

Linear Order and Constituency*

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Abstract

In this article I present a series of arguments that syntactic structures are built incrementally, in a strict left-to-right order. By assuming incremental structure building it becomes possible to explain the differences between the range of constituents available to different diagnostics of constituency, including movement, ellipsis, coordination, scope and binding. In an incremental derivation structure building creates new constituents, and in doing so may destroy existing constituents. The article presents detailed evidence for the prediction of incremental grammar, that a syntactic process may refer to only those constituents that are present at the point in the derivation when the process applies.

Keywords: phrase structure, constituency, incrementality, coordination, binding, scope, ellipsis, movement.

1. Introduction

Tests of constituency are basic components of the syntactician's toolbox. By investigating which strings of words can and cannot be moved, deleted, coordinated or stand in coreference relations, it is possible to draw inferences about the internal structure of sentences. However, it is also well-known that the results of different diagnostics of constituency often diverge, and sometimes even conflict with one another. The purpose of this paper is to show that the varying results of different constituency tests can be understood, even predicted, if we adopt the assumption that syntactic structures are assembled incrementally, from left to right, in the same order that sentences are produced and comprehended (1).

- (1) *Incrementality hypothesis*
Sentence structures are built incrementally from left to right, i.e. in the order in which terminal elements are pronounced.

This one change in how syntactic derivations are assumed to proceed allows for substantial improvements in our understanding of constituency tests, and it allows for significant progress in finding answers to the questions in (2).

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- (2) a. Why do different structural diagnostics identify different and sometimes overlapping constituents?
b. When do pairs of structural diagnostics interact, and when do they operate independent of one another?

Briefly, the answer to the first question is that incremental building of conventional syntactic structures leads to changes in constituency over the course of a derivation; therefore, different constituents will be available to different syntactic processes, according to when each process applies. The answer to the second question is that syntactic processes only interact when they apply at overlapping stages of an incremental derivation. Detailed evidence for both of these claims is presented in what follows.

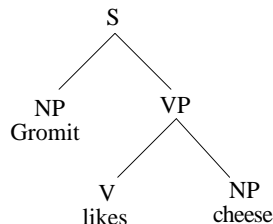
The structure of the argument is as follows. Section 2 briefly reviews the kinds of discrepancies between tests of constituency that have been observed, and the kinds of solutions that have been proposed in the past. Section 3 outlines an approach to incremental structure building which predicts the distribution of constituency conflicts. Section 4 then tests the predictions of incremental structure building, showing that the predictions of the theory are confirmed in detail, leading to explanations of a series of existing and novel puzzles in the theory of constituency. Section 5 discusses some extensions to the proposal, and Section 6 evaluates the adequacy of other accounts of constituency conflicts. Section 7 summarizes the arguments and presents conclusions.

2. Constituency Conflicts

A textbook example of how tests of constituent structure work is shown in (3). A range of different diagnostics all point to the conclusion that the verb phrase in a sentence like *Gromit likes cheese* forms a constituent to the exclusion of the subject. The VP can be coordinated, it can license ellipsis, and it can undergo leftward movement. In addition, tests of anaphor binding indicate that the subject asymmetrically c-commands the object. Collectively, these diagnostics all support a structural analysis for the sentence like (4).

- (3) a. Gromit [likes cheese] and [hates cats] (coordination)
b. Gromit [likes cheese] and Wallace does too (deletion/ellipsis)
c. [Like cheese] though Gromit does ____, he can't stand Brie. (movement)
d. Wallace and Gromit like each other. (reciprocal binding)
e. * Each other like Wallace and Gromit. (illicit reciprocal binding)

(4)



Although such model cases of broad agreement between different constituency tests are sometimes found, discrepancies in the results of different tests are also common. To take just one example, many strings can be coordinated which cannot undergo movement or ellipsis. The examples in (5) show that in addition to coordination of stereotypical VPs (5a), it is possible to coordinate the two objects of a double object construction (5b), or the subject and the verb of a transitive clause (5c), or strings that span portions of two clauses,

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as in (5d). The representation of coordinate structures like these is discussed in more detail in Sections 4.1 and 4.4.

- (5) a. Wallace [visited Wendolene] and [bought some wool].
b. Wallace gave [Gromit a biscuit] and [Shawn some cheese] for breakfast.
c. [Wallace designed] and [Gromit built] an enormous tin moon-rocket.
d. Alice [knew that Fred wanted to talk] and [hoped that he wanted to argue] with the president.

However, not every string that can be coordinated can be moved. For example, although it is possible to coordinate the two objects of the double object construction, it is impossible to topicalize them (6a), and it is also impossible to move them rightwards (6b). Restrictions on movement are discussed in Sections 4.1, 4.2 and 5.3.

- (6) a. * [Gromit a biscuit] Wallace gave ___ for breakfast.
b. * Wallace gave ___ at breakfast-time [his favorite pet beagle an enormous chewy dog-biscuit.]

Similarly, many strings which allow coordination cannot undergo ellipsis. Although an entire VP containing an embedded clause may undergo ellipsis (7a), it is impossible for ellipsis to target the matrix verb plus a subpart of the embedded clause (7b). Note that it is precisely such a string which is coordinated in (5d). Constraints on possible antecedents for ellipsis are discussed in Sections 4.1, 4.3, 5.2 and 5.4.

- (7) a. Alice [knew that Fred wanted to talk with the queen] and Ethel did too.
b. * Alice [knew that Fred wanted to talk] with the queen and Ethel did with the president.

Examples like (5-7) indicate that movement and ellipsis target a subset of the strings that coordination can target, but further examples lead to the more troubling conclusion that *overlapping* strings of words may be diagnosed as constituents by some syntactic processes, contradicting the basic assumption that sentences have nested hierarchical structures. (8) illustrates this for coordination: in (8a) the two objects of a double object construction are coordinated to the exclusion of a following PP adverbial; in (8b) the second object and the adverbial PP are coordinated to the exclusion of the first object.

- (8) a. Wallace gave [Gromit a biscuit] and [Shawn some cheese] for breakfast.
b. Wallace gave Gromit [a biscuit in the morning] and [some cheese just before bedtime.]

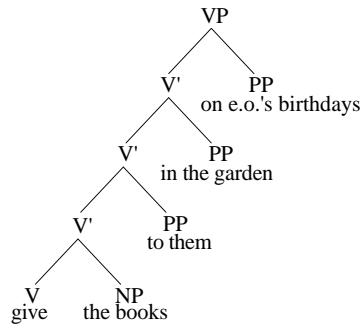
A more striking case, pointed out by Pesetsky (Pesetsky 1995), involves a conflict between two different diagnostics applying to the very same sentence. Based on the VP-fronting seen in (9a,b), which strands VP-modifying material at the right of the sentence, standard syntactic reasoning leads to the conclusion that the fronted phrase is a constituent, and therefore by extension that the stranded modifiers c-command the rest of the VP, as in a traditional left-branching VP-structure such as (10a). On the other hand, the fact that the stranded adverbials contain an anaphor which is bound by an antecedent inside the fronted predicate suggests that the anaphor is c-commanded by its antecedent, as in the radically right-branching VP-structures proposed by Larson and others (Kayne 1984, 1994; Larson 1988; Aoun & Li 1989; Stroik 1990; Pesetsky 1995) (10b).

- (9) a. ...and [give the books to them_i in the garden] he did ___ on each other_i's birthdays.

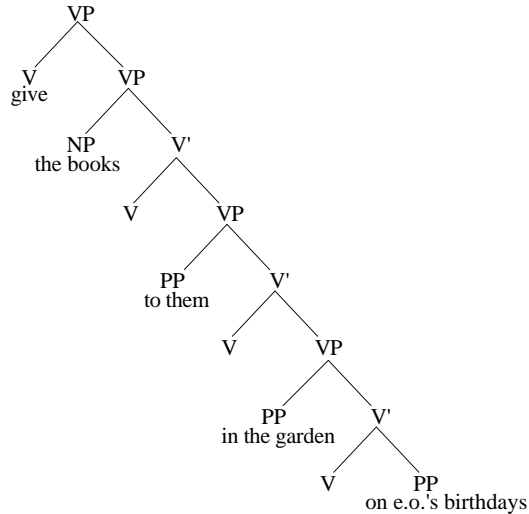
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- b. ...and [give the books to them_i] he did ___ in the garden on each other_i's birthdays.

(10) a.



b.



Although the syntactic literature contains many excellent characterizations of the range of constituents picked out by individual structural diagnostics, there is no general theory of why particular tests yield the results that they do. As a result, discrepancies between the results of constituency tests have typically not been very informative.

The fact that some diagnostics pick out a broader range of constituents than others is easy to accommodate, because it seems reasonable that there should be construction specific restrictions on certain syntactic processes. As a result, many of the discrepancies between constituency tests have generated little concern. Less easy to accommodate are the cases of constituency conflicts (overlapping constituents), which contradict the basic assumption that sentences have a unique phrase marker (or sequence of phrase markers in a derivation), and that syntactic processes apply only to constituent pieces of that phrase marker. Such examples have generated a variety of responses.

Probably the most widespread response to constituency conflicts is to question the assumptions about the tests which lead to the contradictions. One version of this approach is to question the assumption that syntactic processes transparently reflect constituency and c-command relations. For example, the term *non-constituent coordination*, which has often been used to refer to coordinations like (5b), implies that coordination is not restricted to constituents, in order to account for differences between coordination and other processes. Similarly, binding tests have been argued to diagnose precedence and/or m-command relations rather than c-command relations (Barss & Lasnik 1986; Jackendoff 1990; Ernst 1994). Another possible move is to assume that the recalcitrant constituency facts are due to the confounding effects of phonetically null material, such as empty categories left by movement operations. The classic analysis of right node raising sentences like (5c) achieves this by positing string-vacuous across-the-board movement of the shared material (e.g. Ross 1967; Maling 1972; Postal 1974). The effect of this analysis is that what under standard assumptions appears to be non-constituent coordination turns out to be coordination of full clauses. In general, work in the transformational grammar has focused more on structural evidence from movement and binding tests, and has placed less importance on evidence from coordination.

Another reaction to constituency conflicts is to question the assumptions about syntactic structures that lead to the contradictions. The appearance of overlapping constituents is at odds with the widespread assumption that sentences have a unique

constituent structure (or a unique derivation), but overlapping constituents are no longer problematic if we drop the assumption of a single structure, and assume instead that sentences may have multiple parallel structures. This approach has been most extensively explored in certain versions of Combinatory Categorical Grammar (CCG: Ades & Steedman 1982; Dowty 1988; Steedman 1997, 1998), but it has also been pursued in other traditions such as Dependency Grammar (Pickering & Barry 1993) and Transformational Phrase Structure Grammar (Brody 1994; Pesetsky 1995). CCGs in which basic function application rules have been enriched with type raising and function composition rules often allow a given sequence of words to be combined in two or more different orders, thereby creating the effect of *flexible constituency*. Therefore, in CCG constituency conflicts are possible because different syntactic processes can refer to different syntactic structures. Pesetsky's (1995) phrase structure grammar version of flexible constituency claims that sentences have exactly two structural representations: one representation with a left-branching *Layered* VP-structure, and a second representation with a right-branching *Cascade* VP-structure. Furthermore, it is assumed that one set of syntactic processes applies to Layered structures (movement, ellipsis, island constraints, modifier scope interpretation) and the remainder of syntactic processes applies to Cascade structures (e.g. binding, coordination). Flexible constituency approaches are discussed in Section 6.1.

3. Incremental Structure Building

The central hypothesis of this paper is given in (11): I suggest that discrepancies in the results of different constituency tests are primarily due to the incremental manner in which syntactic structures are built up from left to right. By adopting this assumption, it becomes possible to predict which strings of words individual syntactic processes are able to refer to as constituents, and there is no need to assume flexible constituency.

- (11) *Incrementality hypothesis*
 Sentence structures are built incrementally from left to right, i.e. in the order in which terminal elements are pronounced.

The derivation in (12) shows some of the stages in the incremental construction of the sentence *Wallace saw Gromit in the kitchen*, and serves to illustrate the most important consequences of incremental structure building. (12a) shows the structure that is constructed from the subject NP *Wallace* and the finite verb *saw*. Notice that at this point in the derivation the VP contains only the verb, and the string *Wallace saw* is a constituent, by virtue of the fact that it is exhaustively dominated by IP.¹ I assume that in the absence of internal structure, VP does not vacuously project separate V⁰ and VP nodes (cf. Muysken 1982; Kitagawa 1986; Chomsky 1995). I also assume that although the verb *see* is transitive, the object position is not generated in advance of the object itself. The transitivity of the verb is still represented as part of the verb's lexical representation, and the derivation will fail if there is still no object present when it completes.

In the subsequent step of the derivation (12b), the object NP *Gromit* is added to the structure, creating a branching VP node. One important consequence of creating the VP constituent *saw Gromit* is that the constituency of the string *Wallace saw* is thereby destroyed.²

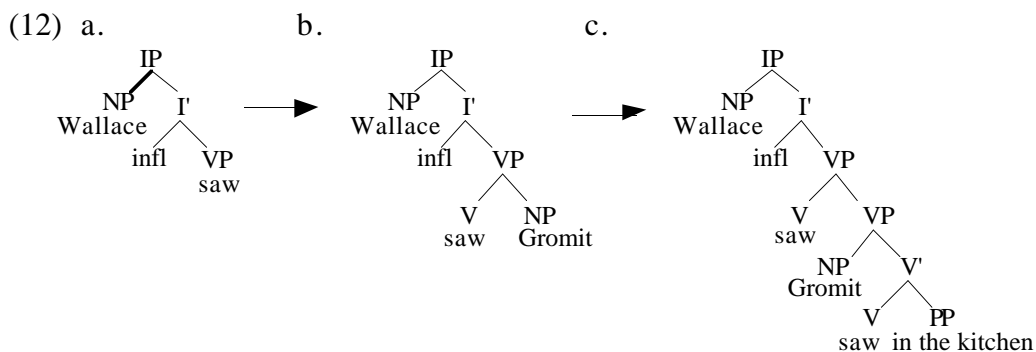
¹ For the purposes of this paper, the internal structure or deconstruction of the head Infl is not important. In addition, the morphosyntactic details of how English verbs and finite inflection are combined also plays no central role in the arguments that follow.

² Readers familiar with the incremental bottom-to-top structure building assumed in much work in the Minimalist framework (e.g. Chomsky 1994, 1995) will notice that incremental derivations like (12a-c) are *countercyclic*, i.e. new material is added to the structure at positions other than the root node. The primary empirical motivation for requiring structure building to be entirely cyclic in the Minimalist approach is in

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Finally (12c) shows the final structure built, in which the locative PP *in the kitchen* has been added to the structure in such a way as to create a right-branching ‘VP-shell’ structure (cf. Larson 1988; Aoun & Li 1989; Stroik 1990). I assume that this structure is created by first making a copy of the higher V node and attaching it to the right of the object NP, and then attaching the adverbial PP as the sister of the lower V head. I assume that VP modifiers must be attached as a sister of a projection of the V that they modify. This allows in principle either right-branching nested VP structures like (12c), or left-branching VP structures, but I assume in addition that an economy condition forces the more right-branching alternative to be chosen wherever possible.³ The only situations in which the right-branching option can be avoided is when the left-branching alternative either yields a distinct interpretation or allows a constituent to be targeted that otherwise could not be targeted (on both of these points, see Section 4.3).

Again, notice that the effect of expanding the right-branching VP in (12c) is to destroy certain constituents that existed at earlier stages. In this case, the addition of the PP destroys the constituency of the verb + object string *saw Gromit*.



Notice two properties of this kind of derivation. First, the final structure that is assembled is not in itself novel. In general, the sentence structures to be discussed below are fairly standard in their final form. The one thing that is unusual is the stages that the structures pass through as a result of their left-to-right assembly.

The second, and for current purposes more interesting consequence of incremental derivations involves the changes in which strings of words are constituents as the derivation progresses. (12) shows specific changes in constituency in assembling a generally right-branching sentence of English. In general, whenever a right-branching structure is assembled incrementally there are strings that are constituents at some point in the derivation but not in the final structure. (13) shows the general form of constituent creation and destruction. A and B form a constituent of type X at one stage in the derivation

order to allow intervention constraints (e.g. relativized minimality effects) to be implemented in a derivational approach. A constraint which blocks an element X from intervening between positions A and B in a chain can be implemented derivationally by preventing movement from A to B across X, but this implementation will work *only* if X is already present when the movement occurs. If the derivation allows X to be added to the structure after the movement from A to B occurs, then the intervention constraint cannot be implemented derivationally. The cyclicity constraint closes this loophole.

