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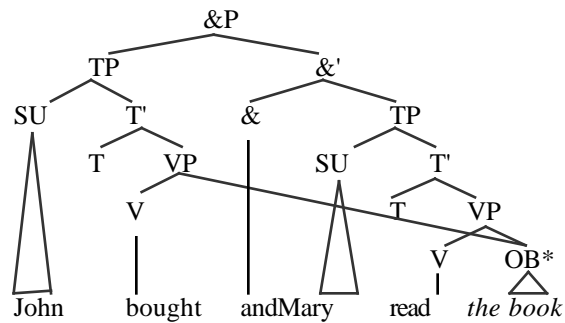
Right Node Raising and the LCA

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1 Constituent sharing in coordination

In (1), a typical ‘right node raising’ (RNR) sentence, the object *the book* is a constituent shared by the verbs of both conjuncts.

- (1) John bought and Mary read the book
- (2) [John bought t_j] and [Mary read t_j] [*the book*]_j
- (3) [John bought ~~the book~~] and [Mary read *the book*]
- (4)



The RNR construction has been variously analysed as (2) *across the board* (ATB) *movement* of the shared constituent out of the coordination (Right Node Raising: Postal 1974); *ellipsis* (3)—deletion of one constituent under identity with a second (Backward Deletion: Wilder 1997); and (4) *multiple*

dominance—a single constituent with two mothers, one in each conjunct (McCawley 1982, Goodall 1987, Muadz 1991, Moltmann 1992).

In view of arguments (see Wilder 1997) that the shared constituent and corresponding gaps in (1) are *inside* the conjuncts, I suppose that (2) is wrong. The choice reduces to whether there are two constituents, one deleted, as in (3); or only a single constituent as in (4), in which case the *single mother condition* must be given up. This paper presents an argument for adopting (4) instead of (3).

Constituent-sharing in coordination includes both ‘forward’ (Gapping, leftward ATB-movement) and ‘backward’ (RNR) dependencies. The directionality of the dependency correlates with a constraint on the placement within conjuncts of ‘gaps’ corresponding to the shared constituent .

- (5) a. If surfaces in the *final* conjunct (RNR), gap(s) corresponding to must be at the *right edge* of their non-final conjuncts.
 b. If surfaces in or to the left of the *initial* conjunct (Gapping), - gaps in non-initial conjuncts underly no such edge restriction.

(5a) is illustrated by the contrast in (6) (Oehrle 1991). The direct object in (6a) can stand after the PP in the first VP, i.e., it can undergo Heavy NP Shift as in (7a). Indirect objects resist heavy shift (7b), so the gap in (6b) cannot be in VP-final position to satisfy (5a). The absence of such a linear restriction in ‘forward’ dependencies is illustrated by the possibility for ‘medial’ verb gaps in Gapping sentences like (8).

- (6) a. I [invited into my house _] and [congratulated *all the winners*]
 b. *I [gave _ a present] and [congratulated *all the winners*]
 (7) a. I invited into my house *all the winners*
 b. *I gave a present *all the winners*
 (8) John *likes* beer and [Mary _ wine]

The ellipsis approach must stipulate (5) (see Wilder 1997). This paper shows that under a multiple dominance (MD) approach, (5) can be derived as a direct consequence of a modified version of Kayne’s (1994) *Linear Correspondence Axiom* (LCA), in conjunction with *Trace Deletion*. This allows the Backward Deletion rule, along with its specific stipulated properties (in particular, (5)) to be eliminated. The proposal depends on two further assumptions: (i) syntactic representations are dominance-only trees, with precedence defined for terminals only by the LCA (as in Chomsky 1995);

and (ii) coordination is syntactically asymmetric (the first conjunct asymmetrically c-commands the second, etc.).

If we also accept the proposal made by Johnson (1997), that Gapping is in fact across-the-board verb movement, then the conclusion might be strengthened to include Forward Deletion rules. Then all directional ellipsis rules can be eliminated in favour of a multiple dominance-plus-linearization theory of constituent sharing in coordination.

