DRAFT

Coordination and the Flow of Information Through Phrase Structure

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Language is a process for transforming and transmitting information. The flow of information in the process exhibits certain invariances that can be characterized as an abstract structure. This is what a linguistic level of representation'' is. For example, the computations involved in recognizing or producing sentences recur in a way that can be abstractly represented as phrase structure. The phrase structure representation abstracts away from the order in which analysis paths may be chosen in the computational search space, and reflects instead the structure of an equivalence class of computations.

Although phrase structure is a highly abstract representation, the information that it structures namely, the sequencing and categorization of words in a sentence is relatively superficial among grammatical properties. A study of the flow of deeper'' grammatical properties with respect to this phrase structure reveals a more abstract organization of linguistic information. These deeper properties include information about the grammatical relations of words their subjects, objects, and other arguments; control and anaphoric binding relations; inversion relations (in which, for example, a subject may be expressed as an object in the presence of an expletive or oblique subject); case assignment properties; thematic roles; referential indices; and grammatical number and number agreement.

What does it mean to speak of the flow of grammatical properties with respect to phrase structure? We suppose that partial information about the deeper grammatical properties is locally available in the surface form of any fragment of language, and that the partial information from each local piece of surface structure must be accumulated and combined with the information from other pieces in a order free, or monotonic, way (Bresnan and Kaplan 1982). Indeed, this assumption seems the most plausible way to account for the ease and naturalness with which we understand arbitrary sentence fragments and for our extensive use of fragments in discourse

contexts. The computational problem of synthesizing this information under these conditions can be solved by a process of simultaneous constraint satisfaction, using a class of algorithms based on recursive unification over equality (Kay ref?, Kaplan and Bresnan 1982, other refs?). If we abstract away from the possible computational orders in which this process may discover and combine grammatical properties, we can see certain invariances in how the information propagates or flows'' across regions of phrase structure. These invariances can be abstractly characterized as a mapping from phrase structure to functional structure (Bresnan ed., Peters ref.).

[Principles governing this mapping have been stated in Bresnan (C&C), Grimshaw ch. 2, and elsewhere. In this study, we . . . .]

I. Grammatical Properties of Coordinate Structures

I.1. objects and oblique arguments

Objects and oblique arguments distribute across conjoined verbs, as in (1)-(2):

1) John dedicated and gave a pie to Bill.

2) *John dedicated and ate a pie to Bill.

The grammaticality of (1) and (2) is predictable from (1') and (2'), where the object and to-object are distributed'' as arguments to each of the conjoined verbs.

1') John dedicated a pie to Bill and John gave a pie to Bill.

2') *John dedicated a pie to Bill and John ate a pie to Bill.

Example (2') is ungrammatical because the verb eat is subcategorized for an object only. In general, the subcategorizations of V_1 and V_2 are satisfied in $[_S$ X $[V_1$ Conj $V_2]$ Y] just in case they are satisfied in $[_S$ X V_1 Y] Conj $[_S$ X V_2 Y].

An apparent counterexample to this generalization is example (3).

3) Bill belched and consumed the pie.

3')*Bill belched the pie and Bill consumed the pie.

However, (3) is easily explained by an alternative analysis: (3) contains not the conjoined verbs [$_V$[$_V$belched] and [$_V$consumed]], but the conjoined VPs [$_{VP}$[$_{VP}$belched] and [$_{VP}$consumed the pie]]. This analysis also explains the contrast between (4) and (5), because conjoined constituents commute. [1] [Footnote 1: modulo implied temporal sequence and excluding pseudo-conjunctions like come and get it.]

4) Bill consumed the pie and belched.

5) *Bill consumed and belched the pie.

I.2. subjects

Subjects distribute across conjoined VPs. This fact is revealed by patterns of anaphora. A reflexive pronoun may normally have either a subject or object antecedent within a simple clause:

6) Mary$_i$ asked John$_j$ about herself$_i$/himself$_j$.

Yet an object in one of two conjoined VPs is not a possible antecedent for a reflexive in the other VP:

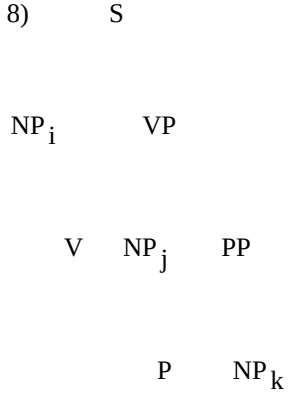
7) Mary$_i$ met John$_j$ and asked about herself$_i$/*himself$_j$.

This fact is explained by the distributivity of subjects and the failure of the object John to distribute in this structure:

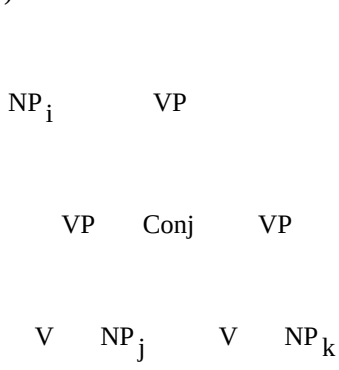
7') Mary met John$_j$ and Mary$_i$ asked about herself$_i$/*himself$_j$.

An alternative explanation for the contrast between (6) and (7) is that John c-commands the reflexive in (6) but not in (7). (6) and (7) have the respective phrase structures given schematically in (8) and (9).

8)



9)



NP_j c-commands NP_k in (8) because every node that dominates NP_j also dominates NP_k. But NP_j does not c-command NP_k in (9) because there is a node (the left conjunct VP) which dominates NP_j and does not also dominate NP_k. Perhaps the extra VP node in the coordinate structure of (9) prevents NP_j's c-commanding NP_k.

However, c-command is known to fail as a condition on anaphora (Bresnan C&C; Bresnan, Halvorsen, and Maling). In (10) and (11), for example, the antecedent John fails to c-command

the reflexive, because it is dominated by a node (the PP) which does not also dominate the reflexive.

10) a. I had an hour-long conversation with John$_i$ yesterday about himself$_i$.

b. That's John, with whom$_i$ I had an hour-long conversation yesterday about himself$_i$.