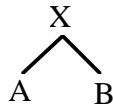
Note that although incremental left-to-right structure building requires counter-cyclic derivations in Chomsky’s sense, the strict left-to-right ordering of derivations should block the escape hatch for intervention constraints at least as effectively as the cyclicity requirement does.

³ This economy condition favoring right-branching structures may ultimately derive from the extensively motivated bias for right-branching structures in on-line processing of syntactic ambiguities. In the sentence processing literature this bias typically falls under the heading of *Right Association* (Kimball 1973), *Late Closure* (Fodor & Frazier 1980), *Recency* (Gibson et al. 1996). See Phillips (1995) and Phillips & Gibson (1997) for discussion of the status of this parsing principle and its relation to syntactic economy constraints.

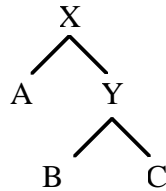
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(13a), but when C is added as sister of B, this forms a new constituent [BC], and destroys the earlier constituent [AB] (13b).

(13) a.



b.



This observation about the creation and destruction of constituents is the key to the explanation of differences between constituency tests, and much of the rest of this paper focuses on verifying specific predictions that follow from this.

The logic of the argument is as follows. Because of differences in when different syntactic processes apply, they make reference to different stages in the derivation of a sentence. For example, coordination is typically a relation between a pair of linearly adjacent strings, and so effectively applies to a single stage in the derivation; movement and ellipsis involve relations between non-adjacent positions in a sentence, and so apply to multiple stages. Leftward topicalization processes and rightward extraposition operations make reference to different pairs of stages. Movement processes involve relations between pairs of positions within a sentence, whereas ellipsis processes typically involve relations between pairs of positions in conjoined or independent sentences. Given that constituency changes stage-by-stage in an incremental derivation, the goal is to show that the constituents that each constituency test is able to refer to are *just those constituents that are present in the syntactic structure when the test applies*. In this way, the range of constituents referred to by each test can be derived from the range of constituents present in the structure when the test applies.

4. Specific Predictions

This section tests in detail the feasibility of the claim that constituency conflicts and differing results of constituency tests in general can be derived from the incremental nature of syntactic structure building.

4.1 Range of Available Constituents

The first prediction is that the range of constituents that a given constituency test can refer to follows directly from the stage of the derivation at which the test applies. The critical point here is that a syntactic process that makes reference to more than one stage in the assembly of a syntactic structure – as most tests do – can only apply to strings that are constituents at each point in the derivation where the process applies.

Prediction 1: A constituency test may refer to only those strings that are constituents at the point in the incremental derivation when the test applies.

4.1.1 Coordination

It is well known that coordination is an extremely ‘liberal’ diagnostic of constituency, allowing coordination of many strings which are not constituents under traditional phrase structure analyses. In addition, coordination stands apart from other constituency diagnostics in this regard. As a result, coordination evidence has often been ignored in favor of the results of less liberal diagnostics such as movement or binding.

Under an incremental approach to structure building, the reason for the exceptional status of coordination is immediately apparent. The two conjuncts in most coordinate

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structures are immediately adjacent to one another (excepting the conjunction, that is), and as a result there is no risk of the first conjunct losing its constituency before the second conjunct is built. As a result, any string that is a constituent at some point during a syntactic derivation should be a candidate for coordination.

(15-20) show the stages in the assembly of the phrase structure for the sentence in (14), and verifies that all of the constituents present at any point in the derivation may be coordinated. As before, I assume that the complex VP is internally right-branching.

- (14) Wallace will give Gromit crackers for breakfast.
- (15) a. [Wallace]
b. Wallace and Wendolene gave Gromit crackers for breakfast.
- (16) a. [Wallace will]
b. Wallace will and Wendolene probably won't give Gromit crackers for breakfast.
- (17) a. [Wallace [will give]]
b. Wallace will give and Wendolene will send some crackers to Gromit for his birthday.⁴
c. Wallace will design but won't actually build an exciting new invention for his dog's birthday.
- (18) a. [Wallace [will [give Gromit]]]
b. Wallace will give Gromit and Wendolene will give Preston a shining new collar for walking about town.
c. Wallace will give Gromit and send Preston a shining new collar for walking about town.
- (19) a. [Wallace [will [give [Gromit crackers]]]]
b. Wallace will give Gromit crackers and Wendolene will give Preston dog food for breakfast.
c. Wallace will give Gromit crackers and Preston dog food for breakfast.
- (20) a. [Wallace [will [give [Gromit [crackers for breakfast]]]]]
b. Wallace will give Gromit crackers for breakfast and Wendolene will give Preston dog food for dinner.
c. Wallace will give Gromit crackers for breakfast and toast for lunch.

Many of the constituents that are coordinated in (15-29) are no longer present in the final structure in (20a), but this is not a problem, since they are all constituents at the point at which the coordinate structure is initially built.⁵

Note that although incremental structure building makes a wide range of constituents available for coordination, this does not mean that *any* substring of a sentence can be a conjunct for coordination. Strings that are never constituents at any point during an incremental derivation cannot be coordinated. (21a-b) show that it is impossible to coordinate strings consisting of a subpart of an NP plus material from a following XP.

⁴ In this example a dative construction is used rather than a double object construction – see Section 5.4 below for discussion of the status of double object constructions in right node raising contexts.

⁵ See Section 4.4 below for more detailed discussion of how coordination of non-final constituents is represented.

(21c) shows that it is impossible to coordinate the final NP of a sentence initial subordinate clause and the subject of the matrix clause.⁶

- (21) a. * The man [who built the rocket has] and [who studied robots designed] a dog.
 b. * Wallace gave his [dog half a dozen] and [sheep a handful of] crackers for breakfast.
 c. * After Wallace fed [his dog the postman] and [his sheep the milkman] arrived.

4.1.2 Movement

Whereas coordination typically involves a relation between a pair of string adjacent constituents, movement processes typically involve a relation between two positions in a sentence that are not string adjacent. Therefore, we predict that it will only be possible to move strings that are constituents at each point in a derivation when a link of the movement chain is built. Strings that are only fleetingly present during a derivation (such as subject-verb constituents), make poor candidates for movement, because they do not survive for long enough to undergo movement.

On the assumption that noun phrases, once built, remain as constituents to the end of a derivation, it is not surprising that noun phrases show the greatest range of possibilities for movement. Consider, for example, the case of a topicalized NP like *the crackers* in (22).

- (22) The crackers, Wallace likes ___.

In order for the topicalized NP to establish a movement relation with the underlined direct object gap position, the NP must be a constituent not only when it is first constructed, but also when the direct object position is created. This requirement is easily satisfied by the derivation in (23). For purposes of the current discussion, we may assume that the sentence initial topic occupies the specifier position of a TopicP projection, and that the movement chain is established by means of a copying operation, although other structural assumptions will also work.⁷

- (23) a. [_{TopP} [_{NP} the crackers] Top⁰]
 b. [_{TopP} [_{NP} the crackers] Top⁰] [Wallace [_{VP} likes]
 c. [_{TopP} [_{NP} the crackers] Top⁰] [Wallace [_{VP} likes [_{NP} the crackers]]]

On the other hand, constituents that are destroyed before a gap position is created cannot undergo movement. We will see two examples of this. This section shows how incremental structure building can explain a widely discussed interaction between movement and binding, involving contrasts between different moving categories with respect to connectivity and scope reconstruction effects (van Riemsdijk & Williams, 1981; Freidin, 1986; Lebeaux 1988, 1990, 1991; Heycock 1995). Another example of

⁶ Note that the examples in (21) appear to be predicted to be possible in the *Dynamic Dependency Grammar* treatment of coordination proposed by Milward (1994).

At this point I have left open the question of whether sentence-initial strings that include a subpart of an NP, such as *Wallace ate the...* are constituents of an incremental derivation and hence possible conjuncts. This question is discussed in more detail in Section 5.1.

⁷ In left-to-right derivations the first (i.e. leftmost) position in which an element appears is almost always the position in which it is pronounced. Almost all syntactic derivation is therefore effectively 'post-phonological'. One convenient consequence of this is that there is no need in this approach to represent which syntactic copies are or are not destined to be spelled-out phonologically, as is required in other approaches (e.g. Chomsky 1995).

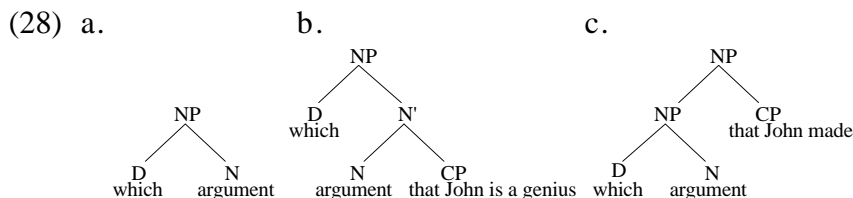
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constituent destruction that blocks a movement operation, involving an interaction between right node raising and movement, is discussed in Section 4.4 below.

The original observation due to Freidin (1986) and Lebeaux (1988), which has been corroborated and extended in more recent work (e.g. Heycock 1995), is that an r-expression inside the complement of a fronted NP induces a Condition C violation when a coreferent NP c-commands the extraction site: the coindexed NPs in the (a) examples in (24–27) cannot corefer, exactly as would be the case if no fronting had occurred, as in the corresponding (c) examples. On the other hand, NPs inside modifiers of fronted NPs fail to induce Condition C violations: the coindexed NPs in the (b) examples in (24–27) can corefer, as if the binding conditions apply to a representation in which the fronted NP does not occupy its underlying thematic position, as shown by the contrast with the corresponding (d) examples.

- (24) a. ?* Which argument that John_i is a genius did he_i believe?
 b. Which argument that John_i made did he_i believe? (Lebeaux 1988)
 c. * He_i believed which argument that John_i is a genius.
 d. * He_i believed which argument that John_i made.
- (25) a. ?* The overwhelming evidence that Henry_i was a spy, he_i refused to accept.
 b. The overwhelming evidence that Henry_i had amassed, he_i refused to present.
 c. * He_i refused to accept the overwhelming evidence that Henry_i was a spy.
 d. * He_i refused to present the overwhelming evidence that Henry_i had amassed.
- (26) a. ?* The remarkable proof of Fermat_i's conjecture, he_i could barely fit in the margin.
 b. The remarkable proof in Fermat_i's book, he_i did not expect to generate much interest.
 c. * He_i could barely fit in the margin the remarkable proof of Fermat_i's conjecture.
 d. * He_i did not expect the remarkable proof in Fermat_i's book to generate much interest.
- (27) a. ?* Which proof that Andrew_i had made a mistake did he_i never publish?
 b. Which proof that Andrew_i had made a mistake in did he_i never publish?
 c. * He_i never published which proof that Andrew_i had made a mistake.
 d. * He_i never published which proof that Andrew_i had made a mistake in.

The contrast between arguments and adjuncts of noun phrases can be explained by incremental structure building in conjunction with the common assumption that there is a structural difference between postnominal complements and postnominal modifiers: complements of nouns are sisters of the head of NP, modifiers are adjoined to NP.⁸ Key stages in the assembly of complex NPs are shown in (28). (28a) shows the NP *which argument* prior to addition of the postnominal phrase: at this point the string *which argument* is a constituent. However, it ceases to be a constituent if the postnominal material is a complement clause, as in (28b), and only survives as a constituent if the postnominal material is an adjoined modifier, as in (28c).



⁸ This analysis may be readily translated into a theory which adopts the DP hypothesis (Szabolcsi 1982; Fukui & Speas 1986; Abney 1987), by assuming that noun phrase modifiers are adjoined to DP.

I assume that in order to create a well-formed *wh*-chain at least the noun phrase consisting of the *wh*-element and the head noun must be copied from the scope position to the theta position. This movement is very similar to standard transformational approaches to *wh*-movement. In standard approaches *wh*-expressions originate in thematic positions and must reach a scope position. In the current approach *wh*-expressions originate in scope positions and must reach a theta position.

Now consider the effect that the structures in (28) have on the creation of the movement chain when the postverbal gap position is created. In the case of an NP containing a complement clause, the smallest constituent containing an NP that can be copied to the theta position is the entire NP in (28b). Therefore, the only constituent that can be copied into the thematic position contains the complement clause, and hence the sentence behaves for binding theory as if the entire NP occupies its underlying thematic position, and leads to a Condition C violation (29a). On the other hand, in the case of an NP containing an adjoined relative clause, the NP *which argument* is still a constituent at the point when the movement chain is built. Therefore, this smaller NP may be copied into the theta position without also copying the adjoined relative clause, and hence no Condition C violation is triggered (29b).

- (29) a. * [Which [argument [that John_i is a genius]]] did he_i believe [which [argument [that John_i is a genius]]]?
 b. [[Which argument] that John_i made] did he_i believe [which argument]?

Therefore, incremental structure building can account for the argument/adjunct asymmetry in the movement of *wh*-NPs, without assuming any difference between arguments and adjuncts with respect to when they enter a syntactic representation. According to a common approach to the asymmetry, arguments of NP are assumed to be combined with the head noun at D-structure, when the noun still occupies its theta position, whereas adjuncts of NP are assumed to (optionally) combine with the NP at S-structure, after *wh*-movement has occurred (Lebeaux 1988; Chomsky 1995).⁹

Despite the contrast between complements and modifiers of fronted NPs with respect to Condition C, fronted predicates (VPs and APs) show no such contrast: fronting of predicates never bleeds Condition C (Hasegawa 1983 (observation attributed to Joan Bresnan); Cinque, 1984; Barss, 1986; Huang, 1993; Takano, 1995; Heycock, 1995). This applies equally to arguments of predicates (30) and modifiers of predicates (31).

⁹ Some authors have questioned the accuracy of the generalization that there is an argument/adjunct contrast with respect to whether extraction bleeds Condition C (e.g. Kuno 1997; Postal 1997; Lasnik 1998). These authors have pointed out examples like (i–iii), which suggest that extraction of arguments of NP may sometimes also bleed Condition C.

- (i) Which piece of evidence that John_i was guilty did he_i successfully refute? (Lasnik 1998)
 (ii) The claim that the director_i was corrupt, he_i was unwilling to discuss. (Postal 1997)
 (iii) Whose claim that the Senator_i had violated the campaign finance regulations did he_i dismiss as politically motivated? (Kuno 1997).

Although I agree with the judgments for (i–iii), I think that it would be incorrect to conclude from facts like these that there is no structural asymmetry in movement/binding interactions to account for. The facts in (i–iii), together with the examples in the text, indicate that there is *variability* in whether extraction of *complements of NP* bleeds Condition C. I have no account of the cause of this variability at present, but note that this does not change the paradigm very much. It is clear that extraction of adjuncts of NP reliably bleeds Condition C, and hence there remains a contrast between arguments and adjuncts. Also, it is also clear that extraction of predicates reliably fails to bleed Condition C, and hence there remains a contrast between nominals and predicates.

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- (30) a. * Proud of John_i, I don't think you can accuse him_i of being. (Heycock 1995)
b. * How proud of Wallace_i's invention does he_i seem to be?
c. * Read Wallace_i's biography though he_i did, he did not enjoy it at all.
- (31) a. * [Playing cards until long after Lucy_i's bedtime] though she_i was, she_i was not at all tired the next morning.
b. * Read a biography in Wallace_i's living room though he_i would like to, there's no chance that he actually will.

The obligatory reconstruction effect is expected if we assume that both arguments and modifiers of predicates are structural complements of verbal or adjectival heads, as in right-branching structures like (12b), and if we assume that a VP constituent (or AP) must be copied into the underlying VP (AP) position, in order for external theta-roles to be assigned. In any right-branching VP-structure, the smallest VP constituent which contains the verb also contains all other VP-material, and therefore the only possibility is to copy the entire VP into its underlying position. As a result, fronted predicates behave for Condition C as if they are in their underlying thematic positions.

This account relies on the assumption that there is a structural difference between these various kinds of phrases. In particular, while arguments of nouns and both arguments and modifiers of predicates are structural sisters of a head, modifiers of nouns are adjoined to NP. Independent support for these structural assumptions can be derived from other structural diagnostics.

The assumption of a structural parallel between arguments and modifiers of predicates is supported by coordination and binding tests, on which PPs which are arguments and modifiers of V behave alike (32–33).

- (32) a. The baker put [the cake in the oven] and [the pastry on the shelf]
b. I saw [the dog in the garden] and [the cat on the roof]
- (33) a. He put the children_i in each other_i's beds.
b. I saw the dogs_i in each other_i's kennels.

