence in (7) and Chomsky-adjoin them to the coordinate node. This counterexample to CSC can be avoided, if we derive (5) from a structure like (8) except that the students's dominated by the head NP's are coreferential. For purpose of discussion, we can represent this structure as

(9)

Now, if we can show that (5) can be derived from (9), we can eliminate the necessity of postulating (7) in the deep structure.
Notice that the distinction between (8) and (9) is that in (8), the two head NP's are not coreferential, but in (9) they are. To get (5) from (9), we apply Relative Clause Formation to (9) to yield

(10)* Students who fail the final exam will be executed or
students who do not do the reading will be executed.

If we apply Coordination Reduction to (10), we get

(11)* Students who fail the final exam or students who do
not do the reading will be executed.

We can now specify that Coordination Reduction must apply obligatory to delete the repeated coreferential head noun of an NP containing a relative clause. Thus, we have to obligatorily apply Coordination Reduction to (10) and (11) to yield (12) and (5) respectively.

(12)* Students who fail the final exam will be executed
or who do not do the reading will be executed.

(5) Students who fail the final exam or who do not do the reading will be executed.

The ungrammaticality of (12) can be explained as due to the violation of HICC, since will be executed is the highest identical constituent in (12). Thus, we get (5) from (11), which comes from the deep structure (9).

We have seen that while Ross derives (5) and (6) from (7) and (8) respectively, we derive (5) and (6) from (9)
and (8) respectively. For two reasons, our approach is better than Ross'. Firstly, we eliminate (5) as a counterexample to CSC. Secondly, since according to Ross' Relative Clause Formation, the relativized NP must be moved out of the relative clause and Chomsky-adjoined to the coordinate S node in (7), it is mysterious that we should get (5) and not (13).

(13)* Students who fail the final exam or do not do the reading will be executed.

Obviously, these two arguments against Ross' approach are much more serious than the one against our present treatment, that is, the argument that Coordination Reduction has to apply obligatorily to delete the repeated coreferential head noun of a relative clause. This argument against our approach even becomes weaker, if we consider the fact that to block (10) and (11), Ross has to block (9) somehow by a deep structure constraint. Perhaps, Ross would like to use the constraint that identical sentences can not be conjoined in the deep structure to block (9). This possibility is closed, since the two conjoined sentences in (9) are not exactly identical. Thus, whether (7) is in the deep structure or not, Ross has to face the problem of (9).

We have shown that structures like (2) and (7) are not needed in the deep structure. Since our argument is applicable to all other cases of conjoined embedded sentences,
we propose that the rule schema of conjunction should not be allowed to apply also for embedded sentences and that the component of phrase structure rules should begin in the following way.

(14) Given $S^*$, $S$

1. $S^* \rightarrow \{ \text{and} \}$
2. $S^* \rightarrow \{ \text{or} \}$
3. $S^* \rightarrow S^n$, where $n \geq 2$

1a. $S \rightarrow \text{NP + VP}$
2. $VP \rightarrow V \{ \text{NP} \}$
3. $NP \rightarrow NP \{ S \}$
4. $---------------------$

The grammar now will start either from 1 or 1a, and after it has finished applying once the phrase structure rules, it can go back to 1 or 1a and reapply again. In (14), we have prevented the embedded sentences from being conjoined. Thus, in our grammar, the base will generate structures like (1) and (8), but not (2) and (7), in which there are conjoined embedded sentences.

7.2 Coordination Reduction as a Last-cyclic Rule

In Chomsky's *Aspects*, it is assumed that all transformations operate cyclically from the lowest sentence to the highest sentence. However, in Lakoff (1966), it is argued that in addition to cyclic rules, which apply to the subpart
of the phrase marker until in the highest sentence, there
exist precyclic rules, which apply to the entire deep phrase
marker before the application of any cyclic rule, and the
last-cyclic rules, which apply only in the last cycle to the
entire phrase marker. He also raised the possibility that
there exist anywhere rules, which apply at any point of the deriva-
tion.

