ABSTRACT
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investigated. Using the Path Containment Condition, as developed by
May (1985), to establish relations between quantified arguments, this
study draws two conclusions about the structure of argument-relations
within VPs. First, arguments have binary relations with projections
of the verb, and second, verbal modifiers have more proximate
D-structure relations with the verb than do the subcategorized
arguments of the verb. Contains 18 references. (Author/LB)

ED342268

THE PATH CONTAINMENT CONDITION AND ARGUMENT STRUCTURE

Thomas Stroik

Abstract: This study investigates the internal
structure of verb phrases (VPs). Using the Path
Containment Condition as developed by May (1985)
to establish relations between (quantified)
arguments, this study draws two conclusions about
the structure of argument-relations within VPs.
First, arguments have binary relations with
projections of the verb. And second, verbal
modifiers have more proximate D-Structure
relations with the verb than do the
subcategorized arguments of the verb.

Introduction

May (1985) develops a theory of logical form that
expresses the logical representation of a sentence
syntactically. His theory, which is grounded in the
Government and Binding framework, derives the logical form
of a sentence from its S-structure through the free
adjunstion of logical operators to the categorial nodes
stated at S-structure. According to May, it is only at this
syntactically-derived level of logical form that the logical
properties of a sentence—its scopal and binding
relations—can be explained. However, since the free
adjunction of operators creates structures that overgenerate
logical properties, May posits a well-formedness condition
on LF-representations, the Path Containment Condition (PCC),
that constrains permissable logical forms.

In this paper, I will use the two major assumptions of
May's theory—free operator adjunction and the PCC—to
investigate the structure of Verb Phrases (VPs). I will
show that, within May's theory, VPs have binary branching
structures and adverbial adjunctions are the most proximate
arguments of a verb.

May's Theory of Logical Form

May (1977) argues that the ambiguity of (1) follows
from the fact that the rule of Quantifier Raising can derive
two different logical forms for (1), namely (2a,b).

(1)   Some man loves every woman

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Kansas Working Papers in Linguistics. Vol. 13, 1988. pp.139-173.

(2a) $[_{S'}[_S$every woman$_3[_S$some man$_2[_S e_2$ loves $e_3]]]]$

(2b) $[_{S'}[_S$some man$_2[_S$every woman$_3[_S e_2$ loves $e_3]]]]$

As (2) shows, Quantifier Raising (QR), a rule that adjoins a logical operator to an S-node, can generate LF-structures that assign broad scope to either quantifier (where the outside quantifier is said to have broad scope). Hence, the ambiguity of (1) obtains from the two syntactic representations that are derivable for (1).

May (1985) revises his account of the ambiguity of (1). Noting that the Empty Category Principle, a locality principle on admissable relations between antecedents or heads and their arguments,[1] requires empty categories to be properly governed at LF, May shows that LF (2a) is well-formed but LF (2b) is not. That is, (2a) satisfies the ECP because all of its empty categories (ECs) are locally governed; on the other hand, (2b) violates the ECP because one of its ECs, viz. e_2, is prohibited from being locally governed by its A'-antecedent by the presence of an intervening A'-operator (the quantifier some).[2] Consequently, (1) has only one well-formed logical representation—(2a). To account for the ambiguity of (1), May employs the Scope Principle (3).

(3) The Scope Principle (SP). In a class of occurrences of Operators X, if O_i, O_j are elements of X and O_i governs O_j, then O_i, O_j have free scope;
where A governs B iff A c-commands B and B c-commands A, and there are no maximal projection boundaries between A and B; and
where A c-commands B iff every maximal projection dominationg A dominates B , and A does not dominate B.

Applied to (2a), an LF-representation in which the operator every governs the operator some, the Scope Principle gives free scope to the quantifiers, allowing multiple readings to be assigned to (1). The SP also successfully predicts the lack of ambiguity for (4), which has LF (5).

(4) Someone believes that everyone left.

(5) $[_{S'}$someone$_2[_S e_2$ believes $[_{S'}$everyone$_3[e_3$ left]]]]$

In (5), since a maximal projection boundary (S') intervenes between the two operators, someone does not govern everyone; therefore, the Scope Principle does not apply to (5). The

only scopal relation that can be assigned to (5) is the one
defined configurationally, the one that gives broad scope to
someone.

What May's theory fails to predict correctly, however,
is an example like (6).

(6) Who bought everything for Max?

QR will generate LF (7) for sentence (6). Unfortunately,
(7) is an ill-formed logical representation: it violates the
ECP because the quantifier prevents the wh-operator from
locally governing e_2. This leaves (6) without a well-formed
LF, making the sentence uninterpretable.

(7) $[_{S'}who_2[_S everything_3[_S e_2 bought e_3 for Max]]]$

To derive a grammatical logical representation for (6), May
replaces QR with a more general rule of free operator
adjunction. Such a rule permits not just S-adjunction, but
adjunction to any categorial node. Since free adjunction
allows VP-adjunction, LF (8) can be derived for (6).

(8) $[_{S'}who_2[_S e_2[_{VP}everything_3[_{VP}bought e_3 for Max]]]]$

Sentence (6) now has a well-formed LF because (8) satisfies
the ECP. A further consequence of LF (8) is that the scopal
relations of (6) are correctly predicted by it. That is, in
(8) the wh-operator does not govern the quantifier because
the maximal projection boundary VP intervenes between these
operators, so when the SP is applied to (8), it correctly
predicts that there will only be configurationally defined
scope.

Support for the above analysis comes from the contrast
between (6) and (9).

(9) What did everyone buy for Max?

Unlike (6), (9) is ambiguous. It permits the reading in
which everyone bought one particular item and the reading in
which every individual each bought something (this thing
could be different for each person) for Max. An account for
the scopal properties just described follows from the rule
of free adjunction and the Scopal Principle. In (10), the
LF of (9), the wh-operator governs the quantifier; so these
operators, given the SP, can engage in free scopal
relations.

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(10) $[_{S'}$what$_2[_S$everyone$_3[e_3[_{VP}$ e$_2$ [$_{VP}$
buy e$_2$ for Max]]]]]

LF (10) then is a logical representation that is
well-formed, because it satisfies the ECP, and that permits
scopal ambiguity under the Scopal Principle.

Besides arguing for the SP and for free operator
adjunction, May (1986) also argues that the ECP should be
replaced by the Path Containment Condition (PCC). May notes
that the ECP makes several incorrect, grammatical
predictions. For one, the ECP incorrectly predicts a scopal
difference between (11a) and (11b); it predicts that (11a)
should permit ambiguity but (11b) should not, since the
subject-trace is properly governed in (11a) but not in
(11b).

(11a) Who do you think everyone saw at the rally

(11b) Who do you think that everyone saw at the rally

For another, because the wh-traces created by LF-movement of
the wh-operators in (12a) and (12b) are all properly
governed, (12a) and (12b) should both be well-formed.
However, there is an obvious difference in the
grammaticality of the sentences.

(12a) ?Whom did you tell that Harry saw who

(12b) *Who did you tell whom that Harry saw

May accounts for the fact that both sentences in (11)
are ambiguous by replacing the empirically inadequate ECP
with Pesetsky's Path Containment Condition (13).

(13) Path Containment Condition (PCC).
Intersecting A'-categorial paths must embed, not
overlap—
Where a path is a set of occurrences of
successively immediately dominating categorial
nodes connecting a binder to a bindee.

Opposed to the ECP, the PCC allows the rule of free operator
adjunction to derive LF-representations (14a) and (14b), the
LFs of (11a) and (11b) respectively.

(14a) $[_{S'}$who$_2[_{S4}$ everyone$_3[_{S3}$ you think $[_{S2}$ e$_3$ [$_{VP}$saw
e$_2$ at the rally]]]]]
Path(2) = {VP,S^2,S^3,S^4,S'}
Path(3) = { S^2,S^3,S^4 }

(14b) $[_{S'}who_2[_S4\ everyone_3\ [_S3\ you\ think\ [_{S'}that[_S2$
$e_3[_{VP}saw\ e_2\ at\ the\ rally]]]]]]$
Path(2) = (VP,S^2,S',S^3,S^4,S')
Path(3) = $(\quad S^2,S',S^3,S^4\quad)$

(Note: read Path(n) as the path for Operator$_n$.) In (14a,b),
Path(3) embeds In Path(2). Therefore, according to the PCC,
these LF-representations are well-formed. Notice that (14a)
and (14b) make the same prediction about scopal relations.
That Is, since the wh-operator governs the quantifier In
both of LF-representations specified In (14), the Scope
Principle predicts that both LFs allow free scopal relations
between the operators. The PCC, then, can account for data
that escapes the ECP.