These parallels were noted by Larson (1990) and Stroik (1990), who concluded that PP modifiers of V must be structurally identical to PP arguments of V, and therefore attached as complements of the lower VP in a nested VP structure.

Whereas arguments and modifiers of V behave alike, evidence from coordination shows an asymmetry between arguments and modifiers of nouns. N-PP sequences can be coordinated to the exclusion of a determiner if the PP is an argument of N (34a), but N-PP sequences cannot be coordinated if PP is a modifier of N (34b). A similar contrast between argument and modifier CPs is shown in (35). Coordination of head nouns and their clausal complements is marginally possible (35a), but coordination of head nouns and relative clause modifiers is substantially degraded. These coordination facts are consistent with the assumption that complements of N are sisters of N and that NP-modifiers are adjoined to NP.

- (34) a. I will never forget the [destruction of the city] and [pillaging of all its riches].
b. * I most liked the [dog in the garden] and [cat on the roof].
- (35) a. ? The [evidence that cats have UG] and [proof that they can solve differential equations] stunned the learned fellows of the society.
b. * The [evidence that Sophie amassed] and [proof that Andrew devised] stunned the learned fellows of the society.

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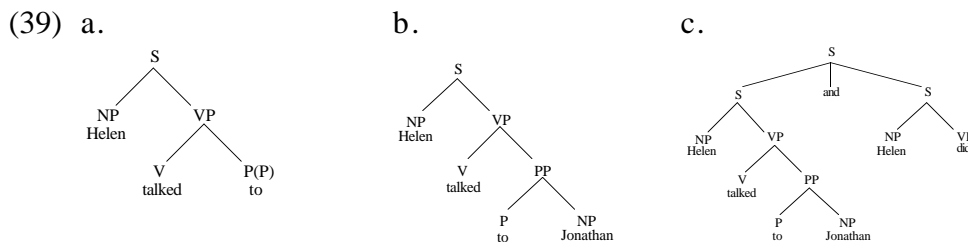
4.1.3 Deletion/Ellipsis

Ellipsis processes are – like movement processes – also rather more restrictive than coordination in the range of constituents that they can apply to. Incrementality explains this restrictiveness as follows. Given the standard assumption that deletion or ellipsis of a constituent is licensed by the presence of some constituent that serves as an antecedent, we predict that the only constituents that can be antecedents for ellipsis are those constituents that are still constituents when the ellipsis site is licensed. Since the antecedent and the gap are typically in different conjoined sentences in ellipsis constructions, this effectively entails that in order to be an antecedent for ellipsis a constituent must survive at least until the end of the first conjoined sentence.

To take a concrete example, consider the following contrast between coordination and pseudogapping (Levin 1979/1986; Jayaseelan 1990; Lasnik 1995). In sequences of a verb followed by a prepositional phrase it is possible to coordinate the verb + preposition sequence (36) to the exclusion of the NP complement of the preposition, but as Postal and Baltin have observed it is impossible for the verb + preposition string to serve as an antecedent for ellipsis in the pseudogapping construction (Postal 1986; Baltin & Postal 1996). (37) shows cases of pseudogapping in conjoined clauses, (38) shows pseudogapping in a comparative construction. In both instances it is possible to delete just the verb, but impossible to delete the verb and the preposition together.

- (36) a. John talked to and gossiped about the kid who sprayed paint on his car.
 b. The cat looked at and then slept on the rug in the middle of the living room.
- (37) a. Helen talked to Jonathan, and Alice did ___ *(to) Matthew.
 b. The cat slept on the mat, and the dog did ___ *(on) the chair.
- (38) a. Helen talked to Jonathan more often than Alice did ___ *(to) Matthew.
 b. The cat slept on the mat more often than the dog did ___ *(on) the chair.

The reason for the contrast is as follows. In the course of the incremental assembly of the verb + PP sequence, the verb + preposition sequence is a temporary constituent (39a). This is sufficient to make it a possible conjunct. However, the verb + preposition constituent is destroyed by the addition of the NP, which creates a branching PP constituent (39b). This presents no problem for coordination, since coordination occurs before the NP is added to the structure, but it makes pseudogapping in a subsequent clause impossible, because the verb + preposition constituent no longer exists at the point when the gap needs to be licensed (39c).



This example provides a direct illustration of how incremental structure building makes different constituents available to different syntactic processes. An additional example of how the nature of ellipsis constructions restricts the range of constituents that it may apply to is discussed in Section 4.3 below, which focuses on a situation in which ellipsis is more restrictive than movement.

4.2 Explaining Constituency Conflicts

A second general prediction that can be derived from the Incrementality hypothesis is that apparent contradictions between different constituency tests must be artifacts of the way in which constituency changes over the course of a derivation. If different tests diagnose overlapping constituents, then it must be that those tests make reference to different stages in an incremental derivation.

Prediction 2: Contradictions between constituency tests can only arise when those tests apply at different stages in the incremental derivation of a sentence.

One example consistent with this prediction has already been seen above: incrementality can account for the fact that coordination can apply to overlapping constituents. (40–41) repeats examples from (19–20) above which show coordination of overlapping constituents in complex VPs. Coordination of the two objects of *give* to the exclusion of the sentence-final PP (40b) is possible when coordination applies to a structure like (40a). Coordination of the second object and the sentence-final PP (41b) is possible when coordination applies to a structure like (41a).

- (40) a. [Wallace [will [_{VP} give [_{VP} Gromit [_V V_{give} crackers]]]]]
 b. Wallace will give Gromit crackers and Preston dog food for breakfast.
- (41) a. [Wallace [will [_{VP} give [_{VP} Gromit V_{give} [crackers [_V V_{give} for breakfast]]]]]]]
 b. Wallace will give Gromit crackers for breakfast and toast for lunch.

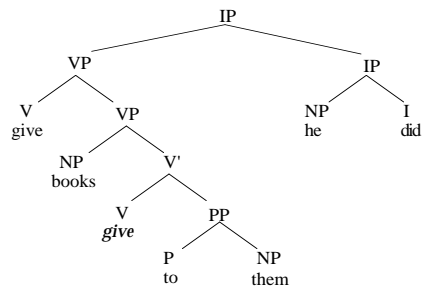
More interestingly, incremental structure building provides a way of dealing with Pesetsky's examples involving apparent constituency conflicts within an individual sentence. Recall that the puzzle that examples like (42, repeated from (9)) present for standard assumptions about constituency is as follows. The fact that the fronted predicate can strand an adverbial PP implies that the VP has an underlying structure in which the PP c-commands the predicate. This entails that the anaphor is not c-commanded by its antecedent. Meanwhile, the fact that the anaphor is successfully bound implies that the anaphor is c-commanded by the pronoun. Hence the contradiction.

- (42) a. ...and [give the books to them_i in the garden] he did ___ on each other_i's birthdays.
 b. ...and [give the books to them_i] he did ___ in the garden on each other_i's birthdays.

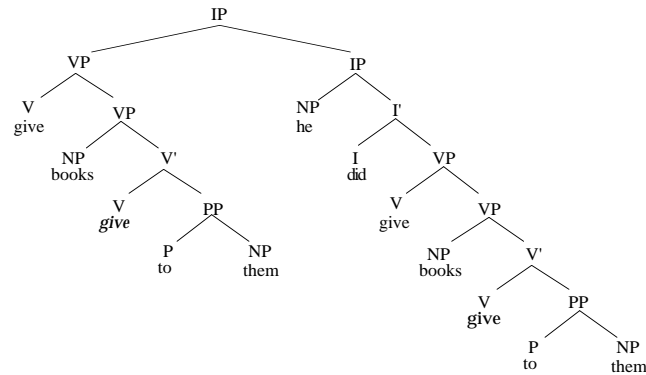
(43) shows the critical steps in the incremental derivation of (42b). (43a) shows the structure at the point in the derivation when the fronted VP-material, the subject and the auxiliary have been built. I assume that the fronted constituent is an internally right-branching VP. (43b) shows the result of copying the VP into its underlying position, in which theta-role assignment is possible. Finally, in (43c) the stranded PP containing the anaphor *each other* is added to the right of the reconstructed VP, at the bottom of the right-branching VP. This creates a structure in which the anaphor *each other* is appropriately c-commanded by its antecedent. It also has the effect of destroying the constituency of the copied VP, but this is unproblematic, because the chain was created by constituent copying at the point at which it was created.

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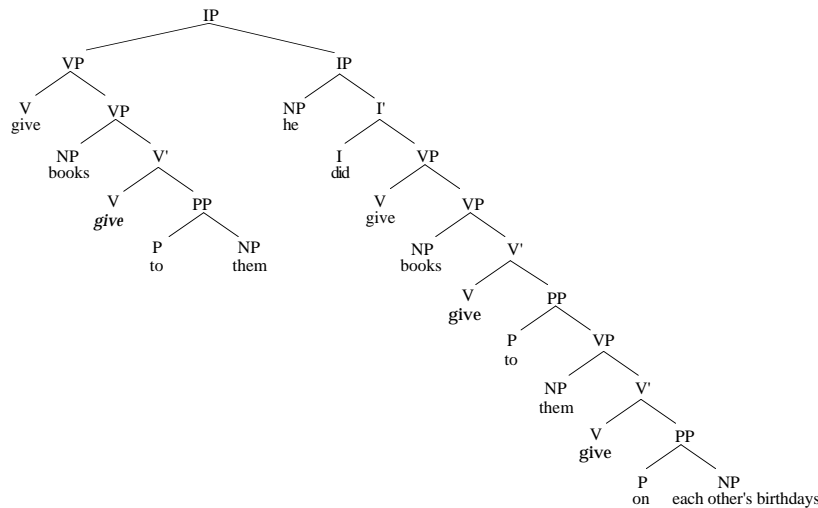
(43) a.



b.



c.



The derivation in (43) shows how the existence of constituency conflicts may be accounted for under the Incrementality hypothesis. However, this just shows that it is possible to reconcile partial VP-fronting with the assumption that c-command is required for binding, and these facts do not rule out an account which deals with the problem by assuming that binding does not require c-command. If anaphor binding is assumed to require m-command, and possibly also precedence (Barss & Lasnik 1986, Jackendoff 1990, Ernst 1994 among others), then both the VP-fronting and the anaphor binding in (42) are entirely compatible with a traditional left-branching analysis of complex VPs, and no conflict arises. Although this paradigm cannot distinguish among these analyses (or Pesetsky's analysis, which solves the problem by assuming parallel structures), Section 4.3 presents a contrast between VP-fronting and VP-ellipsis which provides support for the incremental structure building account of constituency conflicts.

4.3 Vanishing Constituents

Section 4.2 showed examples of situations in which a syntactic process is able to refer to a string that is only a temporary constituent during a derivation, provided that the string is a constituent when the syntactic process applies to it. This section presents evidence for the related prediction, that once a constituent has been destroyed, it is no longer available to any syntactic processes.

Prediction 3: Constituents become unavailable to syntactic processes as soon as they have been destroyed.

4.3.1 *A Contrast between Ellipsis and Movement*

Support for Prediction 3 comes from a contrast between VP-fronting and VP-ellipsis, a pair of constructions that are otherwise extremely similar in the range of constituents that they can apply to.

First, (44) shows that VP-fronting can apply to sequences of phrases starting at the left-edge of a complex VP, stranding varying amounts of material at the right-edge of the sentence. (45) shows that sequences of VP-internal phrases which do not include the left-edge of VP cannot be fronted in a similar manner (the reason why examples like (45) are impossible is discussed in Section 5.3).

- (44) a. ... and [give candy to children in libraries on weekends] he did.
 b. ... and [give candy to children in libraries] he did on weekends.
 c. ... and [give candy to children] he did in libraries on weekends.
 d. ... and [give candy] he did to children in libraries on weekends.

- (45) a. * ...and [to children in libraries] he did give candy on weekends.
 b. * ...and [in libraries on weekends] he did give candy to children.

(46) shows that the same subparts of VP that can be fronted can also be antecedents for ellipsis. In addition to standard cases of VP-ellipsis like (46a), in which the entire VP in the second conjunct undergoes ellipsis, it is possible for ellipsis to strand sequences of phrases at the right edge of VP (46b–c).

- (46) a. John gives candy to children in libraries on weekends, and Mary does (too).
 b. John gives candy to children in libraries on weekends and Mary does on federal holidays.
 c. John gives candy to children in libraries on weekends and Mary does in urban parks on federal holidays.

(47) and (48) show that standard tests for right-branching VP structure involving binding succeed when they are applied to material *inside* the fronted or elided portion of VP.

- (47) a. ... and [introduce the children_i to each other_j] the teacher proceeded to do.
 b. ... and [congratulate everybody_i on his_i birthday] he did.

- (48) a. The principal introduced the children_i to each other_i, and then the teacher did (too).
 b. The boss congratulated everybody_i on his_i birthday, and the receptionist did (too).

VP-fronting and VP-ellipsis constructions diverge, however, in their ability to pass tests of right-branching VP-structure when the tests involve stranded material in addition to the fronted/deleted portion of VP. (49) repeats and expands the examples of VP-fronting discussed in Section 4.2, and shows that it is possible to create an anaphor-binding relation (49a) or a variable binding relation (49b) between an NP in the fronted VP and an NP inside a stranded PP. (49c) shows that it is also possible to obtain either collective or distributive scope readings for the fronted object NP and the stranded modifier. The collective reading asserts that it was the sum of all the books that was read quickly, and the distributive reading asserts that each of the individual book-readings was quick. I assume that the distributive scope reading requires a right-branching VP-structure in which the

If the right-branching structure in (53a) is built in the first conjunct, then the verb + direct object constituent is destroyed as soon as the adverbial is added to the structure, and therefore it cannot be an antecedent for ellipsis in the second conjunct. Hence the impossibility of sentences requiring a right-branching VP, such as (50) and (52). If, on the other hand, a left-branching VP like (53b) is constructed in the first conjunct, then the verb + direct object constituent survives for long enough to serve as the antecedent for ellipsis. The availability of left-branching structures for adverbials like (53b) is why partial VP-ellipsis is possible at all, but it also explains why binding tests fail and only collective scope readings are available in partial VP-ellipsis. Structures in which the two conjuncts show mismatching scope readings (e.g. collective-distributive) are not excluded by incremental derivations, but I assume that they are excluded by the parallelism constraint.

The contrast between VP-fronting and VP-ellipsis is expected based on Prediction 3. Movement targets the verb + direct object constituent before it is destroyed; ellipsis targets it too late. Therefore, the contrast follows directly from the nature of incremental derivations, and this in turn lends support to the incrementality-based account of constituency conflicts given in Section 4.2. Note that although it is relatively straightforward in a more traditional approach to give an account of *either* the VP-fronting facts *or* the VP-ellipsis facts – by assuming a strict left-branching or right-branching VP-structure respectively – it is much less clear how to explain the contrast in a traditional approach to phrase structure. Therefore, it should be stressed that the achievement of the incremental approach here lies in its treatment of the contrast between VP-fronting and VP-ellipsis, and not in its treatment of either of these constructions individually.

Note that according to the account presented here, the failure of tests of right-branching structure in VPE depends on the position of the adverbial that destroys the verb-object constituent, and does not depend on the fact that the elided VP is in the second conjunct rather than the first. Therefore, the same failure of tests of right-branching structure is predicted to be found in constructions in which the clause containing the ellipsis site precedes the clause containing its antecedent, as in (54).

(54) Because John did, Bill read all the books.

In this form of ellipsis the stranding of adverbials is only marginally acceptable for many speakers, but for those speakers who accept this form of ellipsis, the example in (55) shows exactly the same scope properties as (52), allowing just the collective reading. The dummy verb *did* has a VP gap as its complement, which must be licensed by finding an antecedent in a subsequent clause. The only option for the stranded adverbial is to attach by adjunction to the VP-gap, yielding a collective scope reading.

(55) Because Mary did quickly, Bill read all the books slowly.
(collective reading only)

4.3.2 Comparative Ellipsis

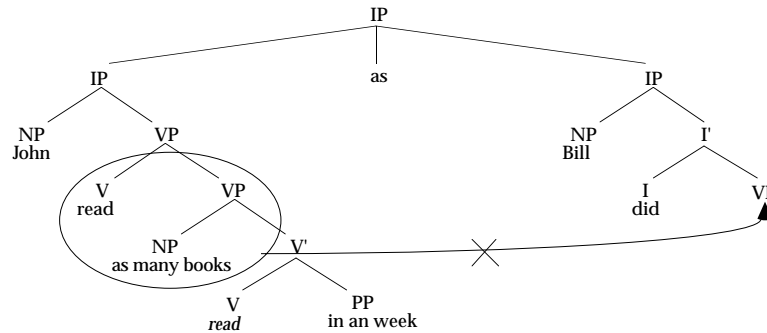
The point of this section is to show that internal to the comparative ellipsis construction (Guéron & May 1984; Heim 1985; Diesing 1992; Wold 1995) exactly the same difference that we have seen between VP-fronting and VP-ellipsis can be replicated. The useful property of comparative ellipsis for current purposes here is that it allows an adverbial stranded by ellipsis to appear with or without a corresponding adverbial in the antecedent VP, as shown by (56).¹¹

¹¹ The reading that is of interest in sentences like (56a) is the one in which the stranded adverbial in the second conjunct is construed with *both* conjuncts, i.e. the ‘right node raising’ interpretation.