In our framework, it does not make sense to say
that Coordination Reduction applies cyclically, for there are
no conjoined embedded sentences. If a rule is an anywhere
rule, it must be able to apply precyclically, cyclically, and
last-cyclically. Since Coordination Reduction can not apply
cyclically in our present theory, it can not be an anywhere
rule. Thus, there are three logical possibilities left, either
it can apply precyclically only, or it can apply last-cyclical-
only, or it can apply both precyclically and last-cyclically.
If it can apply only precyclically, it is a precyclic
rule; if it can apply last-cyclically only, it is a last-
cyclic rule; if it can apply both precyclically and last-
cyclically, it is neither a precyclic rule nor a last-cyclic
rule, but rather a new type of rule.

Considér

(15)a  The girl hit the cat and the girl was kicked by
the boy.
b The girl hit the cat and was kicked by the boy.

(16)a The girl hit the boy and the girl was kicked by the boy.

b The girl hit and was kicked by the boy.

(17)a John was kicked by the boy and James was kicked by the girl.

b John was kicked by the boy and James, by the girl.

(15)-(17) shows that Coordination Reduction can apply after Passive. Since Passive is a cyclic rule, Coordination Reduction cannot be a precyclic rule and apply precyclically only, because a precyclic rule has to apply before any cyclic rule. (15)-(17) has only shown that Coordination Reduction cannot apply precyclically only, but it has not shown that Coordination Reduction cannot apply both precyclically and last-cyclically. The following example shows that Coordination Reduction cannot apply precyclically at all.

(18)a The boy kicked John, and the girl, James.

b* The boy was kicked by John, and the girl, James.

If Coordination Reduction could apply precyclically, we would get (18)a before the cyclic rule Passive can apply and would turn (18)a into (18)b. Since (18)b shows that Coordination Reduction cannot apply precyclically, the possibility that it can apply both precyclically and last-cyclically is ruled out. Thus, we have ruled out two possibilities out of three.
The only possibility left is that Coordination Reduction is a last-cyclic rule and can apply last-cyclically only.

Notice that (18)b is almost the only example we can use to argue that Coordination Reduction can not apply precyclically. In other situations, with the help of Ross' CSC, Coordination Reduction can apply precyclically before Passive. For example, we can apply Coordination Reduction to (19)a to yield (19)b.

(19)a  James kicked the dog and John kicked the dog.

b  James and John kicked the dog.

Now, with CSC, we can apply Passive to (19)b to get (20), but not (21) and (22).

(20)  The dog was kicked by James and John.

(21)* James and the dog was kicked by John.

(22)* John and the dog was kicked by James.

Without CSC, to prevent (21) and (22) from being derived from (19)b, we would have to apply Coordination Reduction after but not before Passive.

We have shown that the only possibility left is that Coordination Reduction is a last-cyclic rule. In the following, we want to find out what kind of a last-cyclic rule Coordination Reduction is. Ross (1967b) has argued that Adverb Preposing, Extraposition, Extraposition from NP, and Particle Movement are last-cyclic rule. By definition, a
last-cyclic rule can apply only in the highest sentence. However, the fact that all these four rules can apply within a conjunct sentence shows that the notion of last-cyclic as proposed by Lakoff (1966) and Ross (1967b) needs modification.

(23)a John hit the dog yesterday and Mary will hit the cat today.

b Yesterday, John hit the dog and Mary will hit the cat today.

c John hit the dog yesterday and today, Mary will hit the cat.

d Yesterday, John hit the dog and today, Mary will hit the cat.

(23) shows that Adverb Preposing can apply within a conjunct sentence.

(24)a That the earth is flat is true and that the moon is round is obvious.

b It is true that the earth is flat and that the moon is round is obvious.

c That the earth is flat is true and it is obvious that the moon is round.

d It is true that the earth is flat and it is obvious that the moon is round.