Of equal Importance to the fact that the PCC explains
data that resists the ECP Is the fact that the PCC can
account for all the data that the ECP serves to explain. In
particular, the PCC, like the ECP, distinguishes (2a) from
(2b)—repeated here as (15 a,b).

(15a) $[_S4\ every\ woman_3[_S3\ some\ man_2[_S2\ e_2[_{VP}loves$
$e_3]]]]$

(15b) $[_S4\ some\ man_2[_S3\ every\ woman_3[_S2\ e_2[_{VP}loves$
$e_3]]]]$

The paths for (15a) are stated In (16).

(16)   Path(2) = $(\quad S^2,S^3\quad)$
Path(3) = (VP,S^2,S^3,S^4)

LF (15a) 's well-formed because Its paths satisfy the PCC;
that Is, Path(2) Is properly embedded In Path(3). The paths
for (15b), on the other hand, violate the PCC. (17)—which
defines the paths for (15b)—shows that the paths Intersect;
however, they overlap rather than embed.

(17)   Path(2) = $(\quad S^2,S^3,S^4)$
Path(3) = $(VP,S^2,S^3\quad)$

Consequently, In accordance with the PCC, (15b) Is an
Ill-formed LF-representation.

The PCC also makes correct predictions about the scopal
differences between (6) and (9), repeated here In (18).

(18a)   Who bought everything for Max.

(18b)   What did everyone buy for Max

The LF-representation derived by operator adjunction for
(18b) is expressed in (19).

(19) $[_{S'}$ what$_2[_{S}3$ everyone$_3[_S2$ e$_3$ $[_{VP}$buy e$_2$ for
       Max]]]]
       Path(2) = {VP,S^2,S^3,S'}
       Path(3) = {   S^2,S^3 }

LF (19) is well-formed; its paths satisfy the PCC because
they embed. (Note the wh-operator governs the quantifier, in
(19), so the ambiguity of (18b) follows from the SP.)
Further, operator adjunction forms two possible
LF-structures for (18a). These LFs are given in (20).

(20a) $[_{S'}$ who$_2[_S3$ everything$_3[_S2$ e$_2$ $[_{VP}$buy e$_3$ for
        Max]]]]
        Path(2) = {   S^2,S^3,S'}
        Path(3) = {VP,S^2,S^3 }

(20b) $[_{S'}$ who$_2[_S$ e$_2$ $[_{VP}$ everything$_3[_{VP}$buy e$_3$ for
        Max]]]]
        Path(2) = {   S,S'}
        Path(3) = {VP,VP   }

Of the two LF-structures, only one—(20b)—is an acceptable
LF. (20a) is an ungrammatical LF because its paths overlap,
in violation of the PCC. On the other hand, the paths in
(20b) vacuously satisfy the PCC; they do not intersect so
the PCC does not rule them out. Since (18a) has (20b) as
its logical representation, the SP applies to (20b)
predicting correctly that, given the fact that a VP-boundary
separates the wh-operator and the quantifier, (18a) has
scopal ambiguity.

Some Consequences of May's Theory of Logical Form

In this section, I will apply May's theory as outlined
above to sentences with VPs that take multiple arguments. I
will show that, under May's analysis, such VPs must be
binary branching structures.[3]

Let us consider a multiple-argument predicate like
read. In sentences such as (21) the operators/arguments of
the verb have ambiguous scope. These scopal relations
result from the application of the SP to (22), an
LF-repesentation of (21).[4]

(21)   What did John read to everyone

(22) $[_{S'}\text{what}_2[_{S3} \text{ everyone}_3[_{S2} \text{ John } [_{VP} \text{ read } e_3$
      $\text{to } e_2]]]]$
      $\text{Path}(2) = (VP,S^2,S^3,S')$
      $\text{Path}(3) = (VP,S^2,S^3 \quad)$

Now (22), which is a well-formed LF because it satisfies the
PCC, gives the VP a nonbinary branching structure. Yet, it
is also possible to give a binary branching structure for
the VP, as in (23).

(23) $[_{S'}\text{what}_2[_{S3} \text{ everyone}_3 [_{S2} \text{ John } [_{V''} [_{V'}\text{read } e_3]$
      $\text{to } e_2]]]]$
      a. $\text{Path}(2) = (VP,S^2,S^3,S')$
         $\text{Path}(3) = (VP,S^2,S^3 \quad)$
      b. $\text{Path}(2) = (V' ,V'',S^2,S^3,S')$
         $\text{Path}(3) = (\quad V'',S^2,S^3 \quad)$

As (23) demonstrates, a binary branching structure for the
VP, regardless of whether it is assumed that only maximal
categorial nodes are specified in a path or that all
categorial nodes are so specified, also produces a
well-formed LF-structure.[5] So (23a,b), like (22), not only
satisfies the PCC—since Path(3) is embedded in Path(2) in
both path-structures stated in (23)—but also permits the SP
to account for the ambiguous readings assignable to (21).

To decide which, if any, of the three logical
representations that we have considered should be the
logical form of (21), we need to examine other evidence.
Relevant evidence comes from (24).

(24) Who did John read everything to?

Interestingly, (24) differs from (21) in that it is not
ambiguous. ((24) only has the reading where the wh-operator
has broad scope over the quantifier.) If (24) is assigned
an LF parallel to (21)—one in which the VP has a nonbinary
branching structure—then the following LF-structure can be
derived for (24).[6]

(25) $[_{S'}\text{who}_2[_{S3} \text{ everything}_3 [_{S2} \text{ John } [_{VP}\text{read } e_3 \text{ to}$
      $e_2]]]]$
      $\text{Path}(2) = (VP,S^2,S^3,S')$
      $\text{Path}(3) = (VP,S^2,S^3 \quad)$

This LF-representation is perfectly grammatical: its paths
fulfill the PCC. However, being well-formed, (25) allows
the SP to apply to it with the consequence that, since the
wh-operator governs the quantifier, (24) is predicted to be

ambiguous. Obviously, such a consequence is undesirable.
If, however, we assume that the VP must binary branch and
that only major phrasal nodes are listed in a path-set, we
can derive LF (26).

(26)　　$[_S \cdot who_2[_S \ everything_3[_S \ John \ [_{V} \cdot \cdot [_{V} \cdot read \ e_3] \ to$
　　　　$e_2]]]]]$
　　　　$Path(2) = \{V \cdot \cdot, S^2, S^3, S'\}$
　　　　$Path(3) = \{V \cdot \cdot, S^2, S^3 \quad \}$

(26), unfortunately, leads to the same conclusion that (25)
does. That is, (26) is a grammatical LF-representation that
predicts that (24) should have ambiguous scopal readings.
But, if we assume that the VP must binary branch and that
all phrasal nodes are specified within a path-set, we can
derive the following LFs for (24).

(27a)　　$[_S \cdot who_2[_S{}^3 \ everything_3[_S{}^2 \ John \ [_{V} \cdot \cdot [_{V} \cdot read \ e_3]$
　　　　$to \ e_3]]]]$
　　　　$Path(2) = \{ \quad V \cdot \cdot, S^2, S^3, S'\}$
　　　　$Path(3) = \{V', V \cdot \cdot, S^2, S^3 \quad \}$

(27b)　　$[_S \cdot who_2[_S John \ [_{V} \cdot \cdot 2 \ everything_3[_{V} \cdot \cdot 1 \ [_{V} \cdot \ read$
　　　　$e_3] \ to \ e_2]]]]]$
　　　　$Path(2) = \{ \quad V \cdot \cdot {}^1, V \cdot \cdot {}^2, S, S'\}$
　　　　$Path(3) = \{V', \ V \cdot \cdot {}^1, V^{=2} \quad \}$

(27c)　　$[_S \cdot who_2[_S John \ [_{V} \cdot \cdot [_{V} \cdot 2 \ everything_3 \ [_{V} \cdot 1 \ read$
　　　　$e_3]] \ to \ e_3]]]$
　　　　$Path(2) = \{ \quad\quad\quad V \cdot \cdot, S, S'\}$
　　　　$Path(3) = \{V \cdot {}^1, V \cdot {}^2 \quad\quad \}$

LFs (27a,b) are ungrammatical. The paths in these
LF-structures violate the PCC because Path(2) intersects and
overlaps with Path(3). So neither (27a) nor (27b) is a
possible LF-structure for (24). (This an important result
because if either of these LFs would be well-formed they
would incorrectly predict that (24) should allow free scopal
relations.) (27c), on the other hand, does not violate the
PCC. The paths of (27c) do not intersect; therefore, they
vacuously satisfy the PCC. This means that (27c) is a
grammatical logical representation of (24). Further,
because (27c) is a possible LF-structure for (24), the Scope
Principle can apply to it. When we apply the SP to (27c),
we discover that the wh-operator does not govern the
quantifier (the intervening V''-node, as a boundary of a
maximal projection, prohibits government). In accordance
with the SP, the operators can only have configurationally
defined scope—a correct prediction.