Once we give up the single mother condition to allow an MD-representation for RNR, then it makes sense to assume that the trace left by ATB movement—e.g. the copy left by ATB-raising of the subject (written twice and marked *) in (9)—also comprises a single multiply dominated constituent, rather than two separate constituents.

(9) Mary [_{&P} [_{VP1} ~~Mary~~* bought a book]] and [_{VP2} ~~Mary~~* read it]]

Gapping sentences provide an argument for the need to assume ellipsis, based on word order together with the Coordinate Structure Constraint (CSC). The CSC forbids movement of any constituent out of a conjunct unless it is shared by all conjuncts, so any constituent belonging to one conjunct only must be *inside* its conjunct. The shared verb *likes* in (8) is preceded by a non-shared constituent, *John*, the subject of the first conjunct. Since *John* must be inside that conjunct, so too must *likes*. The verb gap in the second conjunct is thus not c-commanded by its antecedent, so is not a trace. Hence the need for a special ellipsis rule (Forward Deletion in Wilder 1997), to account for the verb gap.

Johnson (1997) argues that Gapping involves ATB-movement of V out of &P, accompanied by CSC-violating subject-raising out of the initial conjunct, as in (11).

(10) *John likes* [_{&P} [_{t_{SU}} _{t_V} beer] and [Mary _{t_V} wine]]

Suppose that this is correct, and that it generalizes. Wherever shared appears to surface in the *initial* conjunct (as in Gapping), has in fact ATB-moved out of &P, so that the conjuncts share a trace of . This would allow us to dispense with Forward Deletion—gaps attributed to Forward Deletion are in fact due to Trace Deletion. It also leaves only one case where a shared constituent surfaces *inside* the coordination—RNR, in which case surfaces inside the final conjunct, with -gaps in non-final conjuncts restricted to the right edge, as per (5a).

Central to the proposal is the idea that only those MD-trees which can be linearized by LCA are well-formed. The modification of the LCA presented in section 3 is necessary to allow linearization of *any* MD-trees. At the same time, it derives (11), properties of RNR (the first part of (5)):

- (11) If a shared constituent α surfaces inside the coordination, then (i) α surfaces in the final conjunct, and (ii) α -gaps must satisfy the ‘right-edge’ condition (5a)

We can derive (12) (the second part of (5)) by adopting (13):

- (12) If α surfaces outside the coordination (ATB-movement), then α -gaps (=ATB-traces) need not satisfy the ‘right-edge’ condition
- (13) Traces need not be linearized (trace deletion renders terminals of trace copies invisible to the LCA, cf. Chomsky 1995)

In this account, (14), in which the shared verb is a single multiply dominated constituent contained within conjoined clauses (proposed i.a. by Goodall 1987), cannot be correct for Gapping. The LCA rejects (14) as unlinearizable, in contrast to (10), where the shared verb is an ATB-trace.

- (14) [[John *likes** beer] and [Mary *likes** wine]]

The next section addresses some issues regarding syntactic relations in MD-trees, setting the stage for the account of (5) in terms of linearization.

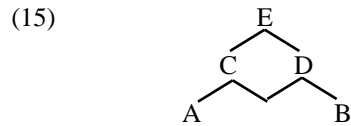
2 Multiple dominance

How does the multiple dominance view differ from an ellipsis (‘copies-and-deletion’) theory? In a ‘copies’ theory, one has two things instead of one. Thus, something can be done to one copy of α without that thing automatically happening to the other copy of α —deletion, for instance. In an MD-theory, there is only one shared constituent α , which happens to be in two places at once. Nothing can happen to α in one position without that thing automatically happening to α in its other position.

In the present proposal about coordination ellipsis, what causes a gap to appear in the string of one conjunct is not ‘deletion’ of a copy of the antecedent. Rather, what happens is that a single shared constituent simply fails to be positioned at that particular place in the string when the tree is linearized.

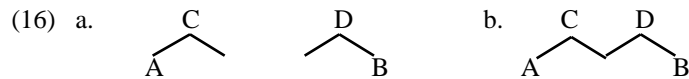
The MD-theory of constituent sharing ensures that the shared constituent is treated as a *single entity* for purposes of linearization.¹

In terms of standard phrase structure theory, this involves relaxing the single mother condition, to allow in trees like (15) that branch ‘upwards’ as well as ‘downwards’.



The proposal is compatible with derivational (e.g. *Merge theory*, Chomsky 1995) or representational views of phrase structure, but presupposes that trees encode only dominance (not precedence), as in Chomsky (1995).²

In Merge theory, MD-structures can be generated by allowing a constituent to be merged more than once. Thus, after merging α once with A to form C, α can be merged a second time with B to form D, giving (16).



C and D do not form a single object in (16). There are two sets that do not form a single set; they simply share a member (in phrase-structure terms, two independent trees that share a subconstituent). In MD-theory, given complete identity between the instances of α in each subtree, (16a) is equivalent to (16b)—they are just two ways of writing the same thing.

In the derivational theory, having two trees ‘floating around’ as in (16) is permissible as a stage of the derivation. However, (16) cannot constitute the final stage of the derivation, since it violates the *single root condition*. In Merge theory, this takes the form of a convergence condition (17b):

- (17) A derivation converges only if (a) the Numeration is empty, and
(b) the output consists of a single syntactic object

A multi-rooted construct like (16) must ultimately be merged to a single object for convergence, e.g. by Merging C and D to form E, as in (15).

¹ The intuition is similar to that of Nunes’ (1995) proposal to derive Trace Deletion from the LCA, though Nunes assumes a copy theory of movement.

² The relations of *dominance*, *immediate dominance* and *sisterhood* obtain as usual. Sisterhood is not transitive: taking sisterhood to be defined as (i), A and α in (15) are sisters, B and α are sisters, but A and B are *not* sisters.

(i) X is sister of Y iff there is a Z s.t. Z immediately dominates both X and Y

The *single mother condition* does not follow from the Merge operation. Rather, its effects are achieved through the stipulation that Merge only applies ‘at the root’, i.e. to pre-existing syntactic objects. This is unlike Move, which can merge a constituent embedded in an object K with that object K.³ To permit (16), we need to relax this condition.

The notion of constituent sharing is essentially multiple dominance—a shared constituent has two mothers, two sisters, and so on. Sharing can be defined as in (18). In (15), C and D share α .

- (18) α is *shared* by X and Y iff (i) neither of X and Y dominates the other, and (ii) both X and Y dominate α .

Relaxing the single mother condition makes available a distinction between two types of dominance: the standard dominance relation, and a stricter relation excluding shared constituents—*full dominance* (19):

- (19) X *fully dominates* α iff X dominates α and X does not share α .

In (15), E fully dominates A, B, C, α , and D; C fully dominates A; and D fully dominates B. Neither C nor D fully dominates α , though both dominate α . Full dominance plays a role in two places in the present proposal: in the definition of c-command, and in modifying the LCA (section 3).

C-command by X and dominance by X are usually held to be mutually exclusive—cf. the second clause of the traditional definition (20).

- (20) X c-commands Y iff (i) X \triangleright Y, (ii) X *does not dominate* Y, (iii) Y does not dominate X, and (iv) all categories that dominate X dominate Y

In (15), given (20), C does not c-command α . However, the present proposal depends on there there being such a c-command relation. I adopt a slightly different view of c-command (21), which treats c-command by X and *full* dominance by X as mutually exclusive:

- (21) X c-commands Y only if X does not fully dominate Y

In (15), given (21), C might c-command α and B (but not A), and D might c-command α and A (but not B). This can be rationalised in terms of a ‘sister containment’ approach to c-command. In (15), C c-commands α by virtue of D, C’s sister, dominating α .

³ Chomsky (1995) distinguishes *syntactic objects*, whole trees that have not (yet) undergone merger, from *terms*, whole trees or their constituents (one-time *syntactic objects* that have undergone merger).

To permit specifiers and adjuncts to be linearized by the LCA, I adopt the view that intermediate projections (and lower segments in adjunction structures) do not act as c-commanders. If D in (15) is an intermediate projection, so that E is a projection of D and C is a specifier, then C asymmetrically c-commands D (i.e., C c-commands D, and B, but D does not c-command anything).