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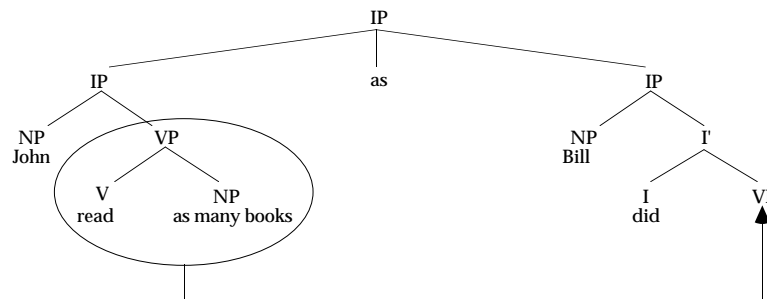
assume that this is again due to the fact that the verb + object constituent is destroyed in the first clause when a right-branching VP containing the adverbial is created.¹³

- (60) a. John read as many books in a week as Bill did in a month.
 (collective reading ok, distributive reading impossible)
 b. * The provost met as many students_i when they_i were first entering the university
 as the dean did when they_{ij} were graduating.
 c.



With (59–60) as background, the critical test of incrementality is shown in (61), in which the verb + object sequence is again the antecedent for ellipsis, but in which the adverbial is in the second conjunct only, *following* the ellipsis site. The relevant test involves which readings are available for the stranded adverbial when it is interpreted in *both* clauses (i.e. the ‘right node raising’ reading). In this case distributive scope readings and variable binding are again available. These examples match the possibilities seen in VP-fronting examples like (44), in which the movement chain is established prior to attachment of the stranded adverbial.

- (61) a. John read as many books as Bill did in a week.
 (collective and distributive readings both ok)
 b.(?) The provost met as many students_i as the dean did when they_{ij} were first
 entering the university.
 c.



Given that (60–61) show that it is possible to replicate internal to comparative ellipsis the same contrast already seen between VP-fronting and VP-ellipsis, this lends support to the incremental account of the contrast, and leaves no apparent advantage to an (as yet unformulated) theory which attributes the contrast between ellipsis and fronting to some independent difference between fronting and ellipsis.

¹³ The use of different indices in the two conjuncts of (60b) and (61b) is intended. The relevant reading is one in which the provost met as many entering students as the dean met graduating students. There is no need for the students to be the same in both cases.

4.3.3 *Other Loss-of-Scope Effects in Ellipsis*

It is tempting to attempt to relate the loss-of-scope effect in partial VP-ellipsis shown above to another set of loss-of-scope in ellipsis facts which have been widely discussed in the literature, involving the availability of subject/object scope ambiguities in VP-ellipsis. However, it can be shown that these loss-of-scope facts are independent of the facts introduced in the preceding sections.

As observed by Sag (1976) and Williams (1977) the scope ambiguity observed in simple transitive clauses like (62) disappears when such clauses are placed in VP-ellipsis contexts like (63), in which the subject of the clause targeted by ellipsis is a non-quantificational NP. In (63) the universally quantified object NP cannot take wide scope with respect to the existentially quantified subject NP.

(62) Some linguistics student won every award. [$\exists > \forall$, $\forall > \exists$]

(63) Some linguistics student won every award, and Wallace did too. [$\exists > \forall$, $*\forall > \exists$]

However, as pointed out by Hirschbühler (1982), the scope ambiguity is preserved if the clause targeted by ellipsis has an existentially quantified subject (64).

(64) Some linguistics student won every award, and some computer scientist did too. [$\exists > \forall$, $\forall > \exists$]

A variety of different accounts of the paradigm in (62–63) have been given in the literature, including accounts based on the structures created by Quantifier Raising (Sag 1976; Williams 1977), economy constraints on syntax-semantics mappings (Fox 1995), focus requirements (Tancredi, 1992; Tomioka 1997), or the properties of quantificational subjects (Cormack 1984; Diesing 1992). The incrementality based account of the loss-of-scope effect in (52) and (60) above draws on none of these existing proposals, because of a number of contrasts between the loss of subject-object scope ambiguities and the loss of object-adverbial scope ambiguities.

One approach to the loss of subject-object scope ambiguities in VP-ellipsis has been to claim that VPE has a scope-freezing effect, which forces the non-elided material to take wide scope with respect to the elided material (Sag 1976; Williams 1977). Although examples like (64) from Hirschbühler rule out a scope-freezing account of the loss of subject-object scope ambiguities, this does not necessarily rule out a scope-freezing account of the loss of object-adverbial scope ambiguities. Evidence against a scope-freezing account comes from the comparative ellipsis facts in (59–61). The problem is that a scope-freezing account predicts that the same scope possibilities will obtain whenever a verb + object sequence is elided. However, this is not the case. The examples of VP-ellipsis in (52) and comparative ellipsis in (60a) show fixed scope readings, but the comparative ellipsis example in (61a) shows a scope ambiguity. This distribution of scope readings is expected based on incremental structure building, but is not expected under a scope-freezing approach.

The first empirical difference in the distribution of subject-object and object-adverbial scope ambiguities involves the need for potential ambiguity in both clauses. As shown by Hirschbühler (1982), subject-object scope ambiguities are available when the subjects of both the antecedent and the elided clause are quantificational, creating a potential truth-conditional ambiguity in both clauses (64). This observation is central to Fox's economy-based account of the loss of subject-object scope ambiguities (Fox 1995). In contrast, the examples of loss of object-adverbial scope readings show that there is loss of scope readings even when both clauses show a potential scope ambiguity. Moreover, the object-adverbial ambiguity is also still unavailable if both clauses have quantificational

subjects (65). Although the use of indefinite subjects creates the potential for additional ambiguity, the existentially quantified subject obligatorily takes wide scope with respect to the universally quantified object, and the distributive reading is still unavailable. (65) therefore contrasts with the Hirschbühler's effect illustrated in (64).

- (65) Some girl finished every book quickly, and some boy did slowly.
 (subject-object: $\exists > \forall, * \forall > \exists$; object-adverbial: collective reading only)

A second difference is that partial VP-ellipsis affects both scope and binding possibilities. Therefore, any explanation which only explains loss-of-scope phenomena will not be sufficient. Most accounts of the loss of subject-object scope ambiguities in sentences like (63) focus on mechanisms specific to scope, and therefore will not be adequate to account for the loss of reciprocal binding and bound variable pronoun licensing possibilities.¹⁴

The third difference between the two loss-of-scope effects involves the consequences of deaccenting instead of deleting. It has been observed in the literature on scope in VP-ellipsis that deaccenting of VP material has very similar interpretive effects to deleting VP material (Tancredi, 1992; Tomioka, 1997). In the following examples a smaller font is used to represent deaccented material. (66) shows that whether VP is elided (66a) or deaccented (66b) in a clause with a referential subject, a wide scope reading for the object is unavailable. (67) shows that making the subject of the second conjunct quantificational rescues the scope ambiguity both for ellipsis and deaccenting.

- (66) a. Some linguistics student won every award, and Wallace did too. [$\exists > \forall, * \forall > \exists$]
 b. Some linguistics student won every award, and Wallace won every award too.
 [$\exists > \forall, * \forall > \exists$]
- (67) a. Some linguistics student won every award, and some computer scientist did too. [$\exists > \forall, \forall > \exists$]
 b. Some linguistics student won every award, and some computer scientist won every award too. [$\exists > \forall, \forall > \exists$]

On the other hand, (68) shows that deaccenting of a verb + object sequence under identity with a prior VP does not block the distributive scope reading (68b), although ellipsis of the same string does block the distributive scope reading (68a).

- (68) a. Mary read all the books quickly, and John did slowly. [collective scope only]
 b. Mary read all the books quickly, and John read all the books slowly. [collective and distributive scope readings both ok]

The sentences in (69) are based on the examples of ellipsis in (50) above, and show that deaccenting of verb + object sequences does not block reciprocal binding or bound variable anaphora, again in contrast with ellipsis of the same strings.

¹⁴ A number of authors have recently proposed that scope relations are determined by the relative A-positions of NPs, rather than by the A'-positions in which they occur (Hornstein 1994; Pica & Snyder 1994; Kitahara 1994). Under such an approach to scope it may be easier to find an account for the parallel between loss of scope and loss of anaphor binding possibilities in partial VP-ellipsis. However, whatever the properties of such a theory, it would still need to account for the generalizations about the linear order of different syntactic processes that I have focused on here. For this reason, some reference to the order of structure building seems necessary, even if different assumptions about how scope and binding relations are adopted from those adopted here.

- (69) a. John gave books to them_i on each other_i's birthdays, and Mary gave books to them_i [on each other_i's first day of school]. (reciprocal binding)
b. Mary congratulated every boy_i at his_i graduation, and Sue congratulated every boy_i [at his_i 21st birthday party]. (variable binding)

The fact that deaccenting does not have the same effect as ellipsis on scope and binding possibilities between objects and adverbials lends further support to the independence of the ellipsis paradigm introduced in Section 4.3.1 and the better known loss-of-scope in ellipsis facts.

Interestingly, the contrast also implies that although deletion processes are constrained to apply to syntactic constituents, deaccenting processes are not constrained in the same manner. One possible reason for the difference between deletion and deaccenting is that whereas deletion requires an antecedent that is a syntactic constituent, deaccenting requires an antecedent that is a phonological constituent. Syntactic constituents are regularly destroyed in the course of incremental structure building, as we have repeatedly seen, but phonological constituents – which are reflected in the acoustic/articulatory form of sentences – are preserved once created. As a result, a verb + object constituent may be initially created which is both a syntactic and a phonological constituent. Subsequent structure building may destroy the syntactic constituent, thereby placing constraints on possible scope readings in ellipsis, but does not destroy the phonological constituency, thereby preserving scope readings in deaccenting.

4.4 Right Node Raising and Movement

As a fourth test of the Incrementality hypothesis this section shows that the normal liberality of coordination tests can be constrained in situations in which coordination and movement processes are combined. As we have already seen, the two conjuncts of a coordination structure are typically string adjacent, and therefore coordination may apply to any constituent of a derivation before it is destroyed by the addition of subsequent material to its right. The best test of this analysis of coordination is to find a situation in which the conjuncts are not string adjacent, and in which material intervening between the two conjuncts destroys the constituency of the first conjunct before the second conjunct is built. Right node raising (RNR) provides just such a test case.

Although I assume that there is no difference between RNR and coordination, they are generally assumed to be different. Right node raising is the name given to a variety of coordination that should not be possible under standard assumptions about constituency, because it involves the coordination of strings that are generally assumed not to be constituents, such as subject + verb sequences, as in (70).

- (70) a. Mary liked but Sue hated the documentary about animals in the Serengeti.
b. John read carefully and Bill barely skimmed the chapter about binding theory.

Another characteristic feature of RNR is that there is some material that is shared between the two conjuncts and occurs to the right of the two conjuncts. This shared material is generally most felicitous when it is phonologically 'heavy', although this is not an absolute requirement. The shared material may be a single NP, as in (70), or any of a variety of other categories. Numerous examples of RNR are given above in (15–19). Although it was claimed in some early analyses of RNR that the shared material must be a single constituent (Ross 1967; Postal 1974), this was later shown to be incorrect (Abbott 1976; Grosu 1976).¹⁵

¹⁵ See Selkirk 1996 for a detailed discussion of the prosodic conditions on Right Node Raising. A more detailed discussion of the constraints on the shared material in RNR can be found in Section 5.4 below.

4.4.1 *Non-Coordinate Right Node Raising and Movement*

The classic analysis of RNR, which reconciles cases of RNR like (70) with standard assumptions about constituency, treats RNR as a disguised form of clausal coordination. According to this analysis, what appears to be coordination of the subject and the verb is in fact coordination of full clauses, following across-the-board rightward extraction of the object NP from the two clauses (e.g., Ross 1967; Maling 1972; Postal 1974). This analysis has been widely discussed and criticized in detail elsewhere, and so there is no need to review the evidence in detail here. A number of arguments against this analysis challenge the claim that the shared material undergoes rightward movement out of the coordinated clauses: the shared material is insensitive to *wh*-islands (Wexler & Culicover 1980); RNR allows preposition-stranding in languages which strictly ban preposition-stranding in unequivocal instances of movement (Irish, Spanish, French, Polish: McCloskey 1986); some of the strings that can be shared in RNR show no independent evidence of being able to move (Phillips 1996).

Another class of analyses of Right Node Raising does not assume that the shared material undergoes rightward extraction, and instead reconciles RNR with standard assumptions about constituency by analyzing it as an instance of first conjunct ellipsis: under this analysis an NP (or other category) at the right periphery of the first conjunct of a coordination structure may be deleted under identity with an identical constituent at the right periphery of the second conjunct (Gleitman 1965; Wexler & Culicover 1980; van Oirsouw 1987; Kayne 1994; Wilder 1994, 1995; Boskovic 1996; Johannessen 1998). This approach to RNR is discussed further at the end of this section.

A third approach to RNR is a class of theories which modify standard phrase structure theories in such a way that the shared material in RNR can be both *in-situ* and literally shared between both conjuncts, without ATB extraction. Versions of this approach have been proposed by Williams 1978 and Ertshik-Shir 1987 under the heading of ‘clausal factorization’, by Goodall 1987 in terms of ‘phrase marker union’, and by Muadz 1991 and Moltmann 1992 under the heading of ‘three-dimensional phrase markers.’ What these approaches have in common is that they assume that RNR is the result of superimposing two partially identical sentences or *factors* upon one another. Where the two sentences are identical, there is just one representation for both occurrences. Only where the factors differ do the representations of the two factors diverge.

The alternative which I pursue here is that RNR is simply coordination of non-final constituents. A critical test of this view of RNR is the following prediction. If the conjuncts of RNR are fleeting constituents in an incremental derivation, which are almost immediately destroyed by the addition of the shared material to their right, then it should not be possible for any syntactic process to refer to these constituents once the shared material has been added to the structure.

Prediction 4: If right node raising is coordination of non-final constituents, then no syntactic process should be able to refer to the conjuncts of right node raising structures after the shared material has been added to the structure.

This prediction is trivially satisfied in standard examples of RNR, in which the conjuncts are string adjacent and the shared material is sentence-final, but it becomes a substantive prediction when we consider ‘non-coordinate right node raising’ (Hudson 1976; Postal 1994), a more exotic variety of RNR which does not require the two conjuncts to be string adjacent.

In non-coordinate RNR the conjuncts are not limited to being connected by regular conjunctions such as *and* or *but*; the role of the conjunction in standard RNR can be taken by any of a variety of verbal or prepositional expressions (71–72). In the examples below

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the conjuncts are enclosed in parentheses and the strings filling the role of ‘conjunctions’ are italicized.¹⁶

- (71) a. Of the people questioned, [those who liked] *outnumbered by two to one* [those who disliked] the way in which the devaluation of the pound had been handled.
b. I’d have said he was sitting [on the edge of] *rather than* [in the middle of] the puddle.
c. It’s interesting to compare [the people who like] *with* [the people who dislike] the power of the unions.

(Hudson 1976)

- (72) a. [Politicians who have fought for] *may well snub* [those who have fought against] animal rights.
b. [People who are learning to speak (in)] *may hate* [those who already can speak (in)] that little-known language.
c. [People who believe there may soon be on Venus] *tend to distrust* [those who believe there already are on Mars] extra-terrestrials capable of understanding parasitic gaps.
d. [Spies who learn *when*] *can be more valuable than* [those able to learn *where*] major troop movements are going to occur.

(Postal 1994)

The most interesting property of this variety of RNR for our purposes here is the fact that unlike other kinds of coordination it escapes the Coordinate Structure Constraint, which prevents movement of one conjunct independent of the other in standard coordination (Ross 1967; Schachter 1977; Gazdar 1981). (73) shows cases of impossible movement of conjuncts in standard coordination; (74) shows that passivization, raising, unaccusative raising, *wh*-movement and topicalization can all apply to the first conjunct in non-coordinate RNR, without affecting the second conjunct.