(24) shows that Extraposition can apply within a conjunct sentence.
(25)a The boy who is dancing is my brother and the girl
who is singing is my sister.
b The boy is my brother who is dancing and the girl
who is my sister is singing.
c The boy who is dancing is my brother and the girl
is singing who is my sister.
d The boy is dancing who is my brother and the girl
is singing who is my sister.

(25) shows that Extraposition from NP can apply within a
conjunct sentence.

(26)a James turned on the light and Tom turned off the radio.
b James turned the light on and Tom turned off the radio.
c James turned on the light and Tom turned the radio off.
d James turned the light on and Tom turned the radio off.

(26) shows that Particle Movement can apply within a conjunct
sentence.

If we represent a conjoined sentence as (27),

(27)

we can see that Adverb Preposing, Extraposition, Extraposition
from NP, and Particle Movement all have $S_1$ or $S_2$ as their
domains, and not $S_0$. Ross (1967b) has argued that all these
four rules must apply only in the last cycle. But, clearly,
the last cycle in (27) is $S_0$ and not $S_1$ nor $S_2$. To make Ross' argument compatible with the data (23)-(26), we have to assume that all $S_0$, $S_1$, and $S_2$ can be counted as highest sentences. This assumption seems to be compatible with (14), in which it is claimed that a sentence can either start as a conjoined sentence or as a simple sentence.

Now, we want to consider the ordering between Coordination Reduction and these four last-cyclic rules. There are three logical possibilities: either Coordination Reduction precedes these four rules, or these four rules precede Coordination Reduction, or Coordination Reduction can either precede or follow these four rules. It is important to see that these three logically possible orderings between Coordination Reduction and these four last-cyclic rules are just like those between Coordination Reduction and Passive in our present framework. It must be understood that although last-cyclic rules can apply only in the last cycle, cyclic rules can also apply in the last cycle. Thus, Passive can also apply in $S_1$ or $S_2$ in (27). For example,

(28) a James hit the dog and John kicked the cat.
   b The dog was hit by James and John kicked the cat.
   c James hit the dog and the cat was kicked by John.
   d The dog was hit by James and the cat was kicked by John.
It should be clear that as far as (27) is concerned, the argument for the rule ordering between Coordination Reduction and Passive is also applicable for that between Coordination Reduction and these four last-cyclic rules. For what we want to find out is the rule ordering between Coordination Reduction and those rules which can apply within $S_1$ or $S_2$ in (27). It is impossible for Coordination Reduction in (27) to be ordered in one way with respect to some rules which apply in $S_1$ or $S_2$, but in other way with respect to some other rules which also apply in $S_1$ or $S_2$.

In the beginning of this section, we have argued that Coordination Reduction is a last-cyclic rule with respect to cyclic rules like Passive. If our argument is correct, Coordination Reduction must be also a last-cyclic rule with respect to these four last-cyclic rule, that is, Coordination Reduction is in fact a last-last-cyclic rule and can only apply after last-cyclic rules have applied. In the following, we can see that Coordination Reduction indeed can apply after these four last-cyclic rules.

(29)a  Yesterday, John hit the dog and yesterday, Mary kicked the cat.

b  Yesterday, John hit the dog and Mary kicked the cat.

(29) shows that Coordination Reduction can apply after Adverb Preposing.
(30) a John turned the radio on and John turned the radio off.
   b John turned the radio on and off.

(31) a John turned the radio on and Suzie turned the light off.
   b John turned the radio on and Suzie, the light off.

(30) and (31) show that Coordination Reduction can apply after Particle Movement.

(32) a It is obvious that John will leave and it is certain that John will leave.
   b It is obvious, and it is certain, that John will leave.

(30) shows that Coordination Reduction can apply after Extraposition.

(33) a The boy is singing whom you hit and the girl is dancing whom you kicked.
   b The boy and the girl are singing and dancing whom you hit and whom you kicked respectively.

(33) shows that Coordination Reduction can apply after Extraposition from NP.