3 The LCA and multiple dominance

Taking precedence to be a relation defined only for the terminals of trees (as in Chomsky's 1995 reinterpretation of Kayne 1994), we can think of the LCA as an algorithm of PF-component that linearizes the terminals of dominance-only trees, by reading c-command among *categories* (input), and delivering precedence between *terminals* (output).

Kayne's proposal has two parts, a hypothesis about the relation between structure and order (22a) and a hypothesis about how that relation constrains the form of phrase-markers (22b).

- (22) a. Precedence among terminals is determined by asymmetric c-command among categories that contain them: if a category X asymmetrically c-commands a category Y, then the terminals of X precede the terminals of Y
- b. There is a requirement for a *linear ordering* of terminals of a tree which determines possible forms of trees via (22a).

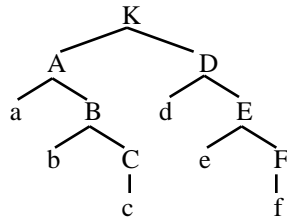
Given (22a), asymmetric c-command between two categories maps to precedence between a pair of *sets* of terminals. The mapping is mediated by the concept of the *image* of a category (23), such that the set of terminals that is the image of one category, X, precedes the set of terminals in the image of another, Y, which X asymmetrically c-commands.

- (23) The *image* of a category X, $d(X)$, is the unordered set of terminals that X dominates. The image of an ordered pair of categories $\langle X, Y \rangle$ is the set of ordered pairs of terminals $d(X) \times d(Y)$.

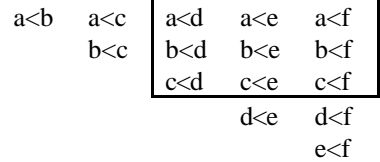
Consider (24), assuming K is a projection of D. For terminal categories (lower case), the mapping is trivial—the fact that *a* asymmetrically c-commands *b* puts *a* before *b*, and so on. The pairs boxed in (25), indicating that *a*, *b*, and *c* each precede *d*, *e*, and *f*, are determined by c-command by the complex category A (which c-commands D and all D's daughters in (24) — *a*, *b*, and *c* are in the image of A, and *d*, *e*, and *f* are in the image of D).

In this way, c-command in K determines a linear ordering of its terminals (25).

(24)



(25)



Kayne proposes that the (natural) idea that there is a requirement for a linear order of terminals explains constraints on the form of trees. If the c-command relations in a tree determine a linear ordering of its terminals, the tree is admissible; if they do not, then the tree is ill-formed. A key assumption thereby is that *every* asymmetric c-command pair in a given tree maps to precedence (26). The LCA takes the set *A* of all asymmetric c-command pairs in the tree as its input. The image of that set *d(A)* is a set of ordered pairs of terminals, which the axiom itself (27) states must constitute a linear ordering of the terminals of the tree.

(26) For a tree K, the LCA takes the image of the set *A* of all pairs of categories <X,Y> in K s.t. X asymmetrically c-commands Y

(27) LCA: *d(A)* = a linear ordering of the terminals of K.

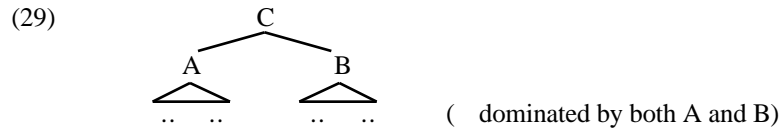
An ordering over a set T is *linear* if and only if the conditions in (28) are met, i.e. the ordering is ‘total’ (or ‘connected’) (i), asymmetric (ii), irreflexive (iii) and transitive (iv).

(28) For any x,y,z ∈ T (i) x<y or y<x; (ii) if x<y then not y<x; (iii) not x<x; and (iv) if x<y and y<z, then x<z

The LCA is violated if in the output, for any x,y,z ∈ T, any of the following obtains: (i) neither x<y nor y<x (incomplete ordering); (ii) x<y and y<x (symmetry violation); (iii) x<x (reflexivity violation); or (iv) x<y and y<z but not x<z (transitivity violation).

The present proposal uses the LCA in a similar way, to filter out multiple dominance trees on the grounds that the *c*-command relations in those trees do not yield a linear ordering of terminals. My claim is that only those multiple dominance trees that do not yield violations of (28) are well-formed. However, this makes it necessary to modify the LCA, which as it stands, cannot linearize *any* multiple dominance trees.

As soon as we have multiple dominance, we have a situation where some category α is simultaneously *dominated by* and (*asymmetrically c-commanded by*) another category A. Consider (29), assuming *c*-command between / in A and B as reflected in the order on the page.



A and B are sisters sharing α . A asymmetrically *c*-commands α . The terminals of α , included in both $d(A)$ and $d(B)$, inevitably precede themselves when the terminals of A and B are ordered ($\alpha < \alpha$ violates the irreflexivity requirement). Thus, mapping any MD-tree to precedence via the standard LCA necessarily leads to *reflexivity violations* in the output.⁴

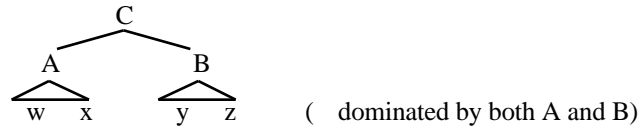
The modification I propose has the effect that the LCA does not yield reflexivity violations in the output when applying to an MD-tree. It is simple, and has no effect on the way the LCA applies to trees containing no shared constituents. We take the image of a category X not to be the set of terminals *dominated by* X, but only the set of terminals *fully dominated by* X. In other words, terminals of constituents shared by X and Y are not included in the image of either X or Y.

(30) $d(X) =$ the (unordered) set of terminals *fully dominated by* X

With this new assumption, consider (31) (again assuming *c*-command between / in A and B as reflected in the order on the page).

⁴ In most cases, the standard LCA also delivers symmetry (and transitivity) violations. If in (29) contains more than one terminal, say *a* and *b*, we get $a < b$ and $b < a$. For any terminal *c* that follows α in A or precedes α in B, we get $\alpha < c$ and $c < \alpha$. But if α is itself a terminal, rightmost in A and leftmost in B, only the irreflexivity requirement is violated ($\alpha < \alpha$).

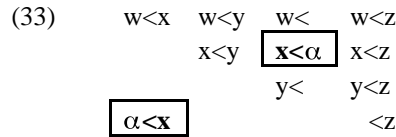
(31)



Since α is shared by A, the terminals of α are not included in the image of A. Then, c-command by A does not cause (terminals of) α to precede anything that A c-commands.

Asymmetric c-command in (31) translates to precedence as shown in (32). C-command inside A (32a), puts w before α and x , and α before x . C-command inside B (32b) puts y before α and z , and α before z . C-command by A (32c) puts w and x (but not α) before y , α , and z . The output is (33).

- (32) a. w c-commands α and x , α c-commands x : $\{w < \alpha, w < x, \alpha < x\}$
- b. y c-commands α and z , α c-commands z : $\{y < \alpha, y < z, \alpha < z\}$
- c. A c-commands y , α , and z : $\{w < y, x < y, w < \alpha, x < \alpha, w < z, x < z\}$



Notice first that there is no reflexivity violation in (33): the LCA does not order α before α . MD-trees are thus in principle linearizable. Secondly, c-command of α by A puts w and x (the image of A) before α . This gives us *backwards directionality*: any ‘gap’ precedes α , and α itself is linearized among the terminals of the *second* (lowest) conjunct. Thirdly, we have a symmetry violation in (33): α precedes x and x precedes α (there is also a transitivity violation: $\alpha < x$ and $x < y$ but not $\alpha < y$).

The reason for the symmetry violation is that c-command of x by α (inside A) determines that α precedes x , while c-command of α by A itself determines that x precedes α . Crucially, if there were no x in A such that α c-commanded x , then we would not have $\alpha < x$. The symmetry violation would disappear (the transitivity violation also). This gives us the *right edge condition* for the gap.