The PCC, then, forces us to analyze the structure of

VPs headed by verbs subcategorized for multiple arguments in terms of binary branching structures.

Further Consequences of the PCC

An interesting consequence of May's theory of Logical Form concerns the structural relationship between adjuncts and VPs. Cosider the scopal relations between the adjunct <u>when</u> and the quantifier <u>everyone</u> in (28).

    (28)   When did John see everyone

In (28), either operator can have broad scope. This is confirmed by the fact that (29a) and (29b) can be acceptable responses to (28).

    (29a)   John saw everyone yesterday.

    (29b)   John saw Mary a week ago; he saw Sarah yesterday; and he saw Bill earlier this morning.

To account for the ambiguity of (28), there must be an LF-representation of (28) that satisfies two conditions. First, since the wh-operator is in the COMP-node at LF, the quantifier must be able to escape the VP-node that dominates it to insure that the VP-node will not prevent the wh-operator from governing the quantifier (thereby preventing free scopal relations). Second, the PCC must be met. Satisfying the PCC, however, can be accomplished in two ways: either the operator paths do not intersect or they are properly embedded. The former case arises in LF (30).

    (30) $[_{S'}$when$_3[_{S}4$ $[_{S}3$ everyone$_2$ $[_{S}2$ John $[_{VP}$ kiss $e_2]]]$
        $e_3]]$
        Path(2) = $(VP, S^2, S^3$ $)$
        Path(3) = $($ $S^4, S')$

In (30), the adjunct <u>when</u> is an adjunct of S^4, a node created at LF-structure (only this type of LF-representation will guarantee that the adjunct-path will not intersect with the quantifier-path). The adjunct, then, would be only an LF-argument—a possibility not compatible with current theories of predication.[7] The second case necessitates that the path of the adjunct-operator includes the path of the quantifier. That is, the path of <u>when</u> must include the VP-node that dominates the quantifier trace. The adjunct, therefore, must be a within the VP, not outside of it. Such conditions are captured in LF (31).

(31) $[_{S'} when_3 [_{S^3} everyone_2 [_{S^2} John [_{VP} kiss\ e_2\ e_3]]]]$
Path(2) = $\{VP, S^2, S^3 \quad \}$
Path(3) = $\{VP, S^2, S^3, S'\}$

Notice that (31) is not only a well-formed logical representation for (28) because its paths properly embed but also a logical representation that predicts that the logical operators in (28) have free scopal relations.

To decide whether (30) or (31) (or both) is the correct representation for (28), we need to cosider further empirical data. Relevant data is provided in (32).

(32)   Who saw what where

Assuming that the adjunct is an S-adjunct and assuming, as do May (1988) and Chomsky (1985), that wh-in-situ elements are moved into the COMP at the LF-level, we can derive LF (33) for (32).[8]

(33) $[_{S'} [_{NP} [what_2\ where_3] who_4] [_{S^3} [_{S^2}\ e_4 [_{VP} see\ e_2]] e_3]]$
Path(2) = $\{VP, S^2, S^3, S', NP\}$
Path(3) = $\{ \qquad S^3, S', NP\}$
Path(4) = $\{ \quad S^2, S^3, S' \quad \}$

In (33), Path(3) and Path(4) intersect but they do not embed. Consequently, this logical representation is an ill-formed LF- representation because it violates the PCC. If we assume that the adjunct is a constituent of the VP, rather than an adjunct to S, we derive LF (34) for (32).

(34) $[_{S'} [_{NP} [what_2\ where_3] who_4] [_S\ e_4 [_{VP} see\ e_2\ e_3]]]$
Path(2) = $\{VP, S, S', NP\}$
Path(3) = $\{VP, S, S', NP\}$
Path(4) = $\{ \quad S, S' \quad \}$

Since all the paths embed in (34), LF (34) satisfies the PCC and is, therefore, a well-formed logical representation if (32). The consequence of the above argument is that adjuncts, at least at the LF-level, are within the verb phrase.

Given that our previous arguments demonstrate that VPs have binary branching structures for the arguments of V, the question arises: what is the branching relationship between adjuncts and subcategorized arguments within the VPs? Sentences that immediately bear upon this question are:
(35a)   When did Mary read a book to everyone?

(35b)   When did Bill tell everyone about Mary's
problem?

(35c)   When did Mary send everyone's paycheck to him?

That the operators in (35) engage in free scopal
relations--see (36) for an example of a broad scope reading
assigned to the quantifier in (35b)--suggests that the
adjunct is at least as deeply embedded in the VP as is the
argument most proximate to the verb.

(36)   Bill told Sally about Mary's problem yesterday;
he told Tom about it today; and he told Jean
about it just minutes ago.

This is the case because if the adjunct were not as deeply
embedded as is the direct object in (35a), the paths for the
quantifier and the wh-operator would overlap, as (37b)
demonstrates.

(37a) $[_S \cdot when_2[_S3\ everyone_3[_S2\ Bill\ [_{V^u}\ [_{V'}\ tell\ e_2$
$e_3]\ about\ Mary's\ problem]]]]$
$Path(2) = \{V', V^u, S^2, S^3, S'\}$
$Path(3) = \{V', V^u, S^2, S^3\ \ \ \}$

(37b) $[_S \cdot when_2[_S3\ everyone_3[_S2\ Bill\ [_{V^u}\ [_{V'}\ tell\ e_3]$
$e_2\ about\ Mary's\ problem]]]]$
$Path(2) = \{\ \ \ V^u, S^2, S^3, S'\}$
$Path(3) = \{V', V^u, S^2, S^3\ \ \ \}$

Note that as represented the paths in (37a), which assume
that the adjunct is as embedded as the direct object,
satisfy the PCC. However, if the adjunct is higher in the
VP-node than is the direct object, as in (37b), then $Path(3)$
$= \{V^u, S^2, S^3, S'\}$. In this case, the paths will intersect and
not embed, in violation of the PCC. It follows therefore
that adjuncts, which are constituents of VPs, must be as
proximate to the verb as is the closest argument of the verb
at LF-structure. The above condition on VP-structure
produces two possible logical representations for verb
phrases: one in which the adjunct and the closest argument
are sisters and one in which the adjunct is a sister to the
verb alone. These VP-structures are given in (38).

(38a) $[_{VP}\ [_{V'}\ V\ adjunct]\ NP]$

(38b) $[_{VP}\ [_{V'}\ V\ adjunct\ NP]]$

The LF-representations in (38) make very different
predictions about multiple-wh constructions, so they can be

tested for empirical adequacy. (38b) predicts that
sentences formed by moving a wh-object and leaving the
wh-adjunct in-situ at S-structure will be as grammatical as
sentences formed by moving the wh-adjunct and leaving the
wh-object in-situ because both types of sentences will have
logical representations that meet the PCC. That is, the
LF-representations derived from multiple-wh constructions
based on (38b) are either (39a) or (39b), both of which are
well-formed.

(39a)　$[_{S'}[_{NP}[\text{wh-adjunct}_2]\text{wh-NP}_3][_S...[_{VP}[_{V'} \text{ V } e_3 \\ e_2]]]]$
Path(2) = {V',VP,S,S',NP}
Path(3) = {V',VP,S,S'　　}

(39b)　$[_{S'}[_{NP}[\text{wh-NP}_3]\text{wh-adjunct}_2][_S...[_{VP}[_{V'} \text{ V } e_3 \\ e_2]]]]$
Path(2) = {V',VP,S,S'}
Path(3) = {V',VP,S,S',NP}

Since the paths in (39a) and (39b) intersect and embed,
either type of multiple-wh construction under consideration
is predicted to be well-formed.

LF (38a) makes different predictions about multiple-wh
constructions than does (38b). It predicts that multiple-wh
constructions with the wh-object in-situ should violate the
PCC, but such constructions with the wh-adjunct in-situ
should satisfy the PCC. This can be seen by examining the
paths for the two constructions under consideration, as
given in (40).

(40a)　$[_{S'}[_{NP}[\text{wh-adjunct}_2]\text{wh-NP}_3][_S...[_{VP}[_{V'} \text{ V } e_2] \\ e_3]]]$
Path(2) = {V',VP,S,S'NP}
Path(3) = {　VP,S,S'　}

(40b)　$[_{S'}[_{NP}[\text{wh-NP}_3]\text{wh-adjunct}_2][_S...[_{VP}[_{V'} \text{ V } e_2] e_3]]]$
Path(2) = {V',VP,S,S'　}
Path(3) = {　VP,S,S',NP}

LF (40a) satisfies the PCC: its paths properly embed. LF
(40b), on the other hand, has paths that intersect and
overlap—a PCC violation. So, if the logical representation
for multiple-wh constructions is as stated in (38a), then
such constructions are predicted to be grammatical if the
wh-adjunct is left in-situ at S-structure and to be
ungrammatical if the wh-object is left in-situ at
S-structure. The above predictions can be tested by the data
presented in (41).

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(41a) ?Why did John buy what

(41b) *What did John buy why

(41c) ?When did John buy what

(41d) *What did John buy when

Now if the VP-structure is as expressed in (38b), there
should be no grammatical distinction between (41a) and (41b)
nor between (41c) and (41d). The fact that there is a
grammatical difference between these pairs suggests that
(38b) does not represent the logical structure of VPs. On
the other hand, if the VP-structure at LF is the structure
expressed in (38a), then we should expect the construction
with the wh-adjunct in-situ to be well-formed and the
construction with the wh-object in-situ to be ill-formed. ·
Interestingly, the data does not support this prediction
either: the data is exactly opposite of what it is predicted
to be.

A Re-analysis of Multiple-Wh Constructions

The above results force a re-examination of our earlier
assumptions (after all, at least one of our assumptions must
be incorrect or we would have one of our predictions
supported by, rather than both of them contradicted by, the
data). I will argue here that the questionable assumption is
the assumption that wh-in-situ elements move into COMP at LF
(note: I am only challenging this assumption for languages
that permit wh-movement as S-structure). I will argue that
wh-in-situ elements remain in-situ at LF where they function
as dependent, lexical variables.

If wh-in-situ elements do indeed move at LF, then we
would predict that the wh-operator moved at S-structure and
the wh-operator moved at LF in multiple-wh constructions
would engage in free scopal relations, in accordance with
the Scope Principle. We can see that this is predicted by
examining the LF of (42)—which is stated in (43).

(42) Which man was kissing which woman

(43) $[_{S'}[_{NP}[\text{which woman}_2]\text{which man}_3][_S e_3 [_{VP} \text{kiss} e_2]]]$

LF (43) shows that under the assumption that wh-in-situ
elements move at LF the wh-operators govern one another;
therefore they should have free scopal relations.

Now let us consider possible responses to (42) in order
to check how free the scopal relations in it really are.
Note the answers given to (42) in (44).

(44a)   John was kissing Mary; Bill was kissing Sue;
         but Tom was kissing no woman.

(44b)   ?*John was kissing Mary; Bill was kissing Sue; but
         no man was kissing Sarah.

We can see that (44b), as a response to (42), is much worse
than (44a) is. This difference is unexpected if (43) is the
LF of (42). After all, LF (43) predicts that the order and
the way in which the wh-arguments are instantiated should
not affect grammaticality—a prediction not compatible with
the evidence given in (44).

An LF-representation for (42), such as (45), that keeps
the unmoved wh-elements in-situ at LF makes different
predictions about grammatical responses to (42) than (43)
does.

(45) $[_{S'}$ which man$_2$ $[_S$ e$_2$ $[_{VP}$ kiss which woman$_3$]]

In (45), Wh$_2$ and Wh$_3$ are not both independent operators that
can freely choose their referents. Rather, only Wh$_2$ is an
operator; so only Wh$_2$ can freely pick a referent or a
non-referent (for example, no man). Wh$_3$, on the other hand,
is a dependent variable—a variable licensed for a referent
if and only if it is bound to a wh-operator that has chosen
a referent (as opposed to choosing a non-referent). (Note
that the assumption that wh-in situ expressions are
variables dependent on a wh-operator will explain why the
absence of a wh-operator in sentences such as "I love who"
are uninterpretable on the non-echoic reading.) LF (45)
then predicts that if Wh$_2$ selects a referent then Wh$_3$ can
freely choose a referent or a non-referent; but if Wh$_2$ does
not select a referent, then Wh$_3$ cannot choose a referent
independently. So (45) predicts the following grammaticality
judgments about responses to (42).

(46a)   No man was kissing any woman

(46b)   *No man was kissing Mary

(46c)   John was kissing Mary

(46d)   John was not kissing any woman

(46e)   Every man wasn't kissing any woman

(46f)   *No man was kissing every woman

The fact that the judgments predicted by (45) accord with
accepted intuitions about responses to (42), while (43) has
no way of differentiating the various responses cited in
(46), suggests that (45)—a logical representation that
leaves wh-elements in-situ at LF—has more empirical
validity than does (43).

A second argument in support of my wh-in-situ analysis
involves scopal relations between conjoined wh-phrases and
other logical operators. Consider (47).

(47)   Which man and which woman was some child dancing
         with

Example (47) is two-ways ambiguous, having the readings
given in (48).

(48a)   For some child x, which man y and which woman z
          are such that x was dancing with x and y

(48b)   For which man y is there some child x_1 and for
          which woman z is there some child x_2 such that
          x_1 loves y and x_2 loves z.

The scopal ambiguity of (47), as captured in (48), follows
from May's theory of scope assignment. In May's theory,
(47) has LF (49).

(49)   [$_S$·which man and which woman$_2$ [$_S$some child$_3$[$_S$e$_3$
         was dancing with e$_2$]]]

Since the conjoined wh-operators govern the quantifier, free
scopal relations arise between the logical operators.
(Note: the reading of (47) given in (48b) follows from a
principle of operator distribution developed in Barwise and
Cooper (1981). They demonstrate that connected operators
that have wide scope over another operator distribute. This
can be represented formally: $(O_1 \bullet O_2)O_3 = O_1O_3 \bullet O_2 O_3$.
Hence in (49), the wide scope reading for the conjoined
wh-operators (i.e., (Which man and which woman) (some
child)) is equivalent to the reading given in (48b): (
(which man)(some child) and (which woman)(some child).) Now
if wh-in-situ element move at LF, then we would expect (50)
to have the same scopal ambiguities as does (47).

(50)   Which child loves which man and which woman

Notice that LF (51)--the LF for (50) in the move-wh at LF
analysis--has the same government relation between the
conjoined wh-operators and Wh_3 as (49) has between the
conjoined wh-operators and the quantifier.

(51) $[_S[_{NP}[$which man and which $child_2]$ which
       $child_3][_S$ e_3 loves $e_2]]$

Since (49) and (51) have the same government relations
between operators, we would predict that they should have
the same range of readings. (50), however, does not have
all the scopal possibilities of (47). It lacks (52), the
equivalent of (48b).

(52)   Which man y for which child x_1 and which woman z
       for which child x_2 are such that x_1 loves y and
       x_2 loves z

The move-wh at LF analysis, then, overgenerates scopal
possibilities and, therefore, needs to be questioned.

A better analysis of (50) is one that assumes that
wh-in-situ elements do not move at LF. This analysis would
give LF-representation (53) to (50).

(53) $[_S$·which $child_2$ $[_S e_2$ $[_{VP}$loves which man and
       which woman]]]$

LF (53) does not permit ambiguous scopal relations because
it has but one operator--this necessarily prohibits a
multiplicity of scopal configurations. The only reading
that (53) allows then is the reading in which the
wh-operator first selects its referent and subsequently the
wh-variable makes a referent choice. So possible answers to
(50) consists of a set of order pairs <which child, which
man and which woman>, where the value of the first member of
the ordered pair determines the value of the second member
of the pair. But such answers, as predicted by (53), are
the only answers to (50) that are well-formed. Although the
wh-in-situ at LF analysis does account for scopal data
(especially (47) and (50)) that resist the move-wh at LF
analysis, there does appear to be some evidence in support
of the latter analysis. In particular, sentences such as
(54) seem to have scopal relations determined by a rule that
moves wh-elements at LF.

(54)   Who took everyone to which restaurant

The fact that the wh-operators both have scope over the

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quantifier is explained by (55), an LF-representation formed by the general move-Wh rule.