11) a. I talked for a long time to John$_i$ about himself$_i$.

b. John, to whom$_i$ I talked for a long time about himself$_i$, is a bore.

The adverbial phrases in (10) and (11) prevent reanalysis of the PP through verb-preposition incorporation (Jespersen ref, Bresnan pass), and the capability of these PPs to front shows that their constituency remains intact.[2] [Footnote 2: However, when the PP containing the antecedent is focussed, the reflexive becomes relatively unacceptable: ?*To whom did you talk for such a long time about himself?, ??It's to John that I talked for such a long time about himself. We know of no explanation for this.]

One might attempt to redefine the c-command relation in such a way as to exclude problematic nodes like the PPs in (10) and (11). In fact, Reinhart's (1976, LI) definition already requires either the first non-branching node above the c-commanding constituent, or the next higher node, if it is of the same type, to dominate the c-commanded constituent; and this formulation could, of course, be amended further to account for (10) and (11). Applied to (12), Reinhart's formulation would allow him$_j$ to c-command John$_k$ because the coordinating VP node is presumably of the same type as the left conjunct VP that dominates him$_j$..

12) Mary met him$_j$ and invited John$_k$ to join her team. (not: j = k)

Assuming with Reinhart (1976) that a pronoun cannot corefer to a nonpronominal NP that it c-commands, this formulation of c-command can account for the noncoference in (12). But (12) has the structure of (9), so c-command now leaves us with no explanation for the contrast between (6) and (7). The distributivity of subjects remains as an explanation for this contrast.

I.3. controllers

The controller of conjoined complements distributes across the conjuncts:

13) Mary$_i$ made John$_j$ proud of himself$_j$ and fond of her$_i$.

14) *Mary$_i$ made John$_j$ proud of him$_j$ and fond of herself$_i$.

Thus the pattern of anaphora in (13)-(14) follows from that in (13')-(14'), where the controller John$_j$ is distributed:

13') Mary$_i$ made John$_j$ proud of himself$_j$ and Mary$_i$ made John$_j$ fond of her$_i$.

14') *Mary$_i$ made John$_j$ proud of him$_j$ and Mary$_i$ made John$_j$ fond of herself$_i$.

The same holds for the controlled infinitives in (15).

15) Mary$_i$ convinced John$_j$ to leave her$_i$/*herself$_i$ alone and to occupy himself$_j$/*him$_j$ otherwise.

15') Mary$_i$ convinced John$_j$ to leave her$_i$/*herself$_i$ alone and Mary$_i$ convinced John$_j$ to occupy himself$_j$/*him$_j$ otherwise.

I.4. expletive inversion

Expletive inversion is illustrated in (16) and (17):

16) a. A driver was missing.

b. There was a driver missing.

c. That man

* he was a driver missing.[3]

it

Somewhere

That man

(Cf: he was a missing driver.)

it

Somewhere

17) a. A cab was stolen.

b. There was a cab stolen.

c. That car

* that was a cab stolen.[3]

it

Somewhere

That car

(Cf: that was a stolen cab.)

it

Somewhere

[Footnote 3: In some dialects of English, it can replace there in this construction (Jespersen ref, Labov). Moreover, a subject that refers to a situation rather than to an individual object can also replace there. Cf: That's one more cab stolen. *That car is one more cab stolen. On the subject status of inverted locatives like somewhere in (16) and (17), see Levin thesis.] These examples illustrate the generalization that the sequence NP be AP/VP can be inverted to be NP AP/VP only if there fills the subject position. In effect, there triggers' the inverted order be NP AP/VP. In coordinate structures such as (18), there triggers this inverted order in both conjuncts, allowing for a curious restriction on the presence of finite be:

18) There was a cab stolen and (*was) a driver missing.

In other words, the inversion-triggering property of there distributes across the conjuncts:

18') There was a cab stolen and there was a driver missing.

What is the source of the restriction on finite be? A possible explanation lies in Falk's (Lg) analysis of the English auxiliary. If the finite be is dominated by S, as Falk (Lg) proposes, rather than VP, then the unacceptable form of (18) must involve conjoined Ss rather than conjoined VPs. This means that the subject of the second conjunct must have been ellipted, as illustrated in (19).

19) S

S Conj S

NP V_{aux} . . . and NP V_{aux} . . .

there is there is

But ellipsis of expletive there is severely restricted, compared to nonexpletive NPs, as the contrast between (20) and (21) shows.

20) That was a mistake, but was not a deliberate mistake.

21) *There was a mistake, but was not a deliberate mistake.

This contrast would explain the restriction on (18): the bad form of the example involves S coordination and expletive subject ellipsis, while the good example involves non-S coordination.

I.5. case assignment

The case assignment to an argument of coordinated verbs is predictable from the coordination of the individual verb-argument combinations: that is, the grammaticality of [NP_1-case [V_1 Conj V_2] NP_2-case] is predictable from [NP_1-case V_1 NP_2-case] Conj [NP_1-case V_2 NP_2-case]. To see this, we will turn from English, whose case system is degenerate and eroding, to Icelandic. (The following Icelandic examples are from Bresnan and Thr ainsson, to appear.)

The Icelandic examples (22) and (23) contrast in grammaticality:

22) J on keypti og bor dadi matinn.

J. bought and ate the-food-acc.

23) *J on stal og bor dadi matinn/matnum.

J. stole and ate the-food-acc/the-food-dat.

The grammaticality of (22) and (23) is predictable from (22') and (23'), where the case-marked object is distributed'' across the verbs.

22') J on keypti matinn og J on bor dadi matinn.
J. bought the-food-acc. and J. ate the-food-acc.

23') a. *J on stal matinn og J on bor dadi matinn.
J. stole the-food-acc. and J. ate the-food-acc.

b. *J on stal matnum og J on bor dadi matnum.
J. stole the-food-dat. and J. ate the-food-dat.

(23') hence (23) is ungrammatical because stal takes a dative object and bor dadi does not.

Some Icelandic verbs lexically govern the case of their subjects (Thra insson thesis; Andrews ref, ref; Maling and Zaenen 1983). We would expect subject case assignment to behave the same as object case assignment with respect to distributivity, but the case of the subject in (24) is an apparent counterexample:

24) B aturinn flaut og rak.
the-boat-nom floated and drifted

24') *B aturinn flaut og b aturinn rak.
the-boat-nom floated and the-boat-nom drifted

(24') is ungrammatical because the verb rak takes an accusative subject:

25) B atinn rak.
the-boat-acc drifted

Yet in (24), the subject of rak is nominative.

The apparent counterexample (24) can be explained by an alternative analysis shown in (26).

26) S

S Conj S

NP VP og NP VP

b aturinn flaut b atinn rak
the-boat-nom floated and the-boat-acc drifted

In (26) there is ellipsis of the subject of the second S conjunct. Such an alternative analysis is not available for (22) or (23): when both verbs are transitive, as in those examples, coordination of higher VP or S nodes would be revealed by the presence of two objects in the string of words; only when both verbs are intransitive as in (24) does the string admit of this structural ambiguity.

R ognvaldsson (1982) cites examples similar to (24) as evidence that some coordinate VPs are derived by reduction from coordinate sentences. (26) incorporates this basic idea by allowing subject ellipsis as distinct from VP and V coordination. (26) predicts that the case marking of the subject must satisfy the first, not the second, verb (which has its own, ellipted, subject). Hence if we commute the Ss, again ellipting the subject of the second conjunct, the result should be grammatical. And if we commute the verbs only, the result should be ungrammatical. Both predictions are correct:

27) B atinn rak og flaut
the-boat-acc drifted and floated

28) *B aturinn rak og flaut.
the-boat-nom drifted and floated

(Note that ellipsis of the subject is restricted to the right conjunct.)

While structure (26) provides a grammatical analysis of sentence (24), we expect structure (29) to be ungrammatical because the nominative subject cannot distribute across verbs which differ in their subject case-assignment properties.

29) * S

NP VP

b aturinn V

V Conj V

flaut og rak

Yes/no questions provide a further test of this prediction.

In yes/no questions the Icelandic verb appears in initial position in the S.

30) J on bor dadi matinn.
J. ate the-food-acc.

31) Bor dadi J on matinn?
ate J. the-food-acc.

The same is true of conjoined verbs. Thus (32) is a possible question corresponding to example (22).

32) Keypti og bor dadi J on matinn?
bought and ate J. the-food-acc
Did John buy and eat the food?'

Similarly, (34) is a possible question corresponding to (33), where both verbs assign accusative case to their subject:

33) Þig vantaði og dreymdi bakur

you-acc needed and dreamed-about books-acc

34) Vantaði og dreymdi Þig bakur?

needed and dreamed-about you-acc books-acc

Consider now the minimal pair of examples (22) and (35):

22) B aturinn flaut og rak.

the-boat-nom floated and drifted

35) B aturinn flaut og hoss aði.

the-boat-nom floated and bobbed

These examples contrast only in their verbs, which differ in the subject case assignment property: those in (22) conflict, while those in (35) match. We predict that only (35) will allow the conjoined verbs in initial position in the yes/no interrogative. This prediction is correct:

36) Flaut og hoss aði b aturinn?

floated and bobbed the-boat-nom

Did the boat float and bob?'

37) *Flaut og rak b aturinn/b atinn?

floated and drifted the-boat-nom/acc

Did the boat float and drift?'

There is a well-formed yes/no question corresponding to sentence (22):

38) Flaut b aturinn og rak?

floated the-boat-nom and drifted

(38) reflects the structure in (26): the verb appears in the initial position of each conjunct S, with the subject still ellipted from the second conjunct. The full structure is apparent in a sentence without subject ellipsis, such as (39)-(40).[4]

39) B aturinn flaut og skipið rak.
the-boat-nom floated and the-ship-acc drifted

40) Flaut b aturinn og rak skipið?
floated the-boat-nom and drifted the-ship-acc

[Footnote 4: Because of the distributivity of subjects (section I.2), we would also predict that coordinate VPs require identical case assignment to their shared subjects. However, we do not yet have a test of the case-distributivity predictions that distinguishes conjoined VPs from conjoined Ss with right subject ellipsis, as in (26).]

I.6. thematic roles

Information about thematic roles appears to distribute across conjuncts. In (41), for example, them is assigned the Agent role of kill and the Patient role of be killed.

41) As for the fish, don't let them kill each other or be killed by the cats.

In (42), me is assigned the Agent role of laugh and the Theme role of be happy.

42) Nothing can make me laugh and be happy again.

Note that subject ellipsis is not possible in these examples:

43) *Don't let them kill each other or them be killed by the cats.

44) *Nothing can make me laugh and me be happy again.

Thus, thematic role assignment differs crucially from case assignment: while an NP cannot have multiple conflicting case assignments (I.5), it can have multiple thematic roles without conflict. This contrast suggests that assumptions in the transformational tradition regarding the uniqueness of theta role assignment'' are incorrect.

I.7. referential indices

In example (1) the same pie is both dedicated and given, but in (1') different pies may be involved:

1) John dedicated and gave a pie to Bill.

1') John dedicated a pie to Bill and John gave a pie to Bill.

Thus the truth conditions of (1) are not captured by the distributed form (1'). Is this then a nondistributive property? We saw before that the arguments of conjoined verbs or verb phrases appear to distribute across the conjuncts (I.1-3). We see now that any referential index (that is, any variable, indeterminate'' (Barwise & Perry), or discourse index'' (Kamp)) introduced by such an argument is also distributed across the conjuncts. This property is not reflected in paraphrases like (1'), but it should presumably be reflected in the abstract structure that underlies (1), representing the organization of information in coordinated structures.

Similarly, the same reporters are involved in the two actions described in (45), but not necessarily in (45').

45) Two reporters came up to John and asked him about himself.

45') Two reporters came up to John and two reporters asked him about himself.

And Bach (Defense) notes the same point in an example like (46)-(46'):

46) John was attacked and bitten by a vicious dog.

46') John was attacked by a vicious dog and John was bitten by a vicious dog.

In (46), under the conjoined verb analysis, trhe same dog has attacked and bitten; different dogs may be involved in (46').