- (73) a. * The syntacticians seemed ___ and the semanticists to far outnumber the phonologists.
b. * The syntacticians were easily outnumbered ___ and the semanticists by the phonologists.
c. * Who did the marauding invaders outnumber ___ and the Celts?
d. * The Saxons, the marauding invaders outnumbered ___ and the Celts.

- (74) a. [The people who liked] *easily outnumbered* the people who disliked the movie.
b. [The people who liked] *must ___ have easily outnumbered* the people who disliked the movie.
c. [The people who liked] *seemed ___ to have far outnumbered* the people who disliked the movie.

¹⁶ Although many predicates can take the role of conjunctions in non-coordinate RNR, not all predicates can do this. In the large set of examples in Postal (1994) most of the predicates express comparison of some kind, as is also true of Hudson’s examples in (71). However, Postal’s examples also include a number of examples of verbs of emotion or interpersonal attitudes, such as *snub*, *hate*, and *distrust* in (72). It is easy to substantially degrade the acceptability of the examples in (71–72) by changing the predicate, as in (i).

(i) ?* As far as I could tell, [those who liked] shouted taunts at [those who disliked] the way in which the devaluation of the pound had been handled.

I leave the question of why non-coordinate RNR is sensitive to the choice of predicate as an unanswered question for now.

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- d. [The people who like] *are easily outnumbered* ___ *by* the people who dislike the movie.
- e. [The people who liked] *arrived* ___ *much earlier than* the people who disliked the movie.
- f. [Which voter group that liked] ___ *outnumbered* which voter group that disliked the info-mercial?
- g. [The group that liked], the producer thought ___ *probably outnumbered* [the group that disliked] the movie.

Interestingly, the movement possibilities for the conjuncts of non-coordinate RNR are quite restricted. All of the acceptable extractions in (74) share the same two properties: first, it is the left-hand conjunct that is fronted; second, the shared material follows both conjuncts. Movement is only possible if both of these properties hold. (75) and (76) show this for subject-to-subject raising and *wh*-movement respectively. The (a) examples show movement of the left conjunct with the shared material in clause-final position, as in (74), and present no problem. Problems arise in the (b) examples, in which both conjuncts precede the shared material, but the underlying position of the moved conjunct follows the shared material. In the ungrammatical (c) examples the moved phrase includes the shared material and has an underlying position following the unmoved conjunct.¹⁷

- (75) a. [The people who liked] seemed ___ to have offended the people who disliked the movie about Reagan's childhood.
- b. * [The people who liked] seemed to the people who disliked the movie about Reagan's childhood ___ to be complete fools.
- c. * [The people who liked the movie about Reagan's childhood] seemed to the people who disliked ___ to be complete fools.
- (76) a. [Which voter group that liked] ___ outnumbered which voter group that disliked the info-mercial?
- b. * [Which voter group that disliked] did which voter group that liked the info-mercial outnumber ___?
- c. * [Which voter group that disliked the info-mercial] did which voter group that liked outnumber ___?

A generalization which accurately summarizes the facts in (75–76) is that the shared material must follow both the surface and the underlying position of both conjuncts. If the shared material precedes any of the positions of any of the conjuncts, then the sentence becomes impossible. This generalization confirms Prediction 4 above: since the effect of adding the shared material is to destroy the constituency of the conjuncts, creation of a new conjunct or movement of an existing conjunct is predicted to be impossible at any point following the shared material. In both (75b) and (76b) the underlying position of the moved constituent follows the shared material, so the movement operation cannot be

¹⁷ I assume that (76b–c) are not independently ruled out as a superiority violation. Although movement of one *wh*-phrase across another is generally impossible, this restriction is either absent or substantially weaker for *which* phrases, as the contrast between (i) and (ii) shows (Cinque 1986, Pesetsky 1987).

- (i) *What did who read?
- (ii) What books did which people read?

Taking into account the possibility that there may be some residual awkwardness in extraction of *which*-phrases, the relevant observation about (76b,c) is that they are worse than control examples in which no RNR occurs, such as (iii).

- (iii) Which voter group that disliked the info-mercial] did [which voter group that liked it] outnumber?

completed, in contrast with (75a) and (76a) in which the movement chain is completed before the shared material is added. In (75c) and (76c) the shared material immediately follows the first conjunct, and so the second conjunct is built too late to find a matching constituent to coordinate with.¹⁸

While the facts in (74–76) are predicted by the analysis of RNR as coordination of non-final constituents in an incremental derivation, they are unexpected under an approach to RNR which treats it as sentential coordination plus first conjunct ellipsis (see references above). The surface positions of the conjuncts in (75b) and (76b) conform to the pattern for first conjunct ellipsis, and the underlying positions of the conjuncts in (75c) and (76c) conform to the same pattern. Even if an additional condition on first conjunct ellipsis were introduced to accommodate the facts in (74–76), it would have to be an arbitrary constraint, whereas the possible positions of the shared material in RNR are an automatic consequence of the treatment of RNR as coordination of non-final constituents.

Although it is unclear how to represent non-coordinate RNR in the parallel structures/3-D approach to coordination, due to the fact that the conjuncts in non-coordinate RNR do not have parallel grammatical functions, I do adopt one important aspect of these theories, as the next section shows.

4.4.2 Structural Position of Shared Material

Thus far I have shown that the strings that can participate in Right Node Raising correspond to those strings that form a constituent at *some point* during the incremental construction of sentence structures (Section 4.1.1) and provided an argument for viewing RNR as coordination of non-final constituents, based on the interaction of RNR with movement (Section 4.4.1). What remains to be shown in this section is how the shared material is added to the structures created by the coordination of non-final constituents.

The problem to be resolved is the following. In standard coordinate structures, the material that is not coordinated is a sister to the entire conjunction structure. For example, the non-conjoined subject in (77) is sister to the conjoined VP structure. By virtue of being sister to the highest VP node, the subject is assigned an appropriate role by both of the conjoined VPs.

(77) Wallace [_{VP}[_{VP}likes Stilton] and [_{VP}adores Wensleydale]]

In the case of coordination of non-final constituents, on the other hand, the shared material cannot combine with the conjunction structure as a sister to the topmost node of the conjunction structure. Concretely, if a stereotypical right node raising sentence like (78) involves coordination of (incomplete) sentential constituents containing just a subject and a transitive verb (78a), and a shared object is added as the sister of this structure (78b), then this yields a structure in which the internal argument of the verb is not the sister of the verb, preventing theta-role assignment. What is required is for the object NP to become the sister of *both* verbs, simultaneously.¹⁹

¹⁸ Many speakers find the (c) examples in (75–76) to be significantly worse than the (b) examples. If we consider the problems that each causes for an incremental derivation, this is probably not surprising. In the (b) examples we may assume that the shared material is successfully built (and interpreted), and that the only problem is that a required movement to an identified position is then blocked, i.e., the problem is specific and diagnosable. In the (c) examples, on the other hand, the first problem arises because the second ‘conjunct’ is left incomplete, and there are no clear indications of how this might be remedied. In other words, there is no clear diagnosis of why the derivation fails. Clearly diagnosable constraint violations are generally perceived as milder than undiagnosable constraint violations.

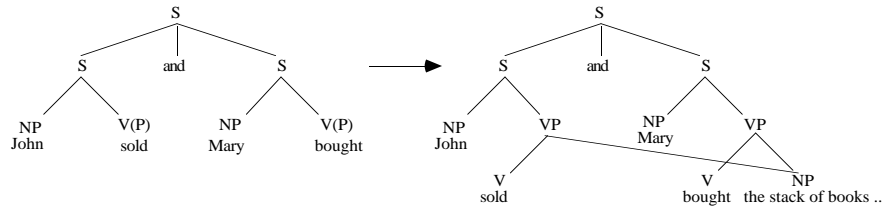
¹⁹ Evidence that the shared material in RNR is *in-situ* is abundant: all of the evidence against the ATB extraction analysis of RNR (see references above) points to this conclusion. Evidence that the shared material is *in-situ* in *both* conjuncts comes from examples in which the shared material takes material in *both* conjuncts as its antecedent, as in (i–iii) (Perlmutter & Ross 1970; Abbott 1976; Jackendoff 1977;

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- (78) a. $[_S [_S [_{NP} \text{Wallace}] [_{VP} \text{likes}]] \text{ and } [_S [_{NP} \text{Wendolene}] [_{VP} \text{detests}]]]$
 b. Wallace likes and Wendolene detests $[_{NP} \text{every kind of cheese}]$.

In order to achieve this, some version of discontinuous constituency (McCawley 1982) or 3-dimensional structures (Goodall 1987, Muadz 1991, Moltmann 1992) is required, to account for how the shared material occupies an appropriate syntactic position in both conjuncts. (79) shows a 2-D representation of the two critical steps in the incremental derivation of a right node raising sentence.

- (79) a. John sold and Mary bought the stack of books required for Linguistics 101.
 b. c.



4.5 Constituency vs. Hierarchy tests

A fifth prediction of incremental structure building concerns a difference between two broad classes of structural diagnostics: tests based on constituency, and tests based on c-command relations. Up to this point I have focused on the fact that in incremental derivations some constituents are destroyed as a result of creating new constituents. However, although constituency changes non-monotonically (i.e. structure building both creates and destroys constituents), incremental structure building is predicted to add c-command relations in a near monotonic fashion. All left-to-right c-command relations are preserved once created, and there is only limited destruction of right-to-left c-command relations.²⁰ Therefore, although tests of constituency may conflict, and we can even predict exactly when they will conflict, we predict that different tests based on c-command relations should never conflict with one another.

Prediction 5: Constituency changes during the course of a derivation, but most c-command relations do not. Therefore, tests involving c-command relations should not conflict with one another.

(80–84) repeats a familiar paradigm from the literature on double object and complex VP constructions (cf. Barss & Lasnik 1986) which show that c-command tests like anaphor binding, negative polarity item licensing and weak crossover all diagnose right-branching structures in double object and dative constructions, as we would expect.

Moltmann 1992). The examples in (iv–vi) are created by copying the shared material in (i–iii) into both conjuncts. To the extent that they are acceptable at all, they do not have the same interpretation as (i–iii).

- (i) A man came and a woman left who knew each other well.
- (ii) John whistled and Mary hummed the same tune.
- (iii) John praised and Mary criticized different people.
- (iv) * A man came who knew each other well and a woman left who knew each other well.
- (v) John whistled the same tune and Mary hummed the same tune.
- (vi) John praised different people and Mary criticized different people.

²⁰ For example, when a constituent [A B] is expanded to form the structure [A [B C]] the c-command relation from B to A is lost when C is added.

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In all of the examples an element towards the left of VP behaves as if it c-commands an element on its right, and not vice versa.²¹

- (80) *Reflexive Binding*
- I showed John himself in the mirror.
 - * I showed himself John in the mirror.
 - I showed the children_i to each other_i in the mirror.
 - * I showed each other_i to the children_i in the mirror.
- (81) *Bound Variable Anaphora*
- I denied each worker_i his_i paycheck.
 - * I denied it_i's owner every paycheck_i.
 - I gave every paycheck_i to it_i's owner.
 - * I gave his_i paycheck to every worker_i.
- (82) *Negative Polarity Item Licensing* (Klima 1964)
- I gave no one anything.
 - * I gave anyone nothing.
 - I gave nothing to anyone.
 - * I gave anything to nobody.
- (83) *Weak Crossover* (Postal 1971; Wasow 1972)
- Who_i did you show his_i reflection in the mirror?
 - * Which lion_i did you show it_i's trainer?
- (84) *Superiority* (Chomsky 1973)
- Who did you give which book?
 - * Which book did you give who?

The agreement among different c-command tests shown by examples like (80–84) provides promising initial support for the prediction that c-command tests should not show conflicts.

There are some differences among these tests, but of a benign nature. Negative polarity item licensing and variable binding typically allow a possessor to command out of the NP that contains it (85a,b), whereas this is not possible for binding conditions A and C (85c,d). However, at deeper levels of embedding inside a subject NP, the differences between these tests disappear (86).

- (85) a. Nobody's parents complained about anything.
b. Everybody's mother warned him_i about the forbidden fruit.
c. * Wallace_i's friends admire himself_i.
d. His_i friends admire Wallace_i.
- (86) a. * The stories about nobody scared anybody.
b. * The stories about everybody_i amazed him_i.
c. * The stories about Wallace_i amused himself_i.
d. The stories about him_i amused Wallace_i.

²¹ See Jackendoff 1990 for extensive documentation of the fact that the paradigms in (80–84) are also found with a wide range of other double complement constructions in English.

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The contrast between c-command tests in (85) is not inconsistent with Prediction 5, because it just shows that the structural relations relevant for conditions A and C are a subset of those relevant for NPI licensing and variable binding; no conflict is shown. A more serious concern for Prediction 5 is raised by sequences of VP-adverbials, which have been reported to show scope relations which conflict with binding relations.

In pairs of sentences like those in (87–89) the first adverbial and the rest of the VP is preferentially interpreted as taking narrow scope with respect to the second adverbial. Reversing the order of the adverbials reverses the preferred interpretation. For example, (87) is most naturally understood as meaning that the frequent kissing was willing, whereas (88) is most naturally understood as meaning that willing kissing was frequent. Similarly, (89) is most naturally understood as restricting concerto playing in foreign countries to weekends, whereas (90) restricts concerto playing on weekends to foreign countries. Facts like this have been taken to motivate left-branching VP structures as the basis for adverbial interpretation (Ernst, 1994; Pesetsky, 1995).

- (87) She kissed him many times willingly.
(88) She kissed him willingly many times.
- (89) Kremer plays concertos in foreign countries on weekends.
(90) Kremer plays concertos on weekends in foreign countries. (Pesetsky 1995)

However, the right-to-left scope interpretations which have been used to argue for left-branching structures are available even in the presence of a left-to-right variable binding dependency of the kind that has been used to motivate *right*-branching structures (91–92) (Ernst 1994; Phillips 1995). This state affairs appears to violate the prediction that there should be no conflicts between the results of different c-command tests.

- (91) a. I misled everyone_i on purpose the day before his_i briefing.
b. She kissed everyone_i willingly on his_i cheek. (Ernst 1994)
- (92) a. Kremer plays quartets in foreign countries_i on their_i national holidays.
b. Kremer plays quartets on new federal holidays_i in their_i first 5 years of existence. (Phillips 1995)

However, the argument based on sentences like (91–92) fails to control for the fact that sentence final focal stress has an independent effect on what material is interpreted as background and new information. Once this effect is controlled for, which can be done by adding a third adverbial (93), we find that the strong right-to-left scope preference seen among the first two adverbials in (91–92) no longer obtains. In (93a) it is much easier than in (87b) to obtain a reading in which it is kissing many times that was done willingly (left-to-right scope), although the reading in which there were many individual willing kisses (right-to-left scope) is also still available. And in (93b) there is no longer a strong preference to interpret the playing of concertos in foreign countries as restricted to weekends.

- (93) a. Sue kissed him willingly many times in front of the boss.
b. Kremer plays concertos in foreign countries on weekends at the height of the season.

The fact that the interpretation of sequences of adverbials is not fixed by their linear order, as the examples in (93) seem to indicate, is consistent with Prediction 5. It suggests that the facts in (87–89) most likely do not reflect obligatory right-to-left c-command among multiple adverbial phrases, but instead reflect the independent effect of focal stress

assignment, which associates by default with a sentence-final adverbial. Furthermore, if the scope readings in (87–89) are not indicative of c-command relations, then the examples in (91–92) also should not be taken as counterexamples to the generalization that c-command tests should not conflict with one another.

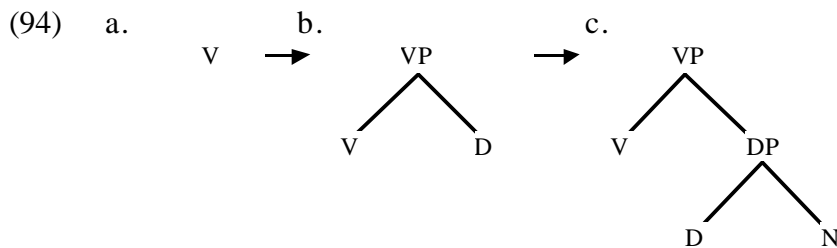
5. Extensions

This section clarifies and extends the domain of what can be explained by the Incrementality hypothesis. It also points to the limits of what can be explained by incrementality.

5.1 NP-internal structure

So far in this paper it has been assumed that structure building is fully incremental, in the sense that each successive word of a sentence is fully integrated into the sentence structure before the following word is encountered. The discussion so far has focused on the status of incrementality at the level of the noun phrase and above, where there is considerable empirical support for the incrementality assumption. This section considers the status of incrementality inside noun phrases, where the evidence is less clear.