One might argue that (29)-(33) only show that Coordination Reduction can follow these four last-cyclic rules, but not that Coordination Reduction must follow these four last-cyclic rules. But, we have argued that if Coordination Reduction is last-cyclic with respect to Passive, it must be last-last-cyclic...
with respect to last-cyclic rules. Therefore, although (29)-(33) do not show that Coordination Reduction must follow last-cyclic rules, they do confirm our argument that Coordination Reduction is last-last-cyclic with respect to last-cyclic rules.

7.3. Coordination Reduction after Equi-NP Deletion and Relative Clause Formation

In 7.1., we have pointed out that without (2) generated in the base, we still can get (3) and (4) through Coordination Reduction. We have also mentioned that either we can apply Coordination Reduction to (1) to get (2) and then apply Equi-NP Deletion to (1) and (2) to get (3) and (4) respectively, or we can apply Equi-NP Deletion to (1) to yield (3) and then apply Coordination Reduction to (3) to yield (4). The former approach assumes that Coordination Reduction can apply precyclically, while the latter assumes that Coordination Reduction can apply last-cyclically. In 7.2., we have argued that Coordination Reduction must apply last-cyclically only. Therefore, the latter approach is the correct one.

In 7.1., we have also assumed that Relative Clause Formation applies before Coordination Reduction. However, in Ross' dissertation, it is assumed that Coordination Reduction applies before Relative Clause Formation. Ross has not given any argument for this assumption. However, Mr. Masatake Muraki
(in personal communication) has informed me that if there is Phrasal Conjunction in the deep structure, Coordination Reduction has to apply before Relative Clause Formation. The argument here is based on evidence such as

(34) The girl and the boy who did not know the answer argued.

Since, according to Lakoff and Peters, verbs like know cannot take NP* subjects in the deep structure, while verbs like argue have to take NP* subjects, the deep structure of (34) must be

(35)

We have to apply Coordination Reduction to (35) to yield

(36)

Then we can apply Relative Clause Formation to (36) to get (34).
However, if we assume that there is Phrasal Conjunction in the deep structure, we can have (37) in the base, in addition to (35).

(37)

We apply Relative Clause Formation to (39) to get

(38)

Then we apply Coordination Reduction to (38) to yield (34).

We have seen that even if we assume that the deep structure has Phrasal Conjunction, it is still possible for Coordination Reduction to apply before Relative Clause Formation.

In Chapter V, we have shown that Phrasal Conjunction can be derived through Coordination Reduction. In our present theory, the deep structure of (34) is not (35) nor (37), but (39).
(39) The girl # the girl did not know the answer # argued with the boy and the boy # the boy did not know the answer # argued with the girl.

We apply Relative Clause Formation to (39) to get

(40) The girl who did not know the answer argued with the boy and the boy who did not know the answer argued with the girl.

We apply Coordination Reduction to convert (40) to

(41) The girl who did not know the answer and the boy who did not know the answer argued with each other.

We can reapply Coordination Reduction to (41) to yield

(42) The girl and the boy who did not know the answer argued with each other.

Finally, we apply Prep-Each-Other Deletion to (42) to yield (34).

Therefore, we have seen that both Equi-NP Deletion and Relative Clause Formation can precede Coordination Reduction.

7.4. Conclusion.

In our framework, we have seen that Coordination Reduction follows various transformations to yield grammatical sentences. If our argument is correct, it confirms Sanders' (1969) argument that Coordination Reduction applies to surface structures only. Furthermore, since there are no conjoined embedded sentences and since we have seen that every movement
transformation has to apply before Coordination Reduction, Ross' Coordinate Structure Constraint is not useful at all in the present framework. This can be seen from the fact that without CSC, (21) and (22) can still be blocked naturally by the already motivated ordering of Passive before Coordination Reduction.

Footnote

1. I borrow this example from Sanders (1969).
VIII. SOME PROBLEMS

8.1. The Correct Definition of Identity

So far, we have assumed that the definition of identity can be stated in terms of derived structure only. In fact, this assumption makes it possible for Coordination Reduction to convert (1)a to (1)b, and (2)a to (2)b.