(55) $[_S \cdot [_{NP}[$which restaurant$_2]$who$_3][_S$ e$_3$ $[_{VP}$ everyone$_4$ [take e$_4$ to e$_2]]]]$

Since there is a VP-boundary between the quantifier and the wh-operators, the Scope Principle correctly permits only configurationally defined scope.

The success that the move-wh analysis has in explaining the scopal relations of (54), however, does not carry over to other types of multiple operator structures. Consider (56), which under May's analysis has LF (57).

(56)   Which book did everyone read to which boy and which girl

(57) $[_S \cdot [_{NP}[$which boy and which girl] $_2$which book$_3][_S$everyone$_4[_S$ e$_4$ read e$_3$ to e$_2]]]$

Given that the operators in (57) govern one another, (57) in accordance with the SP permits free scopal relations between the operators. May's analysis, then, predicts that all the sentences in (58) could be well-formed responses to (56).

(58a)   Everyone read the Bible to John and Mary

(58b)   Peter read the Bible to John and Mary; and Sarah read the Koran to Jean and Harry

(58c) ?*Peter read the Bible to John and Mary; and Sarah read it to Jean and Harry.

(58d)   *Peter read the Bible to John and Mary; and Sarah read the Koran to them

Two of the above responses—(58a), where the the wh-elements have broad scope over the quantifier, and (58b), where the quantifier has broad scope over the wh-elements—are well formed. The other two responses, where the quantifier has narrow scope with respect to one wh-element and broad scope with respect to the other wh-element, are less well-formed and perhaps even ill-formed. Since the data in (58) contradict the predictions made by LF (57), a logical representation that employs the general move-wh rule, there is reason to suspect that wh-movement at LF is not a permissable rule.

Unlike May's move-wh analysis of logical form, an

analysis that assumes that wh-in-situ elements remain
in-situ at LF can account for the scopal relations of both
(54) and (56). If wh-in-situ elements are lexicalized
LF-variables that are value-dependent upon the value
selected by a wh-operator and are not independent operators,
then (54) will have LF (59).

(59) $[_{S'} who_2 [_S e_2 [_{VP} everyone_3 [_{VP} [take e_3] to which restaurant]]]]$

Notice that since the wh-in-situ element is not an operator,
it does not directly participate in scopal relations.
Rather, as a dependent variable, its scope is a function of
the scope of the wh-operator upon which it is
value-dependent. Consequently, the fact that the wh-operator
in (59) has broad scope over the quantifier necessitates
that the in-situ variable also has scope over the quantifier
(hence, this analysis correctly predicts the scopal
relations in (54)). This analysis naturally extends to
account for the scopal relations in (56). That is, because
the in-situ wh-elements have their value attached to the
wh-operator in LF (60), they must indirectly have the same
scopal relations with respect to the quantifier as does the
wh-operator.

(60) $[_{S'} which book_2 [_S everyone_3 [_S e_3 [_{VP} [read e_2] to which boy and which girl]]]]$

In (60), then, the only scopal relations possible are the
relations between the quantifier and which book, and these
relations are free because the wh-operator governs the
quantifier. Further, the in-situ wh-elements, which are
variables that do not overtly participate in scopal
relations, have their values set by the wh-operator. By
having their values set by the wh-operator, the in-situ
wh-elements indirectly absorb the scopal relations of the
wh-operator. Therefore, the wh-elements all either have
broad scope or narrow scope with respect to the quantifier,
but they cannot have mixed scope, as in (58c,d). The
possible scopal relations in (54) and in (56), then, accord
with the predictions this analysis makes about scope.

    Disallowing the general move-wh rule complicates my
analysis of VP-structure. After all, I have appealed to
multiple-wh structures to motivate the assumption that
VP-adjunctions are VP-internal and to argue that such
adjuncts are in fact more proximate to the verb at LF than
the subcategorized arguments of the verb are. Without
move-wh as a general rule, multiple-wh constructions can no
longer be enlisted as evidence to show what VP-structures
the PCC mandates. In what follows, I will introduce new

evidence to support my claims that (I) VP-adjuncts are VP-internal and (II) these adjuncts are sister-related to V at LF.

VP-structure Revisited

There two types of data that support the claim that VP-adjuncts are VP-internal: binding data and VP-deletion data. Some evidence in support of the above claim comes from the binding relations involving R(eferential)-expressions. In the Government and Binding framework, Binding Principle C states that an R-expression must be A-free.[9] This means that an R-expression cannot be coindexed with any element that c-commands it from an A-position. Principle C, then, predicts the binding in (61).

(61a) John broke (only) the piano$_i$ when he dropped it$_i$

(61b) His$_i$ mother loves (only) John$_i$

(61c) *He$_i$ loves (only) John's mother

Binding between the piano and it in (61a) is well-formed, in part, because Principle C is satisfied. That is, since the c-command domain of the pronoun lies within the adjunct-clause, the pronoun does not c-command the R-expression John; so John is A-free. The binding relations specified in (61b) are also well-formed because the pronoun, which has its c-command domain restricted to the NP of which it is a constituent, does not c-command John, thereby preserving Principle C. Opposed to the binding relations illustrated in (61a,b), the binding relations in (61c) are ungrammatical. The pronoun in this sentence has as its c-command domain the entire S; consequently, John is coindexed with and c-commanded by an element in an A-position—an obvious violation of Principle C.

If we apply Principle C to sentences with VP-adjuncts, we can discover something about the structural relationship between adjuncts and verb phrases. Consider the sentences in (62).

(62a) *It amazed her$_i$ that (only) Mary$_i$ was elected

(62b) *John broke it$_i$ when he dropped (only) the piano$_i$

(62c) *John annoyed her$_i$ by talking to (only) Mary$_i$

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(62d)   *Mary gave it₁ to John before she read (only) the book₁

The binding relations expressed in (62) are all ungrammatical. They are so, it can be argued, because they all violate Principle C. The Principle C violation in (62a) is obvious. Given that the VP-structure of (62a) is (63), with both the pronoun and the embedded S within the VP, it follows that since the R-expression <u>Mary</u> is inside the c-command domain of a pronoun that is both in an A-position and coindexed with the R-expression, the R-expression is not A-free.

(63)   [$_{VP}$...her₁ that Mary₁...]

A similar explanation can be advanced for the binding violations in (62b-d) under the assumption that the adjunct lies within the VP. That is, if the structure of the matrix verb phrase is as stated in (64), then the pronoun, which occupies an A-position, will c-command and be coindexed with an R-expresion, in violation of Principle C.

(64)   [$_{VP}$...it₁ when he dropped the piano₁]

If, on the other hand, it is assumed that the adjuncts in (62b-d) are not VP-internal, then the R-expression in the adjunct will not be in the c-command domain of the pronoun—as shown in (65)—and the binding relations expressed in these sentences·should be grammatical.

(65)   [$_S$...[$_{VP}$...it₁][$_S$·when he dropped the piano₁]]

So the ill-formedness of the binding relations in (62) follows only if it is assumed that the adjuncts lie within the VP.

Another binding argument in support of the VP-internal analysis of adjuncts concerns quantifier-pronoun binding. May argues that the binding relations in (66) follow from the PCC.

(66a)   Everyone₁ loves his₁ mother

(66b)   *His₁ mother loves everyone₁

May assigns the sentences in (66) LF-representations (67a,b), respectively.

(67a)   [$_{S3}$ everyone₁[$_{S2}$ e₁ [$_{VP}$loves his₁ mother]]]
        Path(e₁) = { s², s³}

$$\text{Path(his}_i) = \{VP,S^2,S^3\}$$

(67b) $[_{S}3 \text{ everyone}_i [_{S}2 [_{NP} \text{ his}_i \text{ mother}] [_{VP} \text{ loves } e_i]]]$

$$\text{Path}(e_i) = \{VP, \quad S^2,S^3\}$$
$$\text{Path(his}_i) = \{ \quad NP,S^2,S^3\}$$

LF (67a) is grammatical in May's analysis because the paths intersect and embed; and LF (67b) is ungrammatical because the paths intersect and overlap. The above analysis can apply to (68).

. (68)   Mary greeted every man$_i$ when he$_i$ first arrived

If we attempt to explain the well-formed binding relations stipulated in (68) by assuming a logical representation in which the adjunct lies outside the VP, we will posit the following LF.