The Incrementality hypothesis predicts that a VP structure consisting of a verb and its internal argument will be assembled in the sequence shown in (94a–c), such that there is a step in the derivation at which the structure contains a constituent consisting of the verb plus the determiner. The derivation in (94) assumes the DP hypothesis (Szabolcsi 1982; Fukui & Speas 1986; Abney 1987) but the same point can be made if nominal phrases are assumed to be of category NP.



However, coordinations involving conjuncts which contain a verb and a following determiner but not the following N head are marginal at best, and quite unacceptable for many speakers. (95–96) show this for direct object and embedded subject noun phrases respectively. There is a noticeable improvement in the coordinations when the conjuncts do not include the subject (95de, 96de), but the coordinations are still marginal.

- (95) a. * Wallace saw these and Gromit saw those sheep being herded into a big green truck.
 b. ?? Sue met four and Sarah met fourteen students who were hoping to be admitted to the program.
 c. * Bill bought his and Helen bought her giant tomato to the county show.
 d. ? Wallace saw these and heard those sheep being herded into a big green truck.
 e. ? Sue met four and interviewed fourteen students who were hoping to be admitted to the program.
- (96) a. * Wallace thought these and Gromit thought those sheep were sure to meet an unsavory end.

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- b. * Sue hopes that four and Sarah hopes that fourteen students will be admitted to the program.
- c. * Bill wants his and Helen wants her giant tomato to win the competition.
- d. ?* Wallace thought these and knew those sheep were sure to meet an unsavory end.
- e. ? Sue hopes that four and believes that fourteen students will be admitted to the program.

By contrast, sequences of pre-nominal heads can form conjuncts on their own, when they are not combined with material from outside the noun phrase (97), although this kind of coordination is also not entirely free, and becomes substantially degraded when the conjuncts contain more than one adjective, as (98) shows.

- (97) a. The rich and the fortunate students were given luxurious rooms.
 - b. The red and the yellow flowers were among the first to be sold.
 - c. The three youngest and the four oldest grandchildren will present the gift to their grandmother.
 - d. I need three red or five small lemons for the dressing for this salad.
- (98) a. * The small red and the big yellow flowers were among the first to be sold.
 - b. * Two naïve young and three experienced old professors will lead the protest to the president.

Given that coordination has so far provided the most liberal diagnostic of constituency, (97) supports the notion that there is some combination of heads internal to nominal phrases before the N head is built, but (95-96) show no strong evidence that the pre-nominal material is combined into the larger sentence structure before the N head is encountered. This evidence does not necessarily contradict the assumption of full incrementality, but nor does it follow from the assumption of full incrementality.

Note that there *is* evidence from coordination that noun phrases are combined into larger structures once the head noun is reached. The examples in (99) show conjuncts which include pre-nominal material and the head noun, plus material which precedes the noun phrase, but which exclude the portion of the noun phrase which follows the head noun.²²

- (99) a. Bill thought that the burning and Sue thought that the pillaging of the small ethnic neighborhood was sure to lead to rioting.
- b. Joey heard the songs and Rudy saw the paintings that Maggie had created during the summer vacation in Montana.
- c. The Democrats talked to very many and the Republicans talked to very few of the voters from Delaware.

We are therefore left with two possible conclusions. The first possible conclusion is that structure-building is not fully incremental, and that nominal phrases are initially assembled as independent structures, and are not combined with the larger syntactic structure until the head noun is added to the structure. The alternative possibility is to maintain the strongest version of the Incrementality hypothesis and assume that every head is combined into the main structure as it is encountered, and to also add a constraint which requires that any conjunct which properly contains any left-edge portion of a noun phrase must extend at least as far as the head noun of that noun phrase. The syntactic evidence is compatible with both of these alternatives at present.

²² I assume that in (99c) the N head is *many*, and not *voters*.

5.2 Argument stranding in RNR, movement and ellipsis

Movement, ellipsis and coordination can all apply to subparts of VP, stranding adverbial phrases at the right edge of VP, as we have seen above. The discussion in Section 4 shows how incremental structure building can explain a number of facts about which specific subparts of VP are and are not available to each of these syntactic processes. However, there is an additional contrast between movement and ellipsis on the one hand and coordination on the other hand, involving the possibility of stranding arguments. This section shows how this additional contrast can be handled by incremental structure building, and in doing so clarifies certain assumptions about the structure of VP.

As already seen above, fronting or ellipsis of a verb and its arguments may strand non-selected adverbial PPs (100).

- (100)a. ...and [give children candy] he did in libraries on weekends.
 b. John gave the children candy in libraries on weekends, and Sue did ___ in shopping malls on national holidays.

However, fronting or ellipsis which strands argument NPs (101) or which strands the NP of a subcategorized or adverbial PP is quite impossible (102–103).

- (101)a. * ...and [give the children] he did candy in libraries on weekends.
 b. * John gave the children candy in libraries on weekends, and Sue did ___ bagels in shopping malls on national holidays.

- (102)a. * ...and [give candy to] he did the children in libraries on weekends.
 b. * John gave candy to the children in libraries on weekends, and Sue did ___ the babies in shopping malls on national holidays.

- (103)a. * ...and [give candy to the children in] he did libraries on weekends.
 b. * John gave candy to the children in libraries on weekends, and Sue did ___ shopping malls on national holidays.

By contrast, each of the subparts of VP that resist movement and ellipsis in (101–102) can be possible conjuncts for Right Node Raising (104b–d).

- (104)a. John gave children candy and showed babies balloons at the county fair on Memorial Day.
 b. John gave children and showed babies big red balloons at the county fair on Memorial Day.
 c. John gave stickers to and took gum from the excited children as they entered the museum.
 d. John handed bills to parents before and gave stickers to children after the demonstration of the amazing new brain enhancer.

If we continue to assume that each of these processes targets constituents and does not target non-constituents, we therefore need an explanation for the impossibility of fronting or deleting the constituents that are coordinated in (104b–d). First, though, a more precise characterization of the constraint on fronting and ellipsis is needed.

(101) above already shows that the second (theme) object of a double object construction cannot be stranded by ellipsis or movement. (105) shows that the locative PP argument of the locative verb *put* also cannot be stranded. Nevertheless, not all locative PPs resist stranding as strongly as the locative PP argument of *put*. With locative PPs, the possibility of partial VP-fronting and partial VP-ellipsis improves as the locative PP

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becomes less obligatory (106–107), although there is a residual awkwardness to the construction, even with entirely optional locative PPs. The examples in (106–107) are ordered according to the degree of optionality of the locative PP argument.

- (105) a. * ...and put the book he did on the table during the climax of the game.
b. * John put the book on the table during the climax of the game, and Sue did under the bed when she started to get sleepy.
- (106) a. ?* ...and stand the candle he did on the table at the party.
b. ?* ...and nail the diploma he did to the wall on the weekend.
c. ?? ...and attach the diploma he did to the wall on the weekend.
d. ?? ...and pour the wine he did into the glasses before the toast.
e. (?) ...and stow the trunk he did under the bed before the enemy arrived.
f. (?) ...and dump the garbage he did on the street after nightfall.
g. (?) ...and spill the milk he did on the table at the party.
- (107) a. * John stood the candle on the table at the party, and Sue did on the floor at the séance.
b. ?* John nailed the diploma to the wall on the weekend, and Sue did to the door the day after her graduation.
c. ?? John attached the diploma to the wall on the weekend, and Sue did to the fridge when she came home from work.
d. ?? John poured some wine into the glasses and Sue did into the carafe.
e. ?? John stowed a trunk under the bed and Sue did in the basement.
f. ? John dumped the garbage on the street after nightfall, and Sue did on the neighbor's driveway at dawn.
g. (?) John spilled the milk on the table at the party, and Sue did on the floor at breakfast.

In the case of VPs which obligatorily contain a control infinitival, stranding the infinitival by means of ellipsis or fronting is entirely impossible (108–109).

- (108) a. * ...and persuade Bill he did to leave.
b. * ...and promise Mary he did to leave.
- (109) a. * John persuaded Bill to leave, and Sue did to sell his Porsche.
b. * John promised Mary to leave, and Sue did to write more poetry.

Benefactive PPs, which are generally optional, are (relatively) freely stranded by ellipsis or fronting (110). Goal PPs vary slightly in their ability to tolerate being stranded, according to the degree of optionality of the PP (111–112), although the effect of optionality is not as strong as it is with locative PPs.

- (110) a. (?) ...and bake a cake he did for the party in less than an hour.
b. ? John baked a cake for the party in less than an hour, and Sue did for the team meeting in about an hour and a half.
- (111) a. ?* ...and hand candy he did to the children at the birthday party.
b. ?? ...and slip messages he did to the girl sitting at the desk next to him.
c. (?) ...and give candy he did to the children at the birthday party.
d. (?) ...and mail letters he did to the starving children...
e. (?) ...and send a telegram he did to the queen on her 70th birthday.

- (112)a. ?* John handed candy to the children at the birthday party, and Sue did to the toddlers at the supermarket.
 b. ?? John slipped messages to the girl at the desk next to him, and Sue did to the boy at the back of the classroom.
 c. ? John gave candy to the children at the birthday party, and Sue did to the toddlers at the supermarket.
 d.(?) John mailed letters to the starving children, and Sue did to the intransigent congressmen.
 e. John sent a telegram to the queen, and Sue did to the prime minister.

Therefore, the constraint on partial VP-fronting or ellipsis seems to be that the fronted or deleted constituent must be large enough to be a ‘potential complete VP’, with the consequence that strictly subcategorized VP material cannot be stranded. There may be an additional requirement that prevents locative PPs subcategorized by locative verbs from being stranded, even if they are not obligatory.²³

The generalization that restricts VP-fronting and VP-ellipsis to potential complete VP constituents may be explained as follows. The account relies on the following two assumptions. First, that strictly subcategorized arguments of a verb *must* be organized as a right-branching nested VP structure. In Section 4.3 it was proposed that adverbial phrases have some flexibility in their positioning: where possible they are attached inside a right-branching VP-structure, but under some circumstances they may also be right-adjoined to VP in a left-branching structure. This second possibility accounts for the possibility of adverbial stranding in VP-ellipsis, and for the loss of certain scope and binding possibilities in VP-ellipsis. It creates a degree of freedom in the structural position of adverbial phrases which I assume is not available to strictly subcategorized arguments.²⁴

If we assume that for strictly subcategorized phrases the right-branching nested VP-structure is the only possible structure, then the impossibility of stranding any subpart of the strictly subcategorized VP in VP-ellipsis is predicted by incremental structure building as follows. A VP-ellipsis site must have a constituent as its antecedent. In a completed right-branching VP structure (i.e. the completed first conjunct) there is no constituent larger than the verb or any of the individual arguments, but smaller than the entire right-branching structure. Therefore, the smallest potential antecedent for VP-ellipsis is the constituent containing the verb and its strictly subcategorized arguments.²⁵ If we assume that arguments that are not strictly subcategorized have the same structural possibilities as adverbial phrases, then the paradigm in (105–112) above for VP-ellipsis follows.

Right node raising is not subject to the same restriction as ellipsis because coordination applies to constituents that are present before the entire VP is constructed. VP-ellipsis, on the other hand, applies at a stage in the derivation when the entire VP has been constructed in the antecedent clause, with the effect that fewer constituents are available as antecedents for ellipsis.

Support for this account of the restriction on argument stranding comes from comparative ellipsis. As seen in Section 4.3 comparative ellipsis allows stranded phrases to

²³ This additional constraint is reminiscent of a distinction drawn by Culicover & Wilkins (1984) between an inner V1 constituent of VP (including strictly subcategorized arguments of the verb, locative PP arguments and control infinitival complements) and an outer V2 constituent (including goal and benefactive PPs). Thanks to Carson Schütze for valuable suggestions on this point.

²⁴ This distinction between argument and adjunct expressions is similar to a distinction built-into Pesetsky’s (1995) Layered syntax VP-structures. However, whereas Pesetsky’s ternary-branching V’ structures make it impossible for ellipsis or movement to ever strand an argument in a ditransitive VP, the present system preserves the possibility of argument stranding in limited environments, such as the examples of comparative ellipsis below.

²⁵ It is also possible for the verb alone to be the antecedent for deletion. Verb-only ellipsis is usually considered under the heading of pseudogapping.

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be present in the clause targeted by ellipsis, without corresponding phrases in the clause containing the antecedent. (113) shows that verb + argument sequences allow stranding of strictly subcategorized arguments when no counterpart to the stranded phrase precedes the ellipsis site. (114) shows that when a counterpart to the stranded phrase precedes the ellipsis site, the verb + argument sequences again cannot be antecedents for ellipsis. This contrast is exactly as predicted by the incremental structure building approach, and in effect replicates the paradigm shown for the loss of scope and binding possibilities when adverbial phrases are stranded by VP-ellipsis.²⁶

- (113)a. John put more books than Bill did on the table.
b. Wallace stood more buckets than Gromit did in the garage.
c. Sarah gave more children than Susan did candy.

- (114)a. ?* John put more books on the table than Bill did on the floor.
b. ?* Wallace stood more buckets in the garage than Gromit did in the basement.
c. * Sarah gave more children candy than Susan did cookies.

The restriction of VP-fronting to potential complete VP constituents also requires an explanation. In order to explain this constraint, we must consider the antecedents required for the VP-fronting construction. The fronted portion of VP in VP-fronting constructions corresponds to the *entire* VP in the antecedent (often the first conjunct) of these constructions. The initial conjunct for the ungrammatical (a) examples in (101–103) would have to be like (115a–c), which are clearly impossible. Not surprisingly, therefore, the acceptability of VP-fronting improves as a function of how acceptable the fronted constituent is as a complete VP.²⁷

- (115)a. * John intended to give the children, and give the children he did ...
b. * John intended to give candy to, and give candy to he did ...
c. * John intended to give candy to children in, and give candy to children in ...

The impossibility of fronting or deleting a VP constituent containing a preposition but not the complement of the preposition (e.g. 102, 103, 113bc) can be explained in the same way as the impossibility of argument stranding. Although prepositions can be

²⁶ The examples in (114) are not as bad as the corresponding examples of regular VP-ellipsis in (105) and (107); in addition, changing the comparative from *more ... than* to *as many ... as* further improves the deletions in (114). These improvements do not follow from incrementality, and must be left as an unsolved puzzle at this point.

²⁷ Predicate fronting in concessive clauses does not depend on a matching predicate in an antecedent clause. Therefore, it should be easier to violate the constraints on predicate fronting illustrated above. The contrast between (108) and (i) lends support to this (Chomsky 1981, p.146, attributed to Mark Baltin; Radford 1988, p.322).

- (i) Persuade her though I may to resign, I can't imagine I'll persuade her to leave town.

Fronting of predicates that strands argument PPs is also somewhat improved in concessive clauses (ii–iv), although the improvement is not as striking as the contrast between coordinate VP-ellipsis and comparative ellipsis. Stranding of a theme NP in double object constructions is still impossible (v). Thanks to Jason Lilley for bringing these contrasts to my attention.

- (ii) ? [Put the book] though he did on the table during the climax of the game
(iii) ? [Stand the candle] though he did on the table at the party
(iv) [Nail the diploma] though he did to the wall on the weekend
(v) * [Give the children] though he did candy in libraries on weekends

separated from their complements by coordination, indicating that the relevant constituents do exist, in no case of movement or ellipsis will the relevant constituents survive until the point in the derivation at which the movement or ellipsis must be licensed.

Thus, the contrast between right node raising on the one hand and ellipsis and fronting on the other hand with respect to which subparts of VP are available as constituents receives a fairly natural explanation, and the explanation follows substantially from the range of constituents made available during an incremental derivation, plus independently motivated constraints on the antecedents for movement and ellipsis.

5.3 Why argument/adverbial sequences cannot be fronted

Another contrast between coordination and movement involves the possibility of referring to the sequences of argument and adverbial phrases which are predicted to be constituents under a right-branching analysis of VP-structure. Pairs of arguments or sequences of arguments and adverbials may be coordinated (116), but they may not be fronted (117).

- (116)a. Wallace gave [Gromit a biscuit] and [Shawn some grass] for breakfast.
 b. Norman wrote [three papers on Saturday] and [an epic novel on Sunday.]

- (117)a. * [Gromit a biscuit] Wallace gave ___ for breakfast.
 b. * [Three papers on Saturday] Norman decided to write ___.