(1)a James kicked the dog and James was hit by the girl.
   b James kicked the dog and was hit by the girl.
(2)a James is stubborn and James is not easy to please.
   b James is stubborn and is not easy to please.

In both (1)a and (2)a, James in the first conjunct is a deep structure subject; but, it is a deep structure object in the second conjunct. If identity were not defined in terms of derived structure alone, we don't know how to explain why Coordination Reduction can convert (1)a to (1)b, and (2)a to (2)b.

However, Lakoff (1966) points out that identity can not be defined in terms of derived structure alone, and that it involves also the deep structure information. Consider one of his examples,

(3) John objected to the shooting of the hunters and
    Bill objected to the shooting of the hunters.
(4) John objected to the shooting of the hunters and so did Bill.

(3) can be converted to (4) through So Deletion. Since "the shooting of the hunters" is two ways ambiguous, (3) is four ways ambiguous.

(5) Let S "the shooting of the hunters"

John objected to S and Bill objected to S

combination 1:  \( M_1 \)  \( M_1 \)
combination 2:  \( M_2 \)  \( M_2 \)
combination 3:  \( M_2 \)  \( M_1 \)
combination 4:  \( M_1 \)  \( M_2 \)

If identity were defined only in terms of derived structures, (4) should be also four ways ambiguous as (3). However, (4) is only two ways ambiguous, with meaning corresponding to combinations 1 and 2, and not to combinations (3) and (4).

Lakoff thus argues that identity must be defined in terms of both deep structure and derived structure. In order to make the derived structure to be able to carry the information of the deep structure, Lakoff suggests an indexing device which will give two nodes the same index if and only if the two sub-trees dominated by these nodes are identical in the deep structure. Thus, now, identity is defined in terms of derived structure identity and deep structure identity as defined by an indexing device.
Lakoff further considers,

(6) The children are ready to eat and the chickens are ready to eat.

(7) The children are ready to eat and so are the chickens.

Again, (6) can be converted to (7) through So Deletion, and again, while (6) is four ways ambiguous, (7) is only two ways ambiguous, with meaning corresponding to combination 1 and combination 2. But, now, the problem is that with the indexing device, (7) can only mean "both the children and chickens are ready to eat something", but not "both children and chickens are ready to be eaten by someone." For the deep structure of (7) with the latter meaning will contain two verb phrases of (8)

(8)a.  

\[
\text{VP}_i \\
\text{V} \\
\text{eat} \\
\text{the children} \\
\text{NP} \\
\]

(8)b.  

\[
\text{VP}_j \\
\text{V} \\
\text{eat} \\
\text{the chickens} \\
\text{NP} \\
\]

Since these two NP's in (8)a and (8)b are not identical, the verb phrases dominating them can not be identical either.

Thus, according to Lakoff's indexing device, these two verb phrases must carry different indices in the derived structure. For the same reason, the two highest verb phrases in (8)c and (8)d must carry different indices.
After the children and the chickens are raised to the matrix sentences, (8)c and (8)d still carry different indices. And we should not be able to get (7) with the meaning "both children and chickens are ready to be eaten by someone." However, it is not the fact. Therefore, Lakoff suggests that if we don't count the children and the chickens, which in the course of transformation have been moved out of VP₁, VPₐ respectively, (8)a and (8)b would have the same index, and so would (8)c and (8)d. Thus, Lakoff proposes that the correct definition of identity may involve

(9)a Derived structure identity

b Identity of deep structure grammatical relations

among elements present in derived structure.

Lakoff is aware that indexing formalisms like the one he suggests may not be sufficient for the definition of identity in (9).

It should be noticed that although Lakoff uses So Deletion to explore the problem, exactly the same problem exists for Coordination Reduction. If we apply Coordination Reduction to (3) and (6), we will get (10) and (11) respectively.
(10) John and Bill objected to the shooting of hunters.

(11) Children and chickens are ready to eat.

We can see that (10) is two ways ambiguous just like (4), and (11) is two ways ambiguous just like (7).