(69) $[_{S}3 \text{ everyone}_i [_{S}2 \text{ Mary } [_{VP}\text{greeted } e_i] [_{S}*\text{he}_i...]]]$
$$\text{Path}(e_i) = \{ \quad VP,S^2,S^3\}$$
$$\text{Path(he}_i) = \{S^*, \quad S^2,S^3\}$$

If, however, we assume that the adjunct is VP-internal, we will posit LF (70).

(70) $[_{S}3 \text{ everyone}_i [_{S}2 \text{ Mary } [_{VP} \text{ greeted } e_i [_{S}* \text{ he}_i...]]]]$
$$\text{Path}(e_i) = \{ \quad VP,S^2,S^3\}$$
$$\text{Path(he}_i) = \{S^*,VP,S^2,S^3\}$$

Of the two possible LFs, only one—(70)—is well-formed. That is, (69) is an ungrammatical representation because its paths violate the PCC, and (70) is a grammatical representation because its paths satisfy the PCC. Therefore, binding relations in (68) are correctly captured only if it assumed that the adjunct is VP-internal at the level of Logical Form.

The second type of data that supports the claim that adjuncts are VP-internal involves data from VP-deletion. Since VP-deletion is considered a good test of VP-constituency, we can employ such deletion data to determine whether an adjunct does indeed lie within a verb phrase. The relation between VP-structure and VP-deletion can be observed in (71).

(71a)   John saw Mary and so did Sue e

(71b)   John kissed Mary yesterday but he didn't e
         today

Current analyses of VP-deletion data would argue that what
is missing/deleted in the sentences in (71) are those
constituents that comprise the verb phrase. So in (71a),
the empty element e must have as its antecedent the VP of
the first conjunct (giving the reading for the second
conjunct that 'Sue [saw Mary]'). And in (71b), the fact
that today can be appended to the second conjunct suggests
that yesterday is not part of the first VP (or else the
reading of the second conjunct would be: 'he didn't [kiss
Mary yesterday] today').

That the deleted elements in VP-deletion sentences
consist only of VP-constituents allows us to use such
sentences to test whether or not adjuncts are VP-internal.
To this end, consider (72).

(72)   John kicked the dog because he hated it and so
        did Bill e

Interestingly, what the second conjunct in (72) can mean is
that 'Bill kicked the dog because he hated it'; what it
cannot mean is simply that 'Bill kicked the dog.'   (72)
suggests that the empty element e includes within it the
because-adjunct. Hence, the adjunct is VP-internal. This
preliminary conclusion can be tested further.

(73a)   John didn't kiss Mary because he loved her but
         Bill did e

(73b)   *John didn't kiss Mary because he loved her but
         Bill did e because he was told to

The sentences in (73) confirm our earlier conclusion.
(73a), like (72), demands a reading in which the adjunct is
included in e, thus re-inforcing the conclusion that
adjuncts are VP-internal. And (73b) provides similar
re-inforcement. That is, if we assume that the adjunct is
outside the VP in (73b), then we will not be able to explain
the ungrammaticality of the sentence (because the second
conjunct could have the grammatical reading 'Bill did [$_{VP}$
kiss Mary] because he was told to'). However, if the
adjunct is VP-internal, then the ungrammaticality of (73b)
follows from the Projection Principle, which will disallow
(74)—the reading of (73b) in which the adjunct lies within
the VP—for the same reason that it probibits (76): for
having too many arguments.

(74)   *Bill did [$_{VP}$ [kiss Mary because he loved her]
       because he was told to]

(75)   *John kissed Mary the sofa

VP-deletion data like binding data, then supports the
assumption that adjuncts are VP-internal.

Granting that adjuncts are VP-internal leads to the
question: what structural relations are there between the
adjunct and the other constituents of a verb phrase. I will
argue here that adjuncts form part of the predicate, being
adjoined to (i.e., modifying) the verb before the
subcategorized arguments of the verb are adjoined to it.
Since my claim that adjuncts have a closer logical
relationship with the verb than do the arguments of the verb
is extremely controversial, I will offer several (four)
arguments for it.[10]

The first argument in support of the above claim is
provided by Williams' (1977) VP Rule. This rule allows all
the constituents of V' (V and its sisters) to be deleted.
The examples in (76) show the effect of the VP Rule.

(76a)   Who sent a flower to whom
        John did to Mary

(76b)   Who sent Mary what
        *John did a flower

Example (76a) demonstrates that if the complete
V'-constituency (send a flower, in this case) is deleted,
the remaining structure can function as a well-formed
response to the given question. And (76b) demonstrates that
if only part of V' is deleted (see Wilkins and Cullcover
(1984) for arguments that both NPs are sisters of the verb),
then the remaining structure is ungrammatical. So all the
constituents of V' must be deleted to form a grammatical
structure. The VP Rule then provides a test for
V'-constituency. Consequently, by applying the VP Rule to
sentences with VP-adjuncts, we can determine whether or not
an adjunct forms a constituent with a verb. Consider (77).

(77a)   Who kissed whom after the election results were
        announced
        John did Mary.

(77b)   Who was celebrating with whom because the
        Astros won
        John was with Mary

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(77) reveals two facts about VP-structure. First, since the
verb and the adjunct can undergo the VP Rule together in
(75), we can tentatively conclude that they form a V'
constituent. Second, that the VP-object can remain behind
without leaving an ungrammatical structure suggests that the
object is not part of the V'-constituent in (77). To be
concluded from (77), then, is that the VP has structure (78)
at LF.

(78) $[_{VP} [_{V'}$ V adjunct]NP-argument]

A second argument for structural representations like
(78) involves binding data. Binding relations in (79) test
VP-constituent structure.

(79a)   Who did Mary give several books$_i$ to after she
         had read them$_i$

(79b)   What movie would Mary take no man$_i$ to before
         she was properly introduced to him$_i$

(79c)   What does Mary talk to every man$_i$ about just
         before she fires him$_i$

Assuming that adjuncts lie outside V' and recalling earlier
arguments that in structures like (79) the quantifier must
adjoin to V' (where V' now is defined as [V NP]), we posit
LF (80) for (79).

(80) $...[_{VP} [_{V'}2$ Q$_i$ $[_{V'}1$ V e$_i$]]...$[_{S*}$...pronoun$_i$...]]$
        Path(e$_i$)   = {V',V'}
        Path(pronoun$_i$) = undefined
        where Q$_i$ is a quantifier and S* is the
        adjunct-clause

Since there is no path from pronoun$_i$ to Quantifier$_i$,
Path(pronoun) is undefined; hence the pronoun is not
properly bound. The examples in (79) then should be as
ungrammatical as the example in (81a), where the undefined
path from his$_i$ to the quantifier in (81b) makes the LF (81b)
ungrammatical.

(81a)   *Which movie did his$_i$ mother take everyone$_i$ to

(81b) $[_S$ which movie$_2$ $[_S$ his$_i$ mother $[_{VP} [_{V'}$
         everyone$_i$ $[_{V'}$ take e$_i$]] to e$_2$]]]$
         Path(which) = { VP,S,S'}
         Path(e$_i$) = {V'   }
         Path(his$_i$)= undefined

The fact that the sentences in (79) are grammatical under
the stipulated binding relations, while the one in (81a) is
not, suggests that Path(pronoun) in the LF for (79) cannot
be undefined. To express a well-defined path Path(pronoun)
for (79), we must assume that the adjunct lies within
V'—this will allow the pronoun to form a path with the
quantifier that it is coindexed with. From the above
assumption, we can derive two well-formed logical
representations for the sentences in (79).

$$(82a) \quad \ldots[_{VP} [_{V'}2 \; Q_i \; [_{V'}1 \; V \; e_i \; [_{S*}\ldots pronoun_i\ldots]\ldots]]]$$
$$\text{Path}(e_i) \quad = \quad \{ \quad V',V'\}$$
$$\text{Path}(pronoun_i) \quad = \quad \{S*,V',V'\}$$

$$(82b) \quad \ldots[_{VP} [_{V*}2 \; Q_i \; [_{V*}1 \; [_{V'} \; V \; [_{S*}\ldots pronoun_i\ldots]] \; e_i]]]$$
$$\text{Path}(e_i) \quad = \quad \{ \quad V',V*,V*\}$$
$$\text{Path}(pronoun_i) \quad = \quad \{S*,V',V*,V*\}$$

Notice that both logical representations stated in (82) are
grammatical: they both satisfy the PCC.

    At this point in our argument, we have facilitated two
possible logical structures for adjuncts: one where the
adjunct is the sole sister of the verb (82b) and one where
the adjunct shares V-sisterhood with the most proximate
argument of the verb (82a). There are two types of evidence
that can help decide between the variant logical
representations. The first type of evidence comes from data
generated by the VP Rule. As previously discussed, VP
Deletion shows that (82a), an LF-representation in which a
verb , its NP-object, and an adjunct are sister within a
V'-constituent, is ill-formed and that an LF-representation,
which has binary sisterhood as expressed in (82b), is
well-formed. The second type of evidence comes from
sentences that have multiple adjuncts. If (82a) is the
correct representation, then all adjuncts must be sisters
with the verb, with the most proximate argument of the verb,
and with one another. If (82b), on the other hand, is the
correct representation, then adjuncts need not be sisters
with the NP-argument nor with one another; in fact, if
VP-structure is binary in nature, it would be expected that
adjucts would have a structure like: $[_{VP} [\; _{V*} [_{V'} \; V$
$\text{Adjunct}_1] \; \text{Adjunct}_2] \; \text{NP-object}]]]$. With these predictions in
mind, let us consider (83) and some Gapping data associated
with it, as illustrated in (84).

    (83)   John left after Mary returned because he was
            angry.

(84a)   and Bill e because he was sad

(84b)   *and Bill e after Jean returned

Assuming the constituent structure $[_{V'} \text{ V Adjunct}_1 \text{ Adjunct}_2]$, we cannot explain why it is possible to gap only part of a constituent, as in (84a), nor why one ajunct can gap while the other one cannot, as in (84b). However, we can explain the differences in (84) by positing a structure where the adjuncts are not sisters and where the sisters are ordered as verbal modifiers. Such a structure, stated in (85), permits the gapping of the after-adjunct but not the because-adjunct because only the after-adjunct forms a constituent with the verb.

(85) $[_{V''} [_{V'} \text{ V [after...]] [because...]]}$

There is a third argument in support of LF (78)--an argument drawn from the evidence presented in (86).

(86a)   What did John read to Mary; and Bill, to Sue

(86b)   Who did John read a poem to; and Bill, a novel to

Notice the different types of interpretations that are assigned to (86a) and (86b). In (86a), the wh-operator does not bind the wh-variable in the deleted constituent of the second conjunct. This is obvious from the responses that can be given to (86a).

(87a)   The Bible.

(87b)   John read the Bible to Mary and Bill read the Koran to Sue

(87b) demonstrates that the wh-operator can be instantiated differently for each conjunct in (86a); therefore, the operator does not bind both the wh-trace in the first conjunct and the variable in the gapped constituent of the second conjunct (V' is the gapped constituent and it consists of $[V [_{NP} e]]$, where is an empty argument of the verb--hence a variable). In (86b), on the other hand, the wh-operator does bind its trace in the first and the variable in the second conjunct. That such is indeed the case can be seen in responses to (88), where a response is acceptable only if the same value is given to the wh-trace in the first conjunct and the variable in the second conjunct.

(88a)   Betty

(88b) ?*John read a poem to Betty and Bill read a novel
          to Sue

Before considering explanations for the interpretative
differences between (86a) and (86b), let us observe some of
the properties of the sentences in (86). First, notice that
there are two empty elements in each sentence: a gapped verb
and an empty NP--a fact that will be very important to an
explanation of (86a). Second, note that since the variable
in the second conjunct of the sentences is assigned an
interpretation, it must be in the c-command domain of some
operator (or else it would not be properly bound). Third,
example (89) demonstrates that if there is not a variable in
the second conjunct, the construction will not be
grammatical.

(89a)   *Who did Mary read a poem to and Sarah a novel
            to Jean

(89b)   *What did Mary read to John and Sarah a poem
            to Mike

Fourth, from (90), we can observe that only a wh-operator
can license the variable in the second conjunct.

(90)   *John read a novel to someone and Bill, a poem to
With the forementioned properties in mind, an explanation
for the interpretative differences between (86a) and (86b)
can be given along the following lines. First, to explain
the fact that the wh-operator binds the variable in the
second conjunct in (86b), assume that the logical
representation of (86b) has the variable within the
c-command domain of the wh-operator. This condition is
satisfied by structures such as (91) (we are ignoring the
fact that (86b) is a gapping structure because the verb-gap
is irrelevant to the binding of the variable).

(91) $[_{S'}$ wh$_i$ $[_S$ $[_S...e_i...]$ and $[_S...t_i...]]]$
         where e_i is the wh-trace and t_i is a variable in
         VP of the second conjunct.

From LF (91), it is possible to account for the fact that
both empty elements are assigned the same interpretation in
(86b) because they both are bound to the same operator.
Second, to explain the binding in (86a), assume that the
gapped constituent includes both the NP-variable and the
verb. The object-variable would then be part of an empty
constituent, as in (92).

(92) $[_{S'}$ wh$_1$ $[_S$ $[_S...[_{V'}$ read e$_1$...] and $[_S...[_{V'}$ e$_V$
t$_1$]...]]]

(Note: I articulate the deleted elements in the gapped
constituent in (92) rather than just the constituent
itself--$[_{V'}$e]--because structures that are like (86) but do
not have a variable present in the second conjunct are
ill-formed: the examples in (89) show the necessity of
having an NP- variable present in the second conjunct in
order to have a grammatical structure.) Now although the
variable in the gapped constituent is bound by the
wh-operator, it cannot take its interpretation directly from
the operator because the gapped element, of which the
variable is a constituent, has to be bound to and take its
interpretation from some antecedent, the V'-constituent in
the first conjunct. Therefore, the gapped constituent in
(92) must take as its antecedent $[_{V'}$ read e]. The
interpretation given to V' in the second conjunct, then, has
a variable in it that is not directly bound (again, the
variable is bound in (92)--this explains the grammaticality
of (86a)-- but it is not constrained in the interpretation
it takes within the gapped V'-constituent). Consequently,
the variable can be interpreted independent of its bound
counterpart in the first conjunct.

Crucial to the concerns of this paper is not the claim
that the variable in the second conjunct of (92) is a
parameterized variable (an interesting claim in its own
right) but the claim that the differences in the
interpretations of (86a) and (86b) depend on the fact that
the variable in the second conjunct is part of the gapped
constituent. This latter claim, therefore, is one that
needs further verification. Support for the claim under
consideration comes from (93) and (94).

(93)   ?Which book was John reading to Mary and Bill
reading to Sue

Now if the free interpretation of the variable in (86a) is
independent of the relationship between the gapped verb and
the variable, then we would expect that in sentences like
(93) (sentences without gapped verbs) the range of
interpretation for the variable would be the same as it is
in (86a). However, the variable in the second conjunct of
(93) is interpreted like the varible in (86b), not like
(86a). That is, in non-gapped sentences, the variable is
directly bound to the wh-operator. We are forced to conclude
then that the interpretation of the variable in (86a) is
dependent upon its relationship with the verb. Further, the

claim that it is V'-gapping that is responsible for the
interpretative differences in (86) can be tested by examples
in which the V'-argument is not adjacent to the gapped verb;
hence the argument cannot be said to be gapped with the
verb. Such an example is provided in (94).

(94) ??Who did John talk to about Mary's problems and
Jean to about Bill's problems

Notice that (94) is interpreted like (86b), not like
(86a)--this can be seen in (95).

(95a)   Sarah

(96a) ?*John talked to Benny about Mary' problems and
Jean talked to Alice about Bill's problems

From (95), we see that only the response where the
wh-operator binds both its trace and the variable is
well-formed. So when the V'-argument is not adjacent to the
verb and, therefore, not gapped with it, as in (94), the
variable cannot have a parameterized interpretation.

Let us now assume that it is V'-gapping that explains
the existence of the parameterized variable in sentences
like (86). This assumption permits us to determine whether
or not an adjunct is adjacent to the verb within the
V'-constituent. Consider (96).

(96a)   Why did John kiss Mary; and Bill, Sue

(96b)   When did Mary kiss John; and Sue, Bill

(96c)   Where did John meet Mary; and Bill, Sue

The sentences in (96) permit the same range of
interpretations for their variables as (86a) does, with the
variable in the second conjunct free to take a value
different from the adjunct-trace in the first conjunct.
This value differentiation is made obvious in responses to
(96).

(97)   John kissed Mary because he loved her and Bill
kissed Sue because he was told to

Example (97) shows that the adjunct-variable is "free" to
instantiate differently than the adjunct-trace. Given that
V'-gapping is responsible for the readings in which the
variable in the second conjunct takes parameterized values,
we can conclude that the adjunct in (96) is a constituent of

V', more particularly an adjacent sister of V.

My fourth, and final, argument for LF-representations in which adjuncts are the most proximate arguments of a verb is taken from the data given in (98).

(98a)   Why did John meet Mary before Bill did e Jean

(98b)   Where did John meet Mary after Bill did e Jean

What needs to be explained in (98) is why the empty element in (98b) can include, within its interpretation, the wh-adjunct, while (98a) cannot do so with its wh-adjunct. It is possible to see these different interpretations more clearly when we recast (98) as (99).

(99a)   *Why did John meet Mary before Bill met Jean
        for that reason

(99b)   Where did John meet Mary before Bill met Jean
        there

Notice that in (99a) the wh-adjunct position cannot be filled in the adjunct-clause, but in (99b) the wh-adjunct can be filled in the adjunct-clause.

An explanation of the contrasts in (98) and (99) follows from a condition on the deletion of arguments in adjuncts. This condition can be extracted from the evidence in (100).

(100a)   The book that Mary read to John before Bill
         did to Jean

(100b) ??The woman that Mary talked to about Tom's
         problem before Jean did to about Bill's
         problem

The examples in (100) demonstrate that, in adjuncts with deleted verbs, an argument of the verb can be deleted only if the if it is an adjacent sister of the verb. Given the above condition on deletion within an adjunct, we could hypothesize that the ungrammaticality of (99a) and the inability to assign a wh-adjunct reading to the VP within the adjunct-clause arises because the wh-adjuncts are not sisters of the verb. If we accept the above assumptions, we will posit the following logical representations for the VPs in (99).

(101a)   [vp [v* [v· V before-adjunct] why-adjunct]]

(101b)   [$_{VP}$ [$_{V''}$ [$_{V'}$ V where-adjunct] before-adjunct]]

Although the LFs in (101) are the LFs for the matrix VPs in
(99), they are also the LFs for the VPs in the
adjunct-clause. To see this, note that the before-clause
cannot take a before-clause of its own--which is naturally
explained if a before-clause is already present in
adjunct-clause.

(102)   *Where did John meet Mary before Bill did Jean
         before it rained

So the adjunct-clause VPs in (98), under the interpretations
given in (99), have the same structure as do the matrix
clauses: the structure expressed in (101). Given that the
adjunct-clauses in (98) have the VP-structures stated in
(101), we can explain the differences in interpretation
between (98a) and (98b). In particular, since the
wh-adjunct is not a sister with the verb in (101a), it
cannot be deleted with the verb; therefore (98a) cannot have
the why-adjunct present in the verb phrase of the
adjunct-clause, explaining why (98a) lacks an interpretation
that permits the why-adjunct to be part of adjunct-clause
VP. Conversely, the deletion of the verb and its wh-adjunct
is acceptable in (98b) because these two elements form a
constituent. As a consequence, the verb phrase in the
adjunct-clause of (98b) can be interpreted as including the
wh-adjunct.

    Additional support for the conclusions just derived can
be found in multiple-wh constructions. The following
sentences give the relevant evidence.

(103a)   ?Who ate where when

(103b)   ?*Who ate when where

(103c)   ?Who ate when why

(103d)   *Who ate why when

The fact that the ordering of the wh-elements in (103) is
crucial to the well-formedness of the sentences suggests
that these wh-elements cannot have equivalent logical
relations with the verb. That is, (103a,b) show that
structures are grammatical if where is more proximate to the
verb than when is, but ungrammatical if when is more
proximate than where. Similar results obtain for where and
why in (103c,d). Importantly, the above relations are

exactly those predicted by (101).

The arguments that I have put forth In this section converge to the same point: VPs binary branch In such a way that their verbs accept arguments one at a time, beginning with all the adjuncts and ending with the NP-arguments. On some Intuitive level, this conclusion seems correct. After all, In (104), the NP-object Mary seems more like the argument of the extended predicate see after Bill left, as represented In (104), than an argument of see.

(104a)   John saw Mary after Bill left
(104b)   (see after Bill left) (John, Mary)

Further Considerations

In this paper, I have argued that VP-structures binary branch and that VP-adjuncts are the most proximate arguments of V at LF. These conclusions raise some Interesting questions about the relationship between the levels of representation posited in GB and some of the principles of grammar hypothesized In GB (In particular Case Theory, Th-Criterion, and the Projection Principle). For one, what needs to be explained Is why VP-adjuncts are discontinuous with the verb at S-structure when they are continuous with the verb at LF. Now there seems to be an answer to this question. The reason for this S-structure discontinuity follows In a straightforward way from Case Theory within the GB-framework. According to Case Theory, structural case Is assigned at S-structure. Further, Case Is only assigned under conditions of adjacency. For case assignment of the direct object within a VP, the above conditions require the object to be adjacent to Its case assigner (the verb) at S-structure. It Is, therefore, the case that the verb and Its "logical" sister (the adjunct) cannot be sisters at S-structure or else the assignment of structural Case of the object will be prohibited.

Although we can suggest an answer to problem that my analysis raises for Case Theory, there are some questions that arise that cannot be resolved so easily. These questions have to do with the D-structure position of VP-adjuncts. Are the adjuncts D-structure sisters of the verb? If so, doesn't that configuration Interfere with th-marking? (Relatedly, can X'-elements, as well as X^0-elements, th-mark complements—as N' may do with Its arguments when N^0 Is modified by an adjective?) If not, what Is the mechanism through which an adjunct comes to be the "logical" sister of a verb? Such questions, although very Interesting, are however beyond the scope of this paper and

must await empirical investigation.

NOTES

1 The Empty Category Principle (ECP) states that:
(I) An empty category must be properly governed.
There several definitions of proper government (see Aoun and Sportiche (1982) and Chomsky (1982, 1986). May's definition of proper government, although never stated, seems to be a notion built upon local antecedent government, where an empty category cannot be separated from its antecedent by another possible binder.

2 An A'-operator is informally defined as an operator that has moved to a non-argument position.

3 Chomsky (1986) argues that there is a binary relationship between an X^0 category and its complement and between an X^1 category and its specifier. However, he allows the internal structure of the complement and of the specifier to be nonbinary. My analysis argues that all constituent structure is binary.

4 Another LF-representation is possible for (21).
(I) [which novel$_2$[John [$_{VP}$ everyone$_3$ [$_{VP}$ read e$_3$ to e$_2$]]]
However, since LF (I) cannot predict the ambiguity of (21) because the VP-node prohibits free scopal relations, I do not consider it as an LF for (21).

5 The assumption that it is possible to adjunct element to non-maximal categories is a controversial assumption. Chomsky (1986: 6) claims that elements only adjunct to maximal categories. On the other hand, Fiengo and Higginbotham (1981) argue that adjunction to interrmediate categories is possible.

6 LF (I) can also be derived for (24).
(I) [who$_2$ [John [$_{VP}$ every book$_3$ [$_{VP}$ read e$_3$ to e$_2$]]]]
This logical representation both satisfies the PCC and predicts the correct scopal relations for (24). I do not discuss (I) because (I) is irrelevant to the issue under consideration: that May's theory overgenerates logical

representations for (24). I am attempting to develop a
theory of logical form that permits all and only the correct
logical representations for a sentence.

7   The assumption that the adjunct could be an argument
only at LF violates the Projection Principle, which states
that all arguments are represented at each syntactic level
(D-structure, S-structure, and LF).

8   May (1985) and Chomsky (1986) assume that wh-in-situ
elements are adjoined to COMP at LF. May refines this
assumption by claiming that only one operator can be
adjoined per projection. For (33), this means that the
wh-in-situ elements do not adjoin to COMP, which already has
the wh-element that has moved at S-structure adjoined, but
to the wh-element already in COMP. I will follow May's
assumption in all the logical representations that I give
for multiple-wh constructions.

9   I am using the Binding Principles developed in
Chomsky (1981, 1982). Principles of the Theory of Binding

    A. An anaphor is bound in its governing
        category
    B. A pronominal is free in its governing
        category
    C. An R-expression is free

The terms "bound" and "free" are defined as A-bound and
A-free respectively; that is, bound means bound by an
element in an A-position and free means not bound by an
element in an A-position.

10   The claim that VP-adjuncts are more proximate to
the verb than V-arguments are is controversial because it
goes against the prevalent assumption in GB that such
adjuncts are outside the VP. See Chomsky (1986) for
arguments in support of the current GB-assumption about
adjuncts.

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