The fact that these sequences of phrases are available for coordination but unavailable for fronting is expected based on the Incrementality hypothesis and the structure for right-branching VPs assumed here. Following Larson (1988), Aoun & Li (1989) and others I assume that the constituents of right-branching VP-shells that contain sequences of arguments and adverbials also contain unpronounced copies of the verb. These unpronounced copies of the verb are copied to create nested VP-structures *after* the initial pronounced copy of the verb has been built at the left edge of VP. The strings in parentheses in (117) are unable to front because they precede the overt copy of the verb, and hence are unable to even form a constituent before the verb is added to the structure.

5.4 Case constraint on RNR

Excepting the uncertainty about how noun phrases are constructed incrementally (cf. Section 5.1), all of the evidence presented so far is consistent with the assumption that all constituents present at any point during an incremental derivation may serve as conjuncts for coordination or right node raising. There is one class of exceptions to this generalization, which requires the introduction of an additional constraint based on case assignment.²⁸ However, even this constraint may ultimately be reducible to a constituency conflict. Descriptively, the constraint is as follows.

- (118) *Case Constraint on Right Node Raising*
 * “[...V] and [...V] NP ...”
 when (i) NP is case-marked by V, but (ii) NP is not the direct object of V

²⁸ As is well known, acceptability judgments for examples of RNR are often sensitive to the choice of contrastive focus and phonological phrasing. See Selkirk (1996) for a characterization of some prosodic constraints on RNR. The contrasts shown in this section are clearest when the examples are read with a natural phrasing for RNR, such that there is a prosodic break between the second conjunct and the beginning of the shared material.

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The first set of examples accounted for by the constraint in (118) involve conjuncts which end in verbs which exceptionally case-mark the infinitival subject that begins the shared material (119). These examples were first noticed by Postal (1974), who presented them as evidence for a raising-to-object analysis of ECM subjects.

- (119)a. ?* I find it easy to believe, but Joan finds it hard to believe—Tom to be a dishonest person.
b. ?* I wanted to prevent, but I couldn't prevent—Bob from meeting Sally.
c. ?* Tony hopes to stop, but only I can stop—the bomb from going off.
d. ?* I didn't expect to want, but I ended up wanting—Nixon to win.

As pointed out by Postal, it is possible to construct a number of examples closely related to the examples in (119), which are however acceptable. In all of these examples the constraint in (118) is not violated. In (120a) the shared material is a finite clause; in (120b) the infinitival subject is case-marked by a preposition inside the shared material; in (120c) the infinitival clause lacks an overt subject.

- (120)a. I find it easy to believe, but Joan finds it hard to believe—that Tom is a dishonest person.
b. It is possible, but it would be unwise—for Bob to meet Sally.
c. I want, and Tom really needs—to be out of here by 6:30 to catch the last bus back to Boddington.

Double object constructions create similar problems for RNR. When the shared material begins with the first object of a double object construction, which is case marked by the verb, but is not the direct object of the verb, the result is degraded (121). In contrast, no such problem arises when the shared material consists of the two complements of a dative construction, or a direct object and an adverbial PP. The examples in (122) are taken from Abbott (1976) and Grosu (1976).²⁹ All of the examples in (122) satisfy the constraint in (118) because the NP that begins the shared material is the direct object of the verb in addition to being case-marked by the verb.

- (121)a. ?* John offered, and Harry gave—Billy Schwartz a Cadillac.
b. ?* The boys sent, and the girls actually gave—their favorite biology teacher a big bunch of flowers.
- (122)a. Joan offered, and Mary actually gave—a gold Cadillac to Billy Schwartz.
b. Smith loaned, and his widow later donated—a valuable collection of manuscripts to the library.
c. I borrowed, and my sisters stole—large sums of money from the Chase Manhattan Bank.
d. John has sliced, and Mary also seems to have sliced—a large piece of cake with a shining new knife.
e. Bill may present, and Mary certainly will present—a series of papers at tomorrow's linguistic meeting.

²⁹ Both Abbott (1976) and Grosu (1976) present examples like those in (122) as counterexamples to the generalization that the shared material in RNR must be a single constituent (e.g. Ross 1967; Postal 1974). However, examples like (119) and (121) demonstrate that it would be incorrect to conclude that there are no constraints on the sequences of VP-internal phrases that can be a conjunct for RNR.

Small clause complements also appear to resist RNR (123).³⁰

- (123)a. * I used to find, and Sue still does find—Pete annoying.
 b. * I used to consider, and Sue still does consider—the guy who just left the room completely and utterly insane.

Given that incremental structure building predicts all of the conjuncts in (119–123) to be temporary syntactic constituents, the ill-formed examples must be ruled out by an additional constraint, such as the descriptive generalization in (118). Obviously, the generalization in (118) begs for a deeper explanation.

One promising possibility is that the constraint reflects a conflict at the level of prosodic constituency. Right node raising strongly favors a prosodic structure in which each of the conjuncts corresponds to a prosodic constituent (e.g. Selkirk 1996; Steedman 1998). This bias has the effect of placing a prosodic boundary between the structural case assigner and the structural case assignee. If we assume that there is an additional constraint which requires a verb to be in the same prosodic phrase as an NP that is case-marked by the verb but is not the direct object of the verb, then a conflict arises between the two prosodic constituency requirements. This conflict may underlie the generalization in (118). This conjecture is supported by an observation of Selkirk (1996) that sharing of the two objects of a double object construction is significantly improved by deviating slightly from the normal RNR prosody which makes each of the conjuncts a constituent. Although the example with standard RNR phrasing is bad (124a), incorporating the goal object into the same prosodic constituent as the verb leads to improvement (124b).

- (124)a. * (Jòhn shówed) (and Hàrry gáve) (Sáally the Cádillac she had always wanted).
 b. (Jòhn shówed) (and Hàrry gáve Sáally) (the Cádillac she had always wanted).

Although an incremental grammar makes it possible to closely match phonological and syntactic constituents (Phillips 1996), there is one important difference between phonological and syntactic constituents. Since prosodic constituency is overtly expressed in the phonology of a sentence it cannot undergo the incremental updating that we have seen with pure syntactic constituency. This fixed character of prosodic constituency has the effect that it should not be possible for processes applying at different stages in a derivation to refer to overlapping phonological constituents, in contrast to what we have repeatedly seen with syntactic constituents.

5.5 Clause constraint on movement/ellipsis

Verb phrases containing embedded clauses can be antecedents for ellipsis (125a), and can even be fronted – although fronting such heavy VPs can become awkward (125b).

- (125)a. Wallace believed that Wendolene loved Wensleydale, and Gromit did too.
 b. Wallace needed to believe that Wendolene loved Wensleydale, and believe that she loved Wensleydale he did, ... though he knew it to be a lie.

When VPs containing embedded clauses undergo ellipsis or fronting, adverbial PPs can be stranded, as already seen above for ellipsis and fronting of less complex VPs.

³⁰ These tests are, of course, only relevant for speakers who find their non-RNR counterparts acceptable. Some readers may have difficulty with (ii) in particular, but many speakers find it acceptable, and clearly better than (123b).

- (i) Sue still finds Pete annoying.
 (ii) Sue still considers the guy who just left the room completely and utterly insane.

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However, the stranded adverbials in these constructions can only be interpreted with the matrix VP, as (126) shows for VP-ellipsis and as (127) shows for VP-fronting.

- (126)a. Wallace remembered how Gromit rescued the sheep at the farm, and Wendolene did at the wool shop. (PP in matrix VP only)
- b. Wallace confirmed that Gromit had prepared the porridge before breakfast, and Preston did late at night. (PP in matrix VP only)
- c. Wallace resolved to fix the motorcycle in the garage, and Gromit did in the basement. (PP in matrix VP only)
- (127)a. Wallace wanted to remember how Gromit rescued the sheep, and remember how Gromit rescued the sheep he did at the farm. (PP in matrix VP only)
- b. Wallace wanted to confirm that Gromit had prepared the porridge, and confirm that Gromit had prepared the porridge he did before breakfast. (PP in matrix VP only)
- c. Wallace needed to resolve to fix the motorcycle, and resolve to the fix the motorcycle he did in the garage. (PP in matrix VP only)

This restriction on adverbial interpretation does not apply to coordination/right node raising. The shared adverbial PPs in each of the examples in (128) can be interpreted as either a matrix VP or an embedded VP modifier.

- (128)a. Wallace confirmed that Gromit had prepared the porridge and Preston confirmed that Gromit had prepared the toast before breakfast. (PP in matrix or embedded VP)
- b. Wallace remembered how Gromit rescued the sheep and Wendolene remembered how Gromit rescued the chickens at the farm. (PP in matrix or embedded VP)
- c. Wallace resolved to fix the motorcycle and Gromit resolved to fix the moon-rocket in the garage. (PP in matrix or embedded VP)

The descriptive generalization is given in (129).

- (129) *Clause constraint on VP-gaps*
In the sequence [... Aux [_{VP} null] adverbial ...] the adverbial is interpreted as a clausemate of the Aux.

The constraint in (129) will be left with no deeper explanation in this paper. It cannot be derived in any straightforward fashion from the available constituents in an incremental derivation. This example serves as a reminder that the Incrementality hypothesis does not explain the full details of which constituents are available to which syntactic processes. Additional constraints may apply. What the Incrementality hypothesis does is place an *upper bound* on the range of constituents that any structural diagnostic may pick out.

Nevertheless, it is tempting to try to give a by now familiar constituency-based account for the restriction on adverbial interpretation in ellipsis in (126). The logic would run as follows: in order to generate the embedded clause interpretation of the adverbial in the second conjunct of the ellipsis examples, the adverbial in the first conjunct would also have to be attached inside the embedded clause. However, in creating this attachment in the first conjunct the constituent that serves as the antecedent for ellipsis would be destroyed. Hence, the required derivation is blocked. Although tempting, this argument is probably not correct in this instance. In earlier sections in which we have used this argument to account for restrictions on VP-ellipsis, we have also corroborated the argument by showing that the restrictions can be escaped in comparative ellipsis constructions (see Section 4.3

and Section 5.2). In this case, though, the evidence from comparative ellipsis does not support the incremental explanation.

(130) shows an example of comparative ellipsis in which the antecedent for ellipsis may be interpreted either as the embedded VP *fix x many motorcycles* or as the matrix VP *resolve to fix x many motorcycles*. Since the adverbial PP *in the garage* is not added to the structure until after the ellipsis site, incremental structure building predicts that it should be possible to obtain a reading in which ellipsis targets the matrix VP, but the adverbial is interpreted in the embedded clause.

(130) Wallace resolved to fix as many motorcycles as Gromit did in the garage.

	<u>ellipsis</u>	<u>adverbial interpretation</u>
	embedded	matrix
	embedded	embedded
	matrix	matrix
*	matrix	embedded

Since the embedded clause reading is unavailable even in comparative ellipsis, we conclude that the constraint in (129) is required to account for the ellipsis facts in (126), and cannot be derived from an incremental structure building account.³¹

It is also tempting to try to derive the constraint in (129) from a requirement that the VP-gap left by movement or ellipsis correspond to a constituent, which must therefore exclude the adverbial. However, such an account depends on the assumption that the constituent that undergoes movement or ellipsis must remain a constituent *even after the movement or ellipsis has been licensed*. But this assumption is at odds with the central assumption made throughout this paper that constituency requirements on syntactic processes apply only when the each syntactic process applies. The assumption is also at odds with the empirical evidence shown in a number of places above that constituents targeted by VP-fronting and VP-ellipsis do *not* need to remain as constituents after movement or ellipsis has been licensed (see Sections 4.3 and 5.2).

6. Alternative Approaches to Constituency Conflicts

Existing answers in the literature to the question of when and why different syntactic tests pick out different strings as constituents fall into two broad classes. First, and most prominently in the tradition of phrase structure grammar and transformational grammar, it has been assumed that differences between tests reflect idiosyncrasies of the tests, which apply to a single phrase-marker or derivation. A second approach, which has been developed most extensively in the categorial grammar tradition, has been to assume *flexible constituency*: according to this approach, a sentence may have two or more different structural descriptions or derivations, which collectively account for the variety of

³¹ The test in (130) is restricted to examples containing an infinitival embedded clause, because comparative ellipsis appears not to easily target complex VPs containing finite embedded clauses, even in the absence of adverbial stranding, as (i–ii) show. Therefore, the test cannot be run with these examples.

- (i) *Wallace confirmed that Preston had stolen as many sheep as Wendolene did.
- (ii) *Wallace proved that the theorem had as many solutions as Gromit did.

As observed by Jason Lilley (p.c.), this constraint may be derived from the assumption that *as*-headed clause in comparative ellipsis undergoes QR to a site outside the antecedent VP. Given the generalization that QR is typically restricted to the domain of a finite clause (Farkas 1981; May 1995), this prevents the *as*-headed clause from moving to a position higher than the matrix VP. For discussion of a similar clause-boundedness restriction on antecedent contained deletion see Baltin (1987), Larson & May (1990), Hornstein (1994), Kennedy (1997).

strings picked out by the different structural tests. This section compares the results of these approaches with the results based on incremental structure building.

6.1 Flexible Constituency

In direct response to the problems raised by discrepancies among constituency tests notions of flexible constituency have been incorporated into a number of different syntactic theories. Although there are many differences among flexible constituency theories, they share the assumption that the complete structural description of an individual sentence may consist of two or more different surface structures for the sentence. If different syntactic processes can refer to different surface structures for the same sentence, then results which lead to contradictions for theories which assume a single structure are no longer contradictory.

6.1.1 Combinatory Categorical Grammar

In many versions of Categorical Grammar (CG) rules have been proposed which allow the words of a given sentence to be combined in a number of different ways. I focus here on the *Combinatory Categorical Grammar* approach developed by Steedman and others (e.g. Ades & Steedman 1982; Hepple 1990; Jacobson 1990; Steedman 1993, 1997, 1998; Wood 1993). A sentence may be derived by means of function application alone, using only the rules of *Forward Application* ($>$) and *Backward Application* ($<$), as in the derivation of the sentence *Leo saw Elliot* in (132). In the examples below underlines are placed below the categories being combined – these are roughly equivalent to nodes in a phrase marker; annotations on the underlines indicate the rule that is used to combine the underlined categories.

(131)a. *Forward Application* ($>$)

$X/Y \quad Y \quad \Rightarrow \quad X$

b. *Backward Application* ($<$)

$Y \quad X \backslash Y \quad \Rightarrow \quad X$

(132)

Leo	saw	Elliot
-----	-----	-----
NP	(S\NP)/NP	NP
	----->	
	S\NP	
	-----<	
	S	

The addition of type-raising and function composition rules makes it possible to combine a given set of terminal categories in more than one order, by allowing categories to combine which cannot combine by forward or backward application alone. For example, by taking advantage of the rules of *Type Raising* (133) and *Forward Function Composition* (134), the sentence *Leo saw Elliot* can be derived in a different order, combining the subject and the verb before the object (135).

(133) *Type Raising* (TR)

a. $X \Rightarrow Y/(Y \backslash X)$

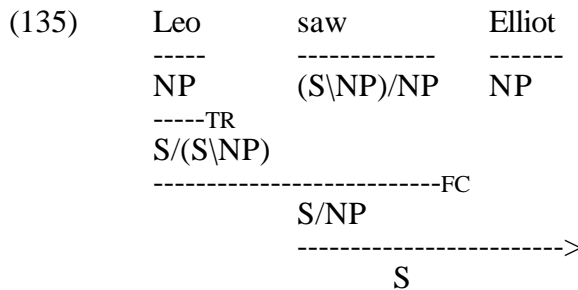
general form

b. $NP \Rightarrow S/(S \backslash NP)$

specific case

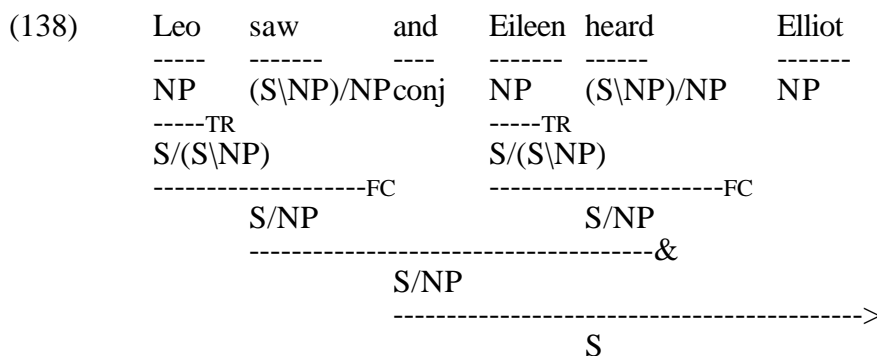
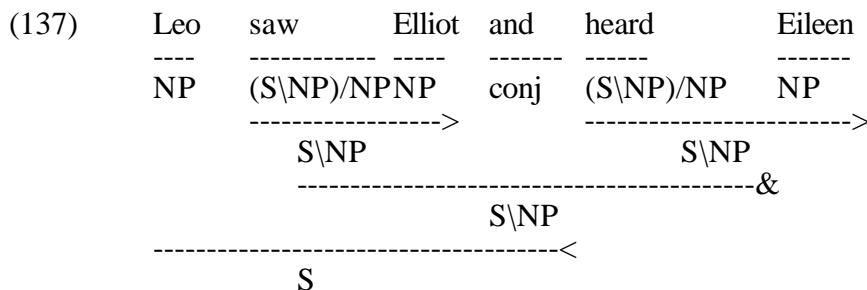
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- (134) *Forward Function Composition (FC)*
 a. $X/Y \quad Y/Z \quad \Rightarrow \quad X/Z$ *general form*
 b. $S/(S\backslash NP) \quad (S\backslash NP)/NP \quad \Rightarrow \quad S/NP$ *specific case*



Type raising and function composition therefore effectively allow multiple structures for a single sentence. As the length of a sentence increases, the number of possible derivations increases. The availability of different derivations for a single sentence makes the description of overlapping constituents relatively straightforward. If most sentences have multiple possible derivations, then it is not particularly surprising that conflicting constituency results are observed. Examples (137–138) show that it is easy to derive both VP coordination and RNR sentences, given the apparatus already introduced plus the coordination rule in (136). The only difference between the two derivations is that the RNR derivation in (138) invokes Type Raising and Forward Composition in order to allow the verb and the subject to combine before they combine with the object.