Now, the problem is that the definition of identity in (9) would exclude (1)b and (2)b as grammatical sentences, since in both (1)a and (2)b, the two James's have different deep structure grammatical relations, yet they are both present as identical derived structures. Obviously, we have a contradiction. The problem becomes even more confusing, if we consider

(12)a The fish is too small to swim and the fish is too small to keep.

b The fish is too small to swim and too small to keep.

c* The fish is too small to swim and to keep.

(12)b presents the same situation as (1)b and (2)b, but it is hard to explain why (12)c is ungrammatical, while (12)b is grammatical. Similarly, consider

(13)a John is eager to please and John is easy to please.

b John is eager to please and is easy to please.

C* John is eager and easy to please.

The data so far show that the deep structure information is in some way relevant to the definition of identity, but we don't know exactly what is relevant, and what is irrele-
vant.

8.2. Distributive Adverbs and Quantifiers

8.21. Distributive Adverbs

Consider

(14)* John came at the same time.

(15) John and Mary came at the same time.

We have argued that no conjoined noun phrases need to be postulated in the deep structure. Now, the question should be raised: how can we account for the fact that distributive adverbs like at the same time can only cooccur with conjoined noun phrases, but not with singular noun phrases.

We will assume that distributive adverbs can be treated as main verbs of higher sentences just like many other classes of adverbs. Thus, the previous stage of (15) can be represented as

(16)

In our present theory, the deep structure of (16) is
We will further assume that there is a single lexical entry for at the same time in the lexicon, and that it (as well as simultaneously) will be marked with transformational rule feature [+Coordination-Reduction]. With this rule feature, we will mark (17) as ungrammatical, if it has not undergone Coordination Reduction. For the same reason, (14) will be marked as ungrammatical. If (17) has undergone Coordination Reduction, it is converted into

(18)

(18) is grammatical, since it has undergone Coordination Reduction. If we reapply Coordination Reduction to the conjoined embedded sentence in (18), we will get (16). Now, the rule of Adverb Lowering, the process of which is essential-
ly to Chomsky-adjoin the higher verb to the lower sentence, will convert (16) into (19), and (18) into (20).

(19)

\[
\text{S} \quad \text{S} \quad \text{VP}
\]

\[
\text{NP} \quad \text{NP} \quad \text{VP} \quad \text{at the same time}
\]

\[
\text{John} \quad \text{Mary} \quad \text{came}
\]

(20)

\[
\text{S} \quad \text{S} \quad \text{VP} \quad \text{at the same time}
\]

\[
\text{NP} \quad \text{VP} \quad \text{NP} \quad \text{VP}
\]

\[
\text{John} \quad \text{came} \quad \text{Mary} \quad \text{came}
\]

While (19) is the structure of (15), (20) is the structure of (21).

(21) John came and Mary came at the same time.

Since we have derived plurals from coordination, the contrast between (22) and (23) can be accounted for in the same way as that between (14) and (15).

(22)* One man came at the same time.

(23) Two men came at the same time.

Although we have assumed that distributive adverbs can be treated as higher verbs, we are not sure that all of the distributive adverbs have to be treated in the same way.
Consider, for example, *together.*

(24)* John came together.

(25) John and Mary came together.

In 5.2., we have derived *John and Mary came (together)* from *John came with Mary and Mary came with John.* Similarly, we can derive (25) from (26).

(26) *John came together with Mary and Mary came together with John.*

The ungrammaticality of (24) can be accounted for, if we require that *together* can only cooccur with *with* phrases in the deep structure. In fact, it is also possible within the framework of present theory to derive (15) from (27) just like we derive (25) from (26).

(27) *John came at the same time as Mary came and Mary came at the same time as John came.*

The ungrammaticality of (14) can be accounted for, if we require that *at the same time* can only cooccur with *as* clauses in the deep structure. In this way, (14) and (24) are accounted for in a similar way. However, consider the contrast between (21) and (28).