Given (30), then, the LCA orders a shared constituent α within the final conjunct, leaving a ‘gap’ in non-final conjuncts where α ‘ought to be’. If α also ‘ought to’ precede any other terminal in a non-final conjunct, then the structure is out (not linearizable).

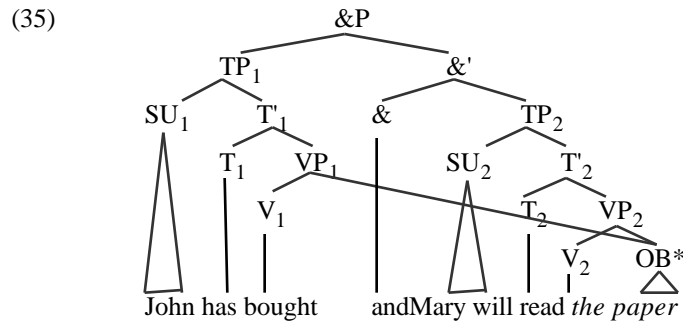
The next section illustrates how this result applies in coordination.

4 Properties of RNR explained

The proposal made above makes specific and correct predictions with respect to four RNR cases illustrated by (34), involving a coordination containing a shared constituent that is (i) final in both conjuncts (34a), (ii) non-final in both conjuncts (34b), (iii) final in the initial conjunct only (34c), and (iv) final in the final conjunct only (34d):

- (34) a. John has bought ___ and Mary will read *the paper*
 b. *John can ___ your book and Mary will read the paper
 c. John should fetch ___ and give *the book* to Mary
 d. * John should give ___ the book and congratulate *that girl*

In (35), representing (34a), the shared constituent, OB*, is ‘final’ in both conjuncts. The terminals *the, paper* are not included in the image of any constituent—in particular, the first conjunct TP₁—which does not fully dominate them.⁵ So c-command by TP₁ does not order the terminals of OB* before anything that TP₁ c-commands.

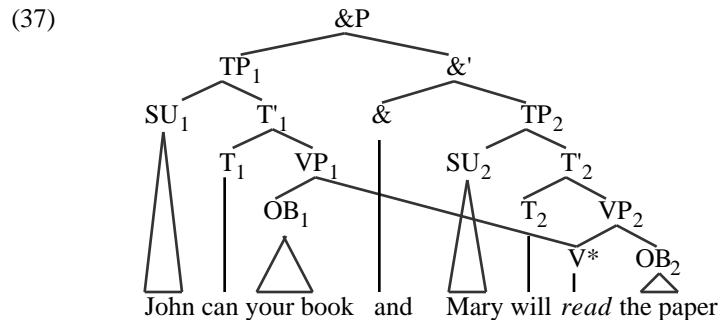


Asymmetric c-command in (35) translates to precedence as follows. Inside TP₁ and inside &', c-command gives exactly the pairs making up (36a) and (36b) respectively. TP₁ itself asymmetrically c-commands &' and its daughters (including OB*), which puts *John, has* and *bought* (but not *the* or *paper*) before *and, Mary, will, read, the,* and *paper* (36c). Putting all this together gives a linear ordering, in the RNR pattern.

⁵ TP₁ shares OB* with &', TP₂, T'2 and VP₂ in (35). TP₁ is the only category which both shares OB* and asymmetrically c-commands anything.

- (36) a. John<has<bought<the<paper
 b. and<Mary<will<read<the<paper
 c. {John, has, bought}<{and, Mary, will, read, the, paper}

(34b) is represented by (37), with a shared constituent that is ‘non-final’ in both conjuncts. The shared constituent V^* (*read*) is not included in $d(TP_1)$, and so c-command by TP_1 does not order *read* before anything. However, c-command *inside* TP_1 (38a) and c-command *by* TP_1 (38b) yield symmetry violations.



- (38) a. V^* c-commands into OB_1 : **read** < { **your, book** }
 b. TP_1 c-commands V^* : {John,should,**your,book**} < **read**

The shared verb *read* is ordered both before and after the *your* and *book*. The output of the LCA is not a linear ordering. The source of the problem is the fact that the shared constituent c-commands, hence precedes non-shared terminals inside the first conjunct.