Would we expect the distributivity of referents to distinguish cases of VP or V coordination from S coordination with subject ellipsis (I.4-5)? Not necessarily: an ellipted subject could be intepreted as a pronoun, picking up its reference from its antecedent.

I.8. number

Unlike the properties previously discussed, the grammatical property of number does not distribute across conjuncts. For example, the plural verb in (47) agrees with the coordinate subject, but not with the individual conjuncts (47'):

47) Sally and John are here.

47') *Sally are here and John are here.

Similarly, the reflexive in (48) agrees in number with the conjoined subject, but not with the individual conjuncts (48'):

48) Both Sally and John talk a lot about themselves.

48') *Sally talks a lot about themselves and John talks a lot about themselves.

Note that example (48) does have the distributed meaning that Sally talks a lot about herself and John talks a lot about himself, as well as the meaning that they each talk a lot about both of them.

II. The Flow of Information Through Phrase Structure

We wish to solve the problem of coordination without merely classifying grammatical properties into those that do and those that do not distribute. It is certainly useful to study and describe formally various modes of propagation that different grammatical features may have in coordinated and other structures (Sag, Gazdar, Wasow, Weisler 1983; Andrews ref). However, our aim is to understand the structure of the information flow itself, insofar as it is general in language, and to derive the behavior of particular features from that abstract structure.

For the reasons outlined at the outset, we assume the LFG. . . .

The solution we propose to the problem of coordination is based on a simple idea: the functional structure of a conjunction of constituents is the set of functional structures of the conjuncts. The following rule schema expresses this idea:

49) X ! X Conj X

e" # e"

In (49) either the left conjunct X or the right Conj X sequence can be iterated arbitrarily. We will leave aside this and other questions about the details of categorial structure, such as the number and types of categories (Peterson ref) and the structural position(s) of the conjunctions (Gazdar ref). These details do not affect the essential features of our analysis. We will also ignore for the moment the contribution to the functional structure of the choice of conjunction.

The effect of schema (49) is illustrated by the structures in (50).

50) annotated c-structure:

NP$_1$

e" # e"

NP$_2$ Conj NP$_3$

Det N and Det N

a boy a girl

f-structure:

f_1 f_2 DEF

PRED BOY'

f_3 DEF

PRED GIRL'

The c-structure is derived by taking X to be NP everywhere in rule (49). The f-structure is derived by instantiating the annotations # e". The leftmost occurrence of # e" means that # , namely the f-structure corresponding to node NP$_2$, is an element of ", namely, the f-structure corresponding to NP$_1$. We call the former f_2 and the latter f_1. Thus, we know that f_1 contains f_2

as an element, and therefore that f_1 is a set of f-structures. We interpret the annotation on the right conjunct in the same way. The result is that the f-structure corresponding to NP_1 namely f_1 is a set of two f-structures: f_2, the f-structure of NP_2, and f_3, the f-structure of NP_3. The contents of f_2 and f_3 come from the familiar derivation of f-structures as described in Kaplan and Bresnan (1982), Bresnan (1982), and elsewhere.

To attribute a simple grammatical property to an f-structure f, we write (f a) = v, where a is the grammatical attribute (a feature or function) and v is its value. For example, we can attribute indefiniteness to f_2 in (50) by writing (f_2 DEF) = . When an f-structure is a set of pairs, as f_2 and f_3 are in (50), (f a) = v is true just in case the pair <a v> $\in$ f. Thus, in (50) (f_2 DEF) = and (f_3 PRED) = GIRL', because <DEF > $\in$ f_2 and <PRED GIRL'> $\in$ f_3. Boolean combinations of grammatical properties are also grammatical properties. For example, (f_2 DEF) = _ (f_2 PRED) = GIRL' is true of f_2 in (50) because it is true that <DEF > $\in$ f_2 or <PRED GIRL'> $\in$ f_2. See Kaplan and Bresnan (1982) for a detailed specification of functional descriptions.

When an f-structure is a set of f-structures, as f_1 is in (50), we must specify what it means to attribute grammatical properties to it. The meaning we desire is of course the distributive one: a set of f-structures has a certain property just in case every f-structure element of the set has that property:

51) Definition of set properties:

For any set S of f-structures, (S a) = v just in case for every f $\in$ S, (f a) = v. In general, for any grammatical property P, P holds of S just in case for every f $\in$ S, P holds of f.

For example, it happens that for the set f_1 in (50), (f_1 DEF) = is true, (f_1 PRED) = GIRL' is false and (f_1 DEF) = _ (f_1 PRED) = GIRL' is true.

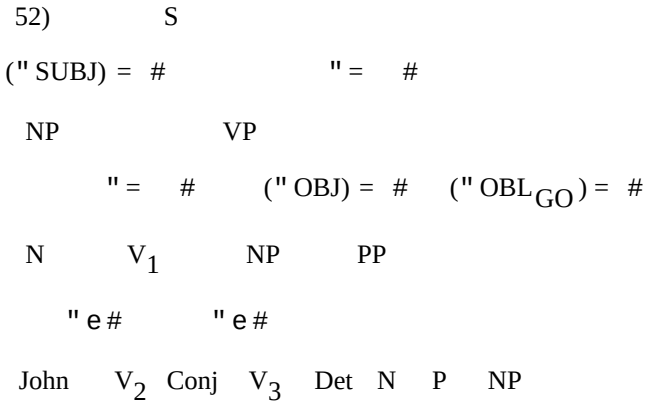
We will return below to a more detailed discussion of conjoined NPs. Our next goal is to explore some consequences of the simple idea sketched above. We will now show that the

generalizations discussed in I.1-I.7 all follow from adding (49) and (51) to the theory of functional structure, and that a variety of other, sometimes surprising, results fall out as well.

II.1. objects and oblique arguments

In the conjoined verb structure of (52), the f-structure of the coordinate V node V_1 will be a set containing the f-structures for V_2 and V_3.

52)



The f-structure for V_1 is shown in (53).

53)

f_1 f_2 SUBJ

TENSE PAST'

PRED DEDICATE <(f_2 SUBJ) (f_2 OBJ) (f_2 OBL_{GO})>'

OBJ

OBL_{GO}

f_3 SUBJ

TENSE PAST'

PRED GIVE <(f_3 SUBJ) (f_3 OBJ) (f_3 OBL_{GO})>'

OBJ

OBL_{GO}

The indices within the lexical forms for dedicate and give come from instantiating the lexical schemata (" PRED) = DEDICATE <(" SUBJ) (" OBJ) (" OBL_{GO})>' and (" PRED) = GIVE <(" SUBJ) (" OBJ) (" OBL_{GO})>' (Kaplan and Bresnan 1982). It is from these lexical schemata that the presence of SUBJ, OBJ and OBL_{GO} functions in f_2 ad f_3 is inferred. Thus a verb carries with it a skeleton form of the f-structures that it can occur in. The actual values of the skeleton arguments SUBJ, OBJ, etc. must be filled in by the surrounding lexical and syntactic structure.

Since V_1 is the head of VP, the f-structure of V_1 will be identified with the f-structure of VP. Therefore, the f-structure of VP must be the same set as that of V_1, shown in (53). It follows that any grammatical attribute of the VP f-structure must be a grammatical attribute of each of its f-structure elements, f_2 and f_3. For example, (f_1 OBJ) = . . . means just that (f_2 OBJ) = . . . and that (f_3 OBJ) = . . . , by (51). Hence, the f-structure of the VP in (52) must be that in (54).

54) f_1 f_2 SUBJ

TENSE PAST'

PRED DEDICATE <(f_2 SUBJ) (f_2 OBJ) (f_2 OBL_{GO})>'

OBJ f_4 DEF

PRED PIE'

OBL_{GO} f_5 PRED BILL'

f_3 SUBJ

TENSE PAST'

PRED GIVE <(f_3 SUBJ) (f_3 OBJ) (f_3 OBL_{GO})>'

OBJ f_4

OBL_{GO} f_5

Observe that the same subsidiary f-structures f_4 and f_5 have functions in two different f-structures, f_2 and f_3. In other words, the object and oblique object are shared by both conjuncts. This explains the contrast between examples (1) and (2), repreated here:

1) John dedicated and gave a pie to Bill.

2) *John dedicated and ate a pie to Bill.

With the PRED EAT <(f_3 SUBJ) (f_3 OBJ)>' replacing GIVE <(f_3 SUBJ) (f_3 OBJ) (f_3 OBL_{GO})>' in (54), f_3 will be incoherent.

Finally, because VP is the functional head of S in (52) (Bresnan C&C), the f-structure of VP will be identified with the f-structure of S. Therefore, the f-structure of S will be the same set as that of VP, shown in (54). It follows that the SUBJ function, which is an attribute of the S f-structure, must be an attribute of f_2 and f_3, yielding the f-structure in (55).

55) f_1 f_2 SUBJ f_6 PRED JOHN'

TENSE PAST'

PRED DEDICATE <(f_2 SUBJ) (f_2 OBJ) (f_2 OBL_{GO})>'

OBJ f_4 DEF

PRED PIE'

OBL_{GO} f_5 PRED BILL'

f_3 SUBJ f_6

TENSE PAST'

PRED GIVE <(f_3 SUBJ) (f_3 OBJ) (f_3 OBL_{GO})>'

OBJ f_4

OBL_{GO} f_5

Again, the SUBJ f-structure f_6 is shared by both conjuncts.

While example (1) John dedicated and gave a pie to Bill has the c-structure and f-structure shown in (52) and (55), the distributed example (1') John dedicated a pie to Bill and John gave a pie to Bill, has the c-structure and f-structure shown in (52') and (55').

52') S_1

" e # " e #

S_2 S_3

NP VP NP VP

N V NP PP N V NP PP

John dedicated Det N P NP John gave Det N P NP

a pie to N a pie to N

Bill Bill

55') f_1 f_2 SUBJ f_4 PRED JOHN'

TENSE PAST'

PRED DEDICATE <(f_2 SUBJ) (f_2 OBJ) (f_2 OBL_{GO})>'

OBJ f_5 DEF

$$
\begin{array}{llll}
 & & \text{PRED} & \text{PIE'} \\
 & \text{OBL}_{\text{GO}} & f_6 & \text{PRED} \quad \text{BILL'} \\
f_3 & \text{SUBJ} & f_7 & \text{PRED} \quad \text{JOHN'} \\
 & \text{TENSE} & \text{PAST'} & \\
 & \text{PRED} & \text{GIVE} <(f_3\ \text{SUBJ})\ (f_3\ \text{OBJ})\ (f_3\ \text{OBL}_{\text{GO}})>' & \\
 & \text{OBJ} & f_8 & \text{DEF} \\
 & & \text{PRED} & \text{PIE'} \\
 & \text{OBL}_{\text{GO}} & f_9 & \text{PRED} \quad \text{BILL'}
\end{array}
$$

Note the difference between the f-structures of the nondistributed and distributed forms: in the latter, the OBJ within each conjunct evaluates to a distinct f-structure (f_5 and f_8), while in the former, the OBJ within each conjunct evaluates to the same f-structure (f_4). Although f_5 and f_8 both contain the lexical contents of a pie, they represent different instantiations of the lexical features of a pie, corresponding to the different object NPs in the c-structure (91). In the c-structure (52), in contrast, there is only one object NP, hence only one instantiation of features; the structure described by this instantiation is shared by the two conjunct f-structures.

This difference in f-structures has semantic consequences. The value of the PRED feature is a semantic form. (In our representation of f-structures these are distinguished from other feature values by single quotes.) Each instantiation of a semantic form creates a unique object for functional uniqueness and because it is functional structures that are semantically interpreted for semantic interpretation (Kaplan and Bresnan 1982: p. 225). Thus, the two objects in the f-structures of distributed examples such as (55') can be interpreted differently, while the shared objects in examples such as (55) cannot be. See II.7.

Note that tense is not a shared attribute of the conjuncts in (55). This happens because tense is specified by the verbal inflections, and so must appear inside each verb's f-structure with all of the other lexical properties of the verb. (See Bresnan C&C.) This leads us to expect that the tense of conjoined verbs will be independent, as in fact it is:

56) a. John either loves or loved Mrs. Charles.

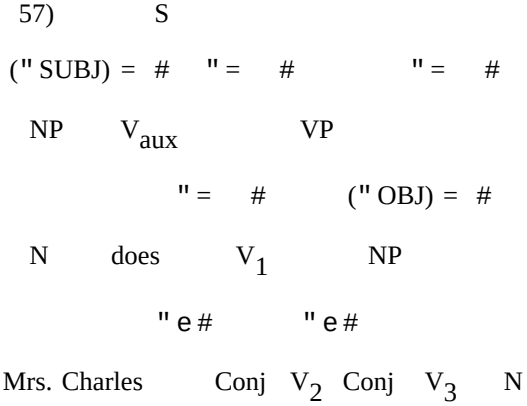
b. She was and is an irrepressible clown.

c. Mary managed and now owns her father's store.

Of course, there are discourse and other constraints on tense use. For example, it is odd to say ??John dedicated and gives a pie to Bill for the same reason that it seems odd to say ??John dedicated a pie to Bill and John gives a pie to Bill.

Observe now that when tense is specified as a property of the whole coordinated structure, tense sharing will occur, as (57) illustrates:

57)



(57) follows Falk's (Lg) analysis of the auxiliary. In (57), the auxiliary does specifies a tense attribute of the matrix f-structure, which is identified with a set; tense will therefore distribute into the conjuncts. This explains (58) and (59):

58) Mrs. Charles does either love or hate John.

59) *Mrs. Charles does either or love or hated John.

The contrast between (58) and (59) supports the lexical theory of inflection over an analysis of tense (or INFL'') as an abstract constituent of S in phrase structure. That is, the information

about tense flows into a clause from the tense-inflected verbs in the surface form, and not from the canonical position of INFL'' in an abstract sentence structure of the form S ! NP INFL VP.

II.2. subjects

In the conjoined VP structure of (60), the VP f-structure will be a set, as in (61):

60) S

(" SUBJ) = # " = #

NP VP

" e # " e #

N VP Conj VP

" = # (" OBJ) = # " = # (" OBL_{TOP}) = #

Mary V NP and V PP

met N asked P NP

John about *himself

61) f_1 f_2 SUBJ

TENSE PAST'

PRED MET <(f_2 SUBJ) (f_2 OBJ)>'

OBJ PRED JOHN'

f_3 SUBJ

TENSE PAST'

PRED ASK <(f_3 SUBJ) (f_3 OBL_{TOP})>'

OBL_{TH} PRED PRO'

GEND M

PERS 3

NCL +

Since the VP is the functional head of the S, the set f_1 in (61) will also be the f-structure of S. Therefore, the SUBJ attribute of the S f-structure will distribute into the conjunct f-structures, f_2 and f_3, as before in (55). The result is (62).

62)

f_1	f_2	SUBJ	f_4	PRED MARY’
		TENSE		PAST’
		PRED		MET <(f_2 SUBJ) (f_2 OBJ)>’
		OBJ		PRED JOHN’
	f_3	SUBJ	f_4	
		TENSE		PAST’
		PRED		ASK <(f_3 SUBJ) (f_3 OBL_{TOP})>’
		OBL_{TH}		PRED PRO’
				GEND M
				PERS 3
				NCL +

Consequently, the subject Mary is shared by both conuncts.

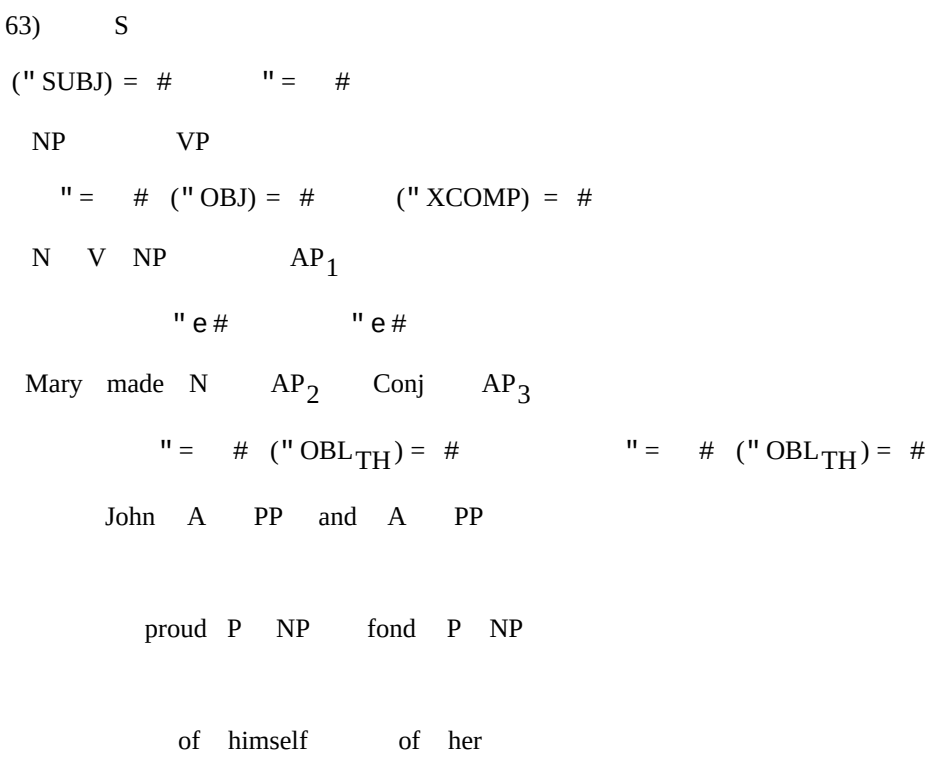
Now a reflexive, or [+ncl], pronoun must be assigned an antecedent in its nucleus, the minimal f-structure containing the reflexive and a SUBJ, (Bresnan, Halvorsen, and Maling ref). Therefore, the only possible antecedent for the reflexive pronoun in (62) is the subject Mary. This explains the restrictions on the reflexives in (7):

7) Mary$_i$ met John$_j$ and asked about herself$_i$/*himself$_j$.

II.3. controllers

In the conjoined AP structure of (63), the f-structure of AP_1 will be the set shown in (64).

63)



64)

f_1 f_2 SUBJ

PRED PROUD-OF <(f_2 SUBJ) (f_2 OBL_{TH})>'

OBL_{TH} PRED PRO'

GEND MASC

NUM SG

PERS 3

NCL +

f_3 SUBJ

PRED FOND-OF <(f_3 SUBJ) (f_3 OBL_{TH})>'

OBL_{TH} PRED PRO'

GEND FEM

NUM SG

PERS 3

NCL

Unlike the coordinate V and VP structures discussed previously, the coordinate AP is not the head of its matrix phrase. It is a complement of the V make, and bears the function of open complement (XCOMP) in the VP f-structure f_0, as shown in (65):

65) f_0 .

.

.

XCOMP f_1 f_2 SUBJ

PRED PROUD-OF <(f_2 SUBJ) (f_2 OBL_{TH})>'

OBL_{TH} PRED PRO'

GEND MASC

NUM SG

PERS 3

NCL +

f_3 SUBJ

PRED FOND-OF <(f_3 SUBJ) (f_3 OBL_{TH})>'

OBL_{TH} PRED PRO'

GEND FEM

NUM SG

PERS 3

NCL

By inspecting (63), we see that in addition to the XCOMP already shown in (65), f_0 must contain the OBJ f-structure and the lexical features of the verb made. These features include TENSE, the PRED of make, and a lexically induced functional control relation which identifies the object of

make as the understood subject of its open complement (Bresnan C&C). This relation is expressed by the control schema (" OBJ) = (" XCOMP SUBJ), which is a predictable lexical property of make. In the context of (65), this control schema means that (f_0 OBJ) = (f_0 XCOMP SUBJ). Since (f_0 XCOMP) = f_1, we have (f_0 OBJ) = (f_1 SUBJ). But f_1 is a set of f-structures, and so the functional control property distributes across its element f-structures, f_2 and f_3, yielding (f_0 OBJ) = (f_2 SUBJ) and (f_0 OBJ) = (f_3 SUBJ), as shown in (66).

66)
f_0 SUBJ
TENSE PAST'
PRED MAKE <(f_0 SUBJ) (f_0 OBJ) (f_0 XCOMP)>'
OBJ f_4 PRED JOHN'
XCOMP f_1 f_2 SUBJ f_4
PRED PROUD-OF <(f_2 SUBJ) (f_2 OBL_{TH})>'
OBL_{TH} PRED PRO'
GEND MASC
NUM SG
PERS 3
NCL +
f_3 SUBJ f_4
PRED FOND-OF <(f_3 SUBJ) (f_3 OBL_{TH})>'
OBL_{TH} PRED PRO'
GEND FEM
NUM SG
PERS 3
NCL

Recall that the principles of bound anaphora require that the reflexive (+ncl) pronoun have an antecedent in its nucleus (f_2), while the nonreflexive (ncl) pronoun not have an antecedent

in its nucleus (f_3) (Bresnan, Halvorsen, and Maling ref). In either case, the only such antecedent is the subject, which has been identified with the matrix OBJ. This explains (13) and (14). In (13) John must be the antecedent of himself and must not be the antecedent of her, while in (14), him must not have John as an antecedent, and herself must.

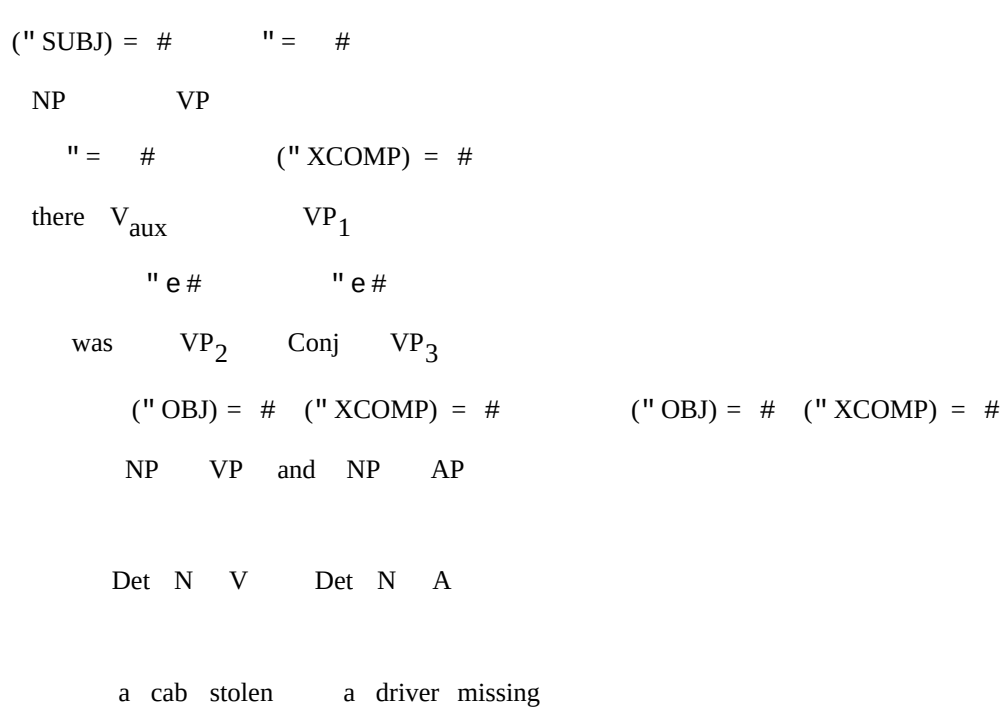
13) Mary$_i$ made John$_j$ proud of himself$_j$ and fond of her$_i$.

14) *Mary made John proud of him$_j$ and fond of herself$_i$.

II.4. expletive inversion

In the conjoined structure (67), we again follow Falk's (ref) analysis of auxiliary verb structures:

67)



The auxiliary position taken by the main verb was leaves the VP verbless. This is effected by letting V be optional in VP; the general principles of coherence, completeness, and uniqueness then create the appearance of verb raising; see Bresnan, Kaplan, Peters, and Zaenen 1982, Falk ref, Ishikawa and Bresnan ref. This analysis (67) accounts not only for the postnominal order of

the modifiers (section I.4), but also for the absence of plural number with the conjoined phrases (see sections I.8 and II.8):

68) *There were a cab stolen and a driver missing.

69) There were a stolen cab and a missing driver (to contend with).[5]

[Footnote 5. Note that speakers who employ the closest conjunct'' strategy for NP conjunction will reject (69) as well; see section II.8.]

The f-structure corresponding to the coordinate node VP_1 in (67) will be the set f_1 shown in (70):

70)
f_1 f_2 OBJ f_4 DEF
PRED CAB'
XCOMP f_5 SUBJ
PRED STEAL <0 (f_5 SUBJ)>'
f_3 OBJ f_6 DEF
PRED DRIVER'
XCOMP f_7 SUBJ
PRED MISSING <(f_7 SUBJ)>'

Note that f_5's PRED is the passive lexical form of steal, in which the SUBJ corresponds to the second (Theme) argument and the Agent is unexpressed (Bresnan pass).

Since VP_1 is the head of S in (67), the set f_1 in (70) will also be the f-structure of S. Therefore, the SUBJ attribute of the S f-structure will distribute into the conjunct f-structures, f_2 and f_3. Furthermore, all the attributes of the V_{aux} was will distribute into the conjuncts. These include the TENSE attribute, the PRED attribute, and the functional control attribute carried by be in expletive there constructions (Bresnan pass). This last is expressed by the lexical schema (" OBJ)

= (" XCOMP SUBJ). In the context of (70) it implies that (f_1 OBJ) = (f_1 XCOMP SUBJ). Hence, by (51) we have (f_2 OBJ) = (f_2 XCOMP SUBJ) and (f_3 OBJ) = (f_3 XCOMP SUBJ). Similarly, from the lexical schema (" PRED) = BE <(" OBJ) (" XCOMP)>(" SUBJ)' it follows that (f_2 PRED) = BE <(f_2 OBJ) (f_2 XCOMP)>(f_2 SUBJ)' and (f_3 PRED) = BE <(f_3 OBJ) (f_3 XCOMP)>(f_3 SUBJ)'. Thus, the f-structure of S will be (71):

71)
f_1 SUBJ f_8 PROX
LOC +
TENSE PAST'$_i$
PRED BE <(f_2 OBJ) (f_2 XCOMP)>(f_2 SUBJ)'$_i$
OBJ f_4 DEF
PRED CAB'
XCOMP f_5 SUBJ f_4
PRED STEAL <0 (f_5 SUBJ)>'

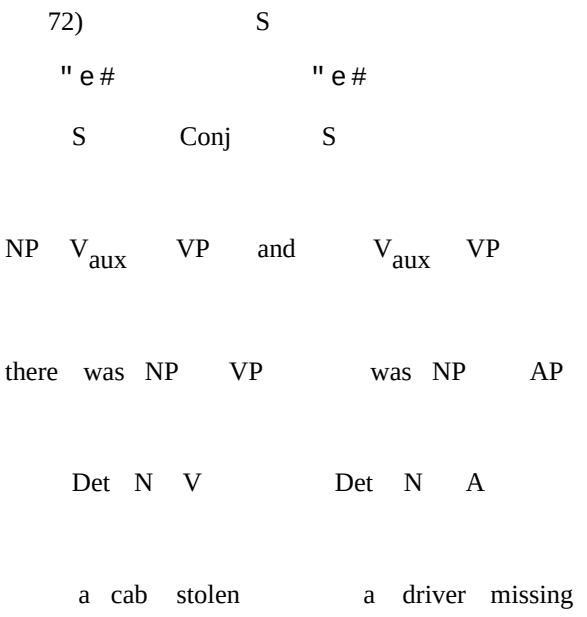
f_3 SUBJ f_8
PRED BE <(f_3 OBJ) (f_3 XCOMP)>(f_3 SUBJ)'$_i$
TENSE PAST'$_i$
OBJ f_6 DEF
PRED DRIVER'
XCOMP f_7 SUBJ f_6
PRED MISSING <(f_7 SUBJ)>'

The specific features of expletive there associated with the OBJ XCOMP construction are selected by the lexical form of be. In (71) these features specify a locative nonproximate pronoun which is semantically empty (i.e. has no PRED). This representation of expletive there differs minimally from that of the locative pronoun there (as in He is there), which presumably has a PRED value

of PRO'. The selection of there by was is then representable by a set of constraint equations in the lexical entry of be: ($\uparrow$ SUBJ PROX) $=_c$, ($\uparrow$ SUBJ LOC) $=_c$ +, etc.

In sum, the expletive subject there distributes (along with the verb was) across the conjuncts in the f-structure (71). However, this will not happen in the conjoined S structure with subject ellipsis:

72)



In (72) the subject NP of the right conjunct has been omitted, producing the incomplete f-structure that is characteristic of ellipsis. (See Levin 1982.) This is illustrated in (73).

73)

f_1	f_2	SUBJ	PROX
			LOC +
		TENSE	PAST'
		PRED	BE <(f_2 OBJ) (f_2 XCOMP)>(f_2 SUBJ)'
		OBJ	f_4 DEF
			PRED CAB'

	XCOMP	f_5 SUBJ f_4
		PRED STEAL <0 (f_5 SUBJ)>'
f_3	SUBJ	
	PRED	BE <(f_3 OBJ) (f_3 XCOMP)>(f_3 SUBJ)'
	TENSE	PAST'
	OBJ	f_6 DEF
		PRED DRIVER'
	XCOMP	f_7 SUBJ f_6
		PRED MISSING <(f_7 SUBJ)>'

Observe that the subject there of the left conjunct f_2 is not shared with the right conjunct f_3. As a result, the constraint equations of was in the right conjunct will fail to be satisfied, even if a rule of subject ellipsis interprets the empty SUBJ as an anaphoric element.[6] This accounts for (18):

18) There was a cab stolen and (*was) a driver missing.

[Footnote 6. We assume that such a rule inserts the information (" SUBJ PRED) = PRO', but we leave for further research the question of whether the information is provided by lexical, syntactic, or discourse processes.]