(28)* John came and Mary came together.

Intuitively, the grammaticality of (21) suggests that *at the same time* has the property of a higher verb. On the contrary, (28) suggests that *together* does not have the property of a
higher verb.

Anyhow, in the present theory, the assumption that
distributive adverbs can be treated as higher verbs is only
tentative. Detailed work has to be done to show that the
assumption is correct, and is compatible with the present
formulation of Coordination Reduction.

8.22. Quantifiers.

In 6.3, we have treated quantifiers as the main
verbs of higher sentences. We have argued that the deep
structure of (30) can be represented as (31).

(30) All (of) the boys will come tomorrow.
(31) The boy (x) ≠ the boy (x) will come tomorrow# be
    all and the boy (y) ≠ the boy (y) will come tomorrow# be all --

We have also argued that by marking all with the rule feature
[+Plural-Formation], we can account for the fact that (30)
is grammatical, but not (32) and (33).

(32)* All (of) the boy will come tomorrow.
(33)* All (of) John, James, and Suzie will come tomorrow.

However, sentences like (34) present a problem with our treat-
ment.

(34) John, James, and Suzie all will come tomorrow.

To get (34), perhaps, we have to use the rule of Quantifier
Movement to obligatorily move all in (33) to the rear of the
conjoined noun phrases. But, if we have to derive (34) from (33), we can not mark (33) as ungrammatical before we get (34). We must allow (33) first, and then obligatorily apply Quantifier Movement to convert (33) into (34). Obviously, the feature \([+\text{Plural-Formation}]\) as interpreted in 6.2. will mark (33) as ungrammatical before we get (34). Perhaps, we have to mark all with feature \([+\text{Coordination-Reduction}]\), rather than \([+\text{Plural-Formation}]\). In this way, we will first mark only (32) as ungrammatical. Thus, before Quantifier Movement, we still have not marked (33) as ungrammatical. We mark it ungrammatical only after the Quantifier Movement rule has applied to it, because all now has to be marked as obligatorily taking this rule.

Notice that the feature \([+\text{Plural-Formation}]\) works well for quantifiers like some and many.

(35) Some of the boys will come tomorrow.

(36)* Some of the boy --------------------.

(37)* Some of John, Suzie, and James -------.

(38)* John, Suzie, and James some --------.

Again, in our present framework, the assumption that quantifiers are higher verbs is tentative. We have not shown how we can get other quantifiers like both, neither, either ---- etc. Further work should be done to see if the assumption is compatible with our present theory of Coordina-
tion Reduction.

8.3. Some Other Reductions in and Conjoined Sentences.

Consider

(40)a James has three books and John has only one book.

b James has three books and John has only one.

The reduction in (40) violates the directionality principle of deletion which we have stated in 2.1. However, we can assume that there is an immediate stage between (40)a and (40)b as Gleitman (1965) suggests. Namely, (40)a is converted to (41) first by the rule of One Pronominalization.

(41)* James has three books and John has only one.

then One in (41) gets deleted obligatorily. This suggestion is in fact supported by the fact that (42)a can be converted into (42)b.

(42)a James saw a big boy and John saw a small boy.

b James saw a big boy and John saw a small one.

If the immediate stage (41) is justified, the reduction in (40) is not a genuine counterexample to the directionality principle of deletion.

Consider also

(43)a The citizen had the right, and the mayor did not have the right.

b The citizen had the right, and not the mayor.
Again, the reduction in (43) violates the directionality principle of deletion. However, we can assume that (43)a is first converted to (44) according to the directionality principle of deletion.

(44) The citizen, and not the mayor, had the right.

then a Conjunct Postposing rule will convert (44) to (43)b. The explanation here is very similar to our explanation of the split conjuncts in Hungarian (see 4.2.). Fred. W. Householder has pointed out to me that in English novels, we can find sentences like

(45) Books lined the walls, and pictures.

Perhaps, (45) can be also explained as the same phenomenon as split conjuncts in Hungarian. That is, we can assume that in written English, just like in Hungarian, Regrouping is always optional no matter whether Identity Deletion results in branching reduced conjuncts or non-branching reduced conjuncts. Thus, we can derive (45) from (46) by a rule of Conjunct Postposing.

(46) Books and pictures lined the walls.

Of course, (46) does not violate the directionality principle.

Consider also,

(47) John kicked the boy and Mary did too.

(48) John kicked the boy and so did Mary.

Again, (47) and (48) violate the directionality principle of
deletion. However, it seems that (47) and (48) can be regarded as cases of pronominalization rather than of Coordination Reduction.

Footnote

1. See Dougherty (1968) for detailed discussion of this rule.
IX. CONCLUSION

This thesis has been an attempt to provide a universal grammar for and coordinate structures within the framework of transformational grammar. The approach we took is to derive all kinds of and coordinate structures from deep structure and coordinate sentences. In Chapter 0, we discussed two alternative hypotheses: the Transformational Hypothesis versus the Phrase Structure Rule Hypothesis. We then argued that the Transformational Hypothesis is in fact correct, and that Coordination Reduction is not only a necessary but also a very general syntactic process. In Chapter I, we pointed out those important observations on which our formulation of Coordination Reduction is based. We also discussed the previous formulations and showed that Postal's approach is more explanatory than the others. In Chapter II, we analyzed Coordination Reduction as consisting of two steps, Identity Deletion and Regrouping. We showed that the present formulation is able to collapse Conjunction Reduction, Gapping, Respectively Transformation, and Reciprocal Transformation, and is therefore more explanatory than Postal's. In Chapter III, we proposed the Anti-ambiguity Condition and the Parallelism Condition for Coordination Reduction. In Chapter IV, we explained the differences between languages in and coordinate
structures as due to different conditions either on Identity Deletion or on Regrouping. We proposed the Immediate Dominance Condition on Identity Deletion for languages like Mandarin Chinese where there is no Gapping, nor deletion of identical objects. We also suggested that the phenomenon of split conjuncts in languages like Hungarian can be explained, if we assume that Regrouping is always optional for these languages. In Chapter V, we argued that Lakoff and Peters' phrasal conjunction can be derived from Coordination Reduction. In Chapter VI, we argued that it is not necessary to postulate plurals and numerals in the deep structure, for they can be derived through Coordination Reduction. In Chapter VII, we eliminated conjoined embedded sentences in the deep structure. Then we argued that Coordination Reduction is a last-last-cyclic rule. In Chapter VIII, unsolved problems were discussed concerning the definition of identity, the proper treatment of distributive adverbs and quantifiers, and the derivation of some special reduction in and coordinate sentences.

All these proposals we have made are, of course, tentative and have to be testified by further works. Further research on and coordinations should be done in various languages to see whether or not the present formulation is able to provide an explanation for all the typological differences in and coordinations. Research should be also done to see
whether or not these conditions we proposed for Coordination Reduction can apply to the other aspects of identity deletion in syntax.
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VITA

James Hau-y Tai was born at Lukang, Changhua, Taiwan on April 10, 1941. From September 1954 to June 1960, he studied at Taiwan Provincial Changhua High School. He entered National Taiwan University in September 1960 and graduated in June 1964 with the degree of Bachelor of Arts in English Language and Literature. He served, from July 1964 to July 1965, in the Air Force of Republic China as an English instructor. In September 1965, he came to this country and studied linguistics at Indiana University, where he received the degree of Master of Arts in September 1967. In the summer of 1968, he attended the Summer Institute of Linguistics at the University of Illinois under the Grant of Summer Study in Linguistics awarded by the Linguistic Society of America. Since September 1968, he has been a graduate student and a research assistant in the Linguistics Department of the University of Texas.

In June 1966, he married Suzana J. M. Wang from Liaoling, China. He has a son named Morris.

In December 1969, he and Gerald A. Sanders read a paper, "Immediate Dominance and Identity Deletion in Mandarin Chinese," at the LSA winter meeting.