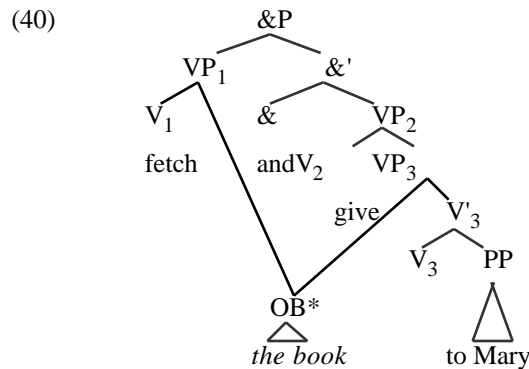
This provides an account for a well-known asymmetry concerning ‘verb-gapping’—‘backward V-gapping’ is restricted to OV languages (Ross 1970). There is no ‘backward V-gapping’ in VO-structures, since a shared verb in non-final position in a non-final conjunct, e.g. V^* in (36) (cf. also (14) above) violates asymmetry ($V^* < OB_1 < V^*$). If a shared verb c-commands no other terminals in non-final conjuncts, as in OV-structures, no symmetry violation is induced and the structure linearizes in the RNR pattern. A shared verb in a VO-structure *can* be linearized, if V^* raises out of $\&P$ (ATB-raising), leaving a trace invisible for the LCA, as in the forward Gapping case discussed above.

The proposal also correctly predicts multiple shared constituents inside conjuncts to be possible, as long as their relative ordering is the same in

both conjuncts and none is ordered before any non-shared terminal in non-final conjuncts. Such a case is provided by ‘RNR’ of the VP-final verbs of both the main clause and the relative clause in the German example (39) (cf. Wesche 1995:55).

- (39) [er hat einen Mann, der drei Hunde,] und
 he has a man who three dogs and
 [sie hat eine Frau, die drei Katzen *besitzt, gekannt*]
 she has a woman who three cats owns known
 ‘he knew a man who owns three dogs and she knew a woman who owns three cats’

To avoid the symmetry problem, a shared constituent must be final in all non-final conjuncts. No symmetry violation is induced, however, by a shared constituent that is non-final in the *final* conjunct. This is illustrated by (34c), which contains conjoined VPs sharing an object, as in (40).



C-command by first conjunct VP1 in (40) puts *fetch* before *the* and *book* (VP1 c-commands OB*), but does not put *the* or *book* before anything in &', since d(VP1) contains only *fetch*.⁶ Hence, applying to (40), the LCA delivers the ordering *fetch*<*and*<*give*<*the*<*book*<*to*<*Mary* seen in (34c), as desired. OB* c-commands no terminal in VP1, so no symmetry violation arises; the fact that OB* c-commands material (*to*, *Mary*) in the final conjunct causes no problem.

⁶ The terminals *the*, *paper* are not included in d(VP1) since VP1 shares OB* (with &', VP2 and VP3); but they are included in the image of &P and categories containing &P, since OB* is fully dominated by those categories.

The fourth case (34d), involving ‘shared non-final in the first conjunct, final in the second conjunct’, yields a symmetry violation of the pattern seen in (37)—*that* and *girl* both precede and follow *the* and *book*.

(34d) * John should give _ the book and congratulate *that girl*

Most descriptions assume that in RNR sentences, not only the gaps but also the shared constituents are subject to a right edge constraint, i.e. that itself has to be final in the final conjunct. Thus, (41) (which would mean ‘John met Mary and Mary laughed’) is ill-formed.

(41) * John met _ and *Mary* laughed

This is not captured by the LCA, correctly so, in view of the well-formedness of (34c). Though the right edge condition is sometimes attenuated for \bar{S} , it holds completely generally for \bar{S} -gaps (cf. (34d)). The ill-formedness of cases like (41) must therefore be attributed to a separate (parallelism?) constraint, which fails to apply in cases like (34c).

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