- (136)a. *Coordination*
 $X \text{ CONJ } X \quad \Rightarrow \quad X$
 b. and: CONJ



The examples above provide only the most basic of illustrations of how combinatory categorial grammars may account for the variety of strings that syntactic processes may refer to (for more details see Wood 1993; Steedman 1993, 1997, 1998 and references cited there). For the purposes of this discussion we may assume that combinatory categorial grammars are able to refer to the full range of constituent types needed to account for contradictory constituency effects. In this respect CCGs are in a better position than most existing syntactic theories, which cannot generate the necessary constituents. However, the more interesting issue here is whether the descriptive power of CCGs also provides answers to the questions that we have focused on here, concerning *why* different syntactic processes pick out different strings as constituents, and *when* different syntactic processes do and do not interact to block one another's application.

CCGs successfully account for the liberality of coordination: essentially any string of words which may combine to form a CCG constituent may be coordinated. Constraints on rules such as Type Raising can be invoked to prevent the generation of impossible coordinations such as (21) above.

However, it is less clear in a CCG approach why other syntactic processes are not as liberal as coordination. Consider, for example, the contrast between coordination and pseudogapping discussed in Section 4.1.3. In order to account for the coordination of verb + preposition strings a CCG approach must assume that V + P may form a constituent. Under the incremental approach adopted here this V + P constituent is a temporary constituent, which is subsequently destroyed by the addition of the complement of the P, which creates a PP constituent. Under this approach the fleeting nature of the V + P constituent explains why it is unavailable to pseudogapping. Under the CCG approach, on the other hand, the V + P constituent should have the same status as any other VP constituent, and therefore it remains unexplained why it cannot be targeted by pseudogapping. Similar considerations arise with respect to the constraint on RNR discussed in Section 4.4.

CCG also differs from the incremental approach in its answer to why constituency tests show much less uniform results than binding tests (Section 4.5). Although there is substantial variation in the kinds of *constituents* that different syntactic processes may refer to, there is much less variation in the kinds of *c-command* relations that different syntactic processes refer to. This basic asymmetry follows naturally from the Incrementality hypothesis, because structure building leads to non-monotonic changes in constituency, whereas c-command relations are added monotonically.³² In CCGs a different explanation for this asymmetry is needed, because constituents are added monotonically in any individual derivation (although flexible constituency of course allows multiple derivations for a single sentence). The effect of this is that 'non-standard' constituents entail 'non-standard' command relations. Steedman (1997) recognizes this point, and argues that the c-command relations relevant for binding should not be computed from surface constituent structures, but should instead be computed from independent *predicate-argument* structures, which represents the positions of the predicates and arguments of a sentence on an obliqueness hierarchy. Although a given sentence may have multiple possible constituent structures, it will have only one predicate-argument structure.

By imposing this division of labor between constituent structures and predicate-argument structures, Steedman imposes a strong asymmetry between constituency relations and c-command relations for binding. This means that it should be relatively easy for CCG to account for the apparent conflicts between results of movement and binding tests pointed out by Pesetsky (1995) and discussed in Section 4.2 above. However, by attributing binding relations to a level of representation which is entirely separated from the level of representation responsible for movement, coordination and ellipsis phenomena, the CCG

³² See Section 4.5 for limited exceptions to the monotonic addition of c-command relations.

approach predicts that movement, coordination and ellipsis should have *no* effect on binding relations. This conclusion is probably too strong, for a number of reasons.

First, we have already seen above (Section 4.1.2) that there are instances of *wh*-movement which bleed Binding Condition C. Relative clause modifiers of *wh*-phrases which induce Condition C violations when in-situ (139a) fail to induce Condition C violations when the entire *wh*-phrase is fronted (139b) (Freidin 1986; Lebeaux 1988). On the assumption that the in-situ *wh*-phrase in (139a) and its fronted counterpart in (139b) occupy identical positions in predicate-argument structure, then no contrast in acceptability is predicted by CCG. An incrementality-based account of this contrast, and why it is restricted to NP-modifiers, is given in Section 4.1.2 above.

- (139)a. * Who thinks that he_i believes which argument that John_i made?
 b. Which argument that John_i made does somebody think that he_i believes?

Second, we also find examples of *wh*-movement which feed Binding Condition A. Although the in-situ reflexive in (140a) may only take the subject of the most local clause as its antecedent, it may take either the matrix or the embedded subject as its antecedent when it is fronted in (140b) (Barss 1986; Huang 1993). An account of this contrast is available in a theory which assumes that movement and binding relations are computed from the same structure, as in Government-Binding theory and similar theories. However, on the assumption that the reflexives in (140a,b) occupy the same position in a CCG predicate-argument structure, and that binding theory looks only at predicate-argument structures, then no contrast in the possible antecedents for the reflexive is predicted.

- (140)a. Wallace_i thought Gromit_i saw some pictures of himself_{*i,j}.
 b. Which pictures of himself_{i,j} did Wallace_i think Gromit_j saw?

In addition to the effects of A-bar movement on binding relations shown in (139–140), the literature on scrambling operations in free word order languages shows that many instances of scrambling feed or bleed binding constraints on the distribution of both anaphors and bound variables (Webelhuth 1989, 1992; Mahajan 1990; Saito 1992).

While it should be straightforward for a CCG theory to account for the non-interaction of predicate fronting processes with tests of scope and binding (Section 4.2), it should be correspondingly difficult for such a theory to account for the interaction of VP-ellipsis processes with scope and binding (Section 4.3). On the assumption that in CCG the targets for ellipsis are the same kinds of surface constituents that are targeted for VP-fronting operations, a CCG approach would predict scope and binding to be just as independent of VP-ellipsis as they are independent of VP-fronting. Section 4.3 shows that such a prediction would be incorrect, and that the contrast between VP-fronting and VP-ellipsis follows directly from the constituent structures predicted by an incremental grammar. Note also that Section 4.3 showed that it would be inappropriate for a theory to attribute the contrast between VP-ellipsis and VP-fronting to an idiosyncrasy of one of the two constructions, because exactly the same contrast can be reproduced *internal* to the comparative ellipsis construction. Section 5.2 also shows how incrementality can explain differences between standard VP-ellipsis in coordinate structures and VP-ellipsis in comparative constructions.

Therefore, the manner in which Steedman captures the asymmetry between constituency and c-command in CCG appears to impose too strong an independence between syntactic processes which refer to constituents (movement, coordination, ellipsis) and syntactic processes which refer to c-command relations (binding, scope).

In general, CCG provides the tools needed to describe many different constituents, probably all that are needed; and it also has mechanisms to block reference to strings that should not ever be treated as constituents. But the CCG approach makes very different

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predictions from the Incrementality hypothesis about the range of constituents that individual syntactic processes may refer to.

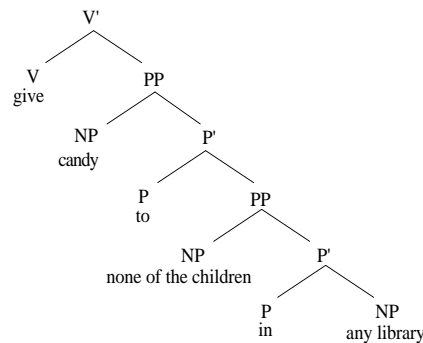
It should also be noted that the flexible constituency allowed by CCG does have the effect of allowing incremental left-to-right structure building. However, given that CCG derivations add constituents monotonically, left-to-right derivations are forced to yield (the equivalent of) left-branching structures. It is impossible in CCG to incrementally construct a right-branching structure. Therefore, although both incrementality and non-standard constituents are available in CCG – just as they are in the incremental approach – in CCG these two features are mutually incompatible.

6.1.2 Parallel Structures

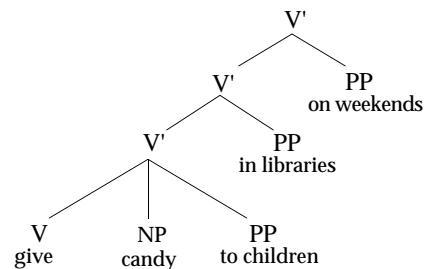
Pesetsky (1995) gives an account of constituency conflicts in a transformational phrase structure grammar framework. As in CCG approaches, Pesetsky assumes that discrepancies in the results of different constituency tests indicate that individual sentences can have more than one phrase structure. However, in contrast to the flexible constituency of CCG approaches, Pesetsky assumes a narrower version of flexible constituency in which any sentence has exactly two constituent structures, and in which differences between those structures are restricted to the internal structure of VP.

The first mode of representation in Pesetsky's theory is extremely right-branching *Cascade* VP structures like (141). These structures are strictly binary branching, and they are just like the structures that I assume here, except that Cascade structures do not contain multiple copies of the verbal head. The second mode of representation is left-branching *Layered* VP structures like (142). These structures are also binary branching, except that the arguments in multiple complement constructions are assumed to be daughters of a ternary or n-ary branching V' constituent.

(141)



(142)



Pesetsky assumes that both structures are represented for all sentences, and that there is a fixed division of labor between the two representations, such that one set of syntactic processes refer to the constituents of Cascade structures and another set of processes refer to the constituents of Layered structures, as shown in (143).

- (143)a. *Layered Syntax*: XP-movement, island conditions on XP-movement, XP-ellipsis, interpretation of modification relations.
 b. *Cascade Syntax*: everything else (binding, polarity item licensing, coordination, etc.)

An important contribution of Pesetsky's theory is the idea that the differences among syntactic processes are systematic, and that the structures they refer to may be divided into a small number of classes. The approach proposed here builds upon the notion

that differences between structural diagnostics are systematic. However, Pesetsky's theory falls short in a number of respects.

First, I have assumed here that constituency conflicts may arise anywhere in a sentence where a constituent formed during the course of structure-building does not survive to the final completed structure for the sentence. This allows, for example, for a subject-verb constituent to be formed to the exclusion of the direct object, while still allowing a negative quantifier in subject position to license a polarity item in object position, implying that the subject c-commands the object (144). In Pesetsky's approach, however, constituency conflicts are predicted to be restricted to VP.

(144) Few people liked and nobody really enjoyed any of the dishes that Harold had spent all day preparing.

Second, as in CCG approaches, Pesetsky's theory takes the different structures that yield constituency conflicts to be independent representations, and therefore interactions between different processes are unexpected. Pesetsky's approach is ideally suited to accounting for the facts discussed in Section 4.2, which show apparent simultaneous evidence for left-branching and right-branching VP-structure, but for the same reason, it incorrectly predicts that VP-ellipsis should similarly fail to affect possibilities for binding and scope. Similarly, there seems to be no way in Pesetsky's system to account for the generalization about right node raising established in Section 4.4: that the addition of the shared material blocks the possibility of subsequently referring to the RNR conjuncts, which are not constituents in the final structure.

One aspect of Pesetsky's Layered syntax representations which is incorporated into the current theory is the assumption that there is a difference between strictly subcategorized arguments and other VP-internal phrases. In both theories this difference allows an account of argument/adjunct contrasts in the possibility of stranding in VP-fronting and VP-ellipsis. However, Section 5.2 above shows that the constraint blocking argument stranding in VP-ellipsis can be escaped in certain forms of comparative ellipsis, precisely where predicted by the Incrementality hypothesis. Since the block on argument stranding is 'hard-wired' in Pesetsky's Layered structures, it is unlikely that the special status of comparative ellipsis could be captured.

Finally, and probably most importantly, although Pesetsky's system makes the important contribution of systematizing different constituency tests according to the kinds of structures that they refer to, it remains somewhat arbitrary *why* particular tests yield the specific results that they do. In contrast, I have attempted to show here that the kinds of structures that a given diagnostic picks out are to a substantial extent predictable from the way in which the diagnostic applies.

6.2 Idiosyncrasies of Processes

A more common approach to the problems raised by constituency conflicts has been to assume that the apparent conflicts simply reflect idiosyncrasies of specific syntactic processes.

One approach is to assume that coordination is the source of the difficulties. By assuming that coordination is an exceptional syntactic process that may apply to non-constituents, the hope is that the problems may be solved.

The first problem with this approach is that it fails to provide an account of possible and impossible coordination, which is provided in the theory proposed here and in the flexible constituency approaches discussed in Section 6.1. More importantly, it is not true that the problems for standard approaches to constituency are only caused by coordination. As we have seen above, there are also clear differences between movement, binding and different varieties of ellipsis.

A second approach is to assume that binding tests are the source of the difficulties, and to replace the c-command requirement on binding with some other requirement, typically involving a combination of m-command and precedence.

Even if this is the correct analysis for binding, it does not solve the problems that are addressed by the Incrementality hypothesis (and the flexible constituency theories). First, as emphasized by Larson (1988) and Pesetsky (1995), the right-branching VP-structures motivated by binding tests also accurately predict possibilities for coordination. Second, even without binding evidence to worry about, there are many contrasts between coordination, movement and deletion which need to be accounted for.

7. Conclusion

What I have tried to do here is develop a general theory of constituency and constituency tests, with the goal of explaining why different tests work the way they do, and why they often produce contrasting or even conflicting results. Although many theories have dealt with some of the contrasts between different structural diagnostics, I know of no general predictive theory of what these contrasts are and *why* they exist.

The critical ingredient of the theory proposed here is the claim that syntactic structures are built up incrementally by the grammar, in a strictly left-to-right order. The effect of this for constituency is that there are strings that are constituents at some point during a syntactic derivation, but are not constituents in the final structure that is built. The effect of this is to place an upper bound on the range of constituents that a given test can pick out – only constituents that are constituents at every point at which the test applies can be referred to. Based on differences in the stages of a derivation that individual syntactic processes refer to, we can explain a substantial amount of the differences among them. The list in (145) summarizes the results explained by the Incrementality hypothesis in this article.

- (145)a. Coordination vs. pseudogapping of V + P sequences (Section 4.1).
- b. Argument/adjunct contrast in bleeding of Condition C by *wh*-movement of NPs (Section 4.1).
- c. NP/predicate contrast in bleeding of Condition C by movement (Section 4.1).
- d. Liberality of coordination vs. other processes (Section 4.1).
- e. Contrasting effect of VP-fronting and VP-ellipsis on scope/binding tests (Sections 4.2 & 4.3)
- f. Contrasting scope possibilities in comparative ellipsis (Section 4.3).
- g. Ban on argument stranding in VP-fronting, VP-ellipsis, but not in comparative ellipsis (Section 5.2).
- h. Non-coordinate right node raising constrained by movement Section 4.4).
- i. Absence of constituency conflicts among c-command tests (Section 4.5).
- j. Contrast between argument cluster coordination and argument cluster movement (Section 5.3).

As a result, not only is it possible to explain constituency conflicts without recourse to flexible constituency – thereby retaining the assumption of a single structure for any sentence – we can also explain where we expect to observe constituency conflicts, and where we do not expect to find them.

Finally, it should be noted that incremental left-to-right structure building is a process that is already well-motivated from experimental studies of language production and comprehension (Marslