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REDUCED COORDINATION AND TRANSFORMATIONS
— a review of current approaches to semantic regularities —

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0. introduction

Since the inception of generative grammar, coordinate structures have been the topic of generative studies, as they provide a variety of non-canonical sentence patterns. The examples in 1. have been regarded as typical exemplifications of deletion and/or movement transformations.

1) a. John loved Mary, and was detested by Jane.
   b. John loved, and Mary detested, the girl from New York.
   c. John loved Mary, and Peter Jane.

Conjunction Reduction, Right Node Raising, and Gapping were thought to be responsible for 1a. b. and c., respectively.

Reduced coordinate structures (those coordinately conjoined structures that involve coordination of non-sentential categories and/or non-canonical sentences) as exemplified above are interesting in that they exhibit a variety of non-clause-internal dependencies. Recent studies by generative grammarians (Kaplan, Bresnan, and Gazdar among others) have not only cast doubts as to the adequacy of transformational treatments of clause-internal dependencies, but have also proposed non-transformational mechanisms that could account for unbounded dependencies. In this article I will reconsider the implications to reduced coordination these new approaches to semantic regularities might have.

1. coordination of non-sentential categories

Sentences of the form exemplified by 1a. provided the classical arguments for Conjunction Reduction Transformation. However, as clause-internal dependencies could be treated by non-transformational mechanisms (see, for example, Bresnan(1979, 1980a,b) and Gazdar(1979a,b) , arguments based on them are

no more convincing than those based on sentences of the following form.

2) John loved Mary, and detested Jane.

There are two possible derivations that transformational grammarians have proposed for sentences of this type; we could either conjoin VPs directly in the base, or coordinate Ss as shown in 2'. and then apply Conjunction Reduction.

2') John loved Mary, and John detested Jane.

Previously there were a great deal of syntactic arguments as to whether base component of English grammar should contain rules for coordinating non-sentential categories. Tai(1969), among others, claimed that all coordinate structures and expressions involving plurals are to be derived through sentential coordination. Dougherty(1970,71), on the other hand claimed that base component of English should contain rules that coordinate non-sentential categories. I claimed elsewhere that such analyses as Tai proposed are fundamentally defective and that English grammar must contain phrase structure rules for non-sentential coordination.[1]

But there is a semantic problem here. Since 2. and 2'. are generated 'independently', so to speak, we must provide an account for the (near) synonymy of the two.[2]

So far as we assume that linguistic representations are mapped onto semantic (or logical) representations, English conjunction "and" must somehow be related to "∧".

This is straightforward enough in the case of sentential coordination. For instance, if we assume that "John", "Mary", "walk/walks", and "talk/talks" translate into "j*", "m*", "walk'", and "talk'", respectively, the sentences in 3. would have corresponding semantic representations as shown in 4.[3]

3) a. John walks.

b. Mary talks.

c. John walks and Mary talks.

4) a. j* walk'

b. m* talk'

c. j* walk' ∧ m* talk'

However, when it comes to the coordination of non-sentential categories, "and" simply cannot translate into "∧". For example, 5a,b. should not be translated into 6a,b., because the latter are not well-formed semantic representations while the former are genuine sentences of English.

5) a. John and Mary walk.

b. John walks and talks.

6) a. j* ∧ m* walk'

b. j* walk' ∧ talk'

Both righthand side and lefthand side of "∧" must be expressions of type t.[3]

Gazdar(1980a) proposed a set-theoretic interpretation of "and" that solves this difficulty. In order to express the same insight in a more string-oriented framework, (which could be incorporated into the system outlined in Partee (1975), for instance,) that is, something more tangible and easy to understand intuitively, something of the order of 7. would be required.

7) a. syntactic rule for coordination

If "a_1" and "a_2" are linguistic expressions of category α, "a_1 and a_2" is a linguistic expression of category α.

b. semantic rule for coordination

i. if $a_1, a_2 \in S$, $a_1 \longrightarrow a_1'$, $a_2 \longrightarrow a_2'$
then a_1 and $a_2 \longrightarrow a_1' \wedge a_2'$

ii. if $c_1, c_2 \in \alpha/\beta$, $c_1 \longrightarrow c_1'$, $c_2 \longrightarrow c_2'$
when $a_1, a_2 \in \alpha$ then a_1 and $a_2 \longrightarrow f(a_1', a_2)$
when $b \in \beta$, $b \longrightarrow b'$, then $c_i b \longrightarrow g(c_i', b')$
where b is a variable, i=1,2,
then c_1 and $c_2 \longrightarrow \lambda b'\ f(g(c_1', b'), g(c_2', b'))$[4]

This is intended as an extention of Montague's rule for conjunction.[5] Actually, 7. does not work with the fragment

outlined in Partee(1975). I am as yet unable to establish any successful substitute for 7, however. In any case, it is evident that we need a mechanism that enables us to interpret non-sentential coordination 'across-the-board', so that linguistic representations in 5. would correspond to the well-formed semantic representations in 8.

8) a. j* walk' ∧ m* walk'
   b. j* walk' ∧ j* talk'

However, unless this is achieved in a principled manner, it would simply be the 'inverse' of unrestricted Conjunction Reduction of the type proposed by Tai.

2. derived categories and Right Node Raising

Another innovative aspect Gazdar brought into grammar is the treatment of unbounded dependencies. Instead of deriving 9a,b. from something like 10a,b. through deletion and/or movement transformations, his system generates these relative constructions directly by phrase structure rules.[6]

9) a. the boy that Mary kissed
   b. the boy whom Mary kissed

10) a. the boy that Mary kissed him
    b. the boy Mary kissed whom

The notion of derived category could be understood as an extension of 'indexed pronoun' in Montague grammar. In order to explain the ambiguity of sentences as exemplified in 11., Montague utilized indexed pronouns.[7]

11) a. Every man loves a woman.
    b. $\wedge x\langle man^{!}_{*}(x) \rightarrow \vee y\langle woman^{!}_{*}(y) \wedge love^{!}_{*}(x,y)\rangle\rangle$
    c. $\vee x\langle woman^{!}_{*}(x) \wedge \wedge y\langle man^{!}_{*}(y) \rightarrow love^{!}_{*}(y,x)\rangle\rangle$

The reading in which universal quantifier has a wider scope than existential quantifier can be attained in a straightforward manner. In order to get the semantic representation in 11c. we have to utilize indexed pronouns.

Let's see how 11a. with the reading 11c. is composed of its parts. First we build up a sentence containing an indexed

pronoun as shown in 12a-c. At the same time we build up the noun phrase "a woman" as shown in 12d.

12) a. every + man = every man

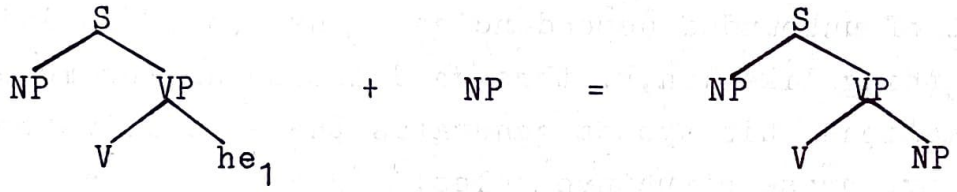
b. love + he_1 = love he_1

c. every man + love he_1 = every man loves he_1

d. a + woman = a woman

Next we 'add' 12c. and 12d together, substituting "a woman" for the indexed pronoun "he_1". As a corresponding rule of translation builds up the semantic representation of each linguistic representation from those of its parts at each stage, 11c. would result as the semantic interpretation of 11a, since the expression containing existential quantifier is introduced to the sentence later than the one containing universal quantifier. Graphically this could be shown as 13.

13)



A sentence containing an indexed pronoun is essentially the same as Gazdar's derived category S/NP, which means a sentence in which a noun phrase is 'missing' somewhere. Note, however, that Gazdar would not allow these 'lowering' operations.

S/NP is present not only in relative constructions such as 9. but also in 'rightward movement' constructions as exemplified by 14.

14) He gave to the children all the food he had brought from the town.

14. could be thought of as consisting of S/NP and NP, as shown in 14'.

14') he gave ___ to the children S/NP

all the food he had brought from the town NP

Now two S/NPs can be conjoined to form a larger S/NP. (Note that in his system any category, including derived categories, could be conjoined.) This larger S/NP could be

concatenated with an NP to form a sentence. This is what has been derived by Right Node Raising Transformation, as exemplified by 1b.

I have noticed two difficulties concerning Gazdar's treatment of 'right node raised' structures.

First, we would have to admit a derived category of type NP/N in order to account for the following expressions.

15) a. a white and a black dog
b. Montague and transformational grammar

15a. would presumably mean 'a white dog and a black dog' and 15b. was the title printed at the top margin of every odd numbered page of Linguistic Inquiry throughout the article entitled 'Montague grammar and transformational grammar'.

Second, 'Right Node Raising' is possible not only in coordinate structures but also in subordinate structures such as 16.[8]

16) It seemed likely to me, though it seemed unlikely to everyone else, that he would be impeached.

However, since no transformational alternative is present that would account for why 16. is acceptable in a principled manner, this in itself does not constitute any argument against Gazdar's system.

Among the three transformations postulated to account for the behaviours of reduced coordination, two have been substituted by non-transformational mechanisms, although these new treatments posed some difficulties. In the next section, we will see what could be said about the one remaining type of reduced coordination, namely gapping.

3. non-transformational treatment of gapping

Stump(1978) proposed and examined an interpretive rule of gapping, which treats the 'gap' as a pronominal element. His conclusion seems, however, that interpretive gapping is imcompatible with otherwise well-motivated restrictions on his Montague-like system.

His treatment seems unsatisfactory to me in that

i. he does not give any semantic rule for non-sentential coordination,

ii. he considers only binary systems,

iii. he does not take into account the close relation between gapping and double-focus construction.

Although I am as yet unable to establish rules that would explain basic features of gapping once and for all, I will try to clarify what a successful non-transformational account of gapping must look like, and the conditions the rules involved must satisfy.

As I have stressed elsewhere (Harada 1980), following essentially Sag(1976) and Kuno(1976), the 'meaning' of gapped sentences are closely related to double-focus construction. Since treatments of presupposition in semantic representations are still very controversial, and Sag's notational conventions are of dubious nature, I will utilize somewhat abstract designations.

First, let us consider the nature of semantic representations for sentences with a focal stress given to a certain constituent. Given a sentence of the form $f(x)$,[4] f for formula, it would be natural to assume that $f(x)$ translates into $f'(x')$, where x' is the translation of x; that is, there is some well-formed semantic representation of type t, in which the translation of x possibly plays a role.

17) if $f(x) \in S$, $x \in \alpha$, α = some category, $x \rightarrow x'$
then $f(x) \rightarrow f'(x') \in t$

Further, when the constituent designated by x is stressed, which I indicate by capitalizing the symbol, the semantic representation of this new sentence would be determined by the translation of x, namely x', and the remainder of the translation of the sentence, regardless of x'.

18) if $f(x) \in S$, $x \in \alpha$, α = some category, $x \rightarrow x'$
$f(x) \rightarrow f'(x') \in t$
then $f(X) \rightarrow F_1(x', f')$

This could easily be extended to double-focus constructions.

19) double-focus assignment

if $f(x, y) \in S$, $x \in \alpha$, $y \in \beta$, α, β = some category

$x \longrightarrow x'$, $y \longrightarrow y'$,

$f(x, y) \longrightarrow f'(x', y') \in t$

then $f(X, Y) \longrightarrow F_2(x', y', f')$

F stands for focus. Note that F_1 and F_2 are conceived of as constants, characteristic of focus assignments. Also, $f'=\lambda s f'(s)$, if λ-abstraction can be thought of as operating on strings of symbols.

19. could be paraphrased in verse as follows. The meaning of double-focus construction is determined by the triplet of i. the meaning of the constituent of the first focus, ii. the meaning of the constituent of the second focus, iii. the meaning of the remainder of the sentence, regardless of the two stressed constituents. Something like this was implicit in the discussions of 'logical form' and 'presupposition' of double-focus construction in Sag(1976).

Given 19, we could 'formulate' a non-transformational rule for gapping.

20) gapping

a. syntactic rule

If "x", "y", "u", and "v" are maximal projections of some category, and "f(x, y)" is a sentence, then "f(X, Y) and U V" is a sentence.

b. translation rule

if $x \longrightarrow x'$, $y \longrightarrow y'$, $u \longrightarrow u'$, $v \longrightarrow v'$

$f(x, y) \longrightarrow f'(x', y')$

then $f(X, Y)$ and $U\ V \longrightarrow F_2(x', y', f') \wedge F_2(u', v', f')$

Many syntactic restrictions follow from this simple rule for gapping, although some minor problems obviously remain. For instance, we do not have to stipulate that "x" and "u", "y" and "v", belong to the same syntactic category, as the resulting semantic representation would be ill-formed if it were otherwise.

I tried to subsume 20b. into a more general schema for coordination, such as 7b, but apparently this was unsuccessful. On the other hand, 20b. could be thought of as contextually determining the meaning of the missing part, or the 'gap', of the second conjunct, namely $\lambda rs\langle F_2(r, s, f')\rangle$. In this respect, this could be revised in a way quite similar to the treatment of 'do-so-pronominalization' and 'VP-deletion' by Gazdar, Pullum and Sag(1981).[9]

NOTES

1. See Harada(1980), especially chapters 1-2, for a brief summary of relevant discussions and arguments against Tai's analyses of conjunction reduction phenomena. The conclusion I gave there was that from syntactic point of view Tai's analyses are untenable, and that we must provide rules for base-coordinating non-sentential categories, while Right-Node-Raising structures and gapping patterns must be accounted for by some other mechanisms.
2. As far as I know, Gazdar(1980a, 81) was the first to explicitly point out this difficulty.
3. See Partee(1975), especially pp. 278 ff., for terminology and notational conventions.
4. f(x) and g(x) designate strings of symbols containing possibly null occurrences of x.
5. See S_{12} (p.252) and T_{12} (p.262) of PTQ in Partee(ed. 1976).
6. See Gazdar(1980b, 1981). Similar approaches to unbounded dependencies can be found in Kaplan and Bresnan(1980).
7. I simply assume that 11a. is in fact ambiguous, following Montague and Partee. This could be questioned, but that is irrelevant here.
8. This example is reported by Bresnan(1974).
9. See Gazdar, Pullum, and Sag(1981), especially p.17 and p. 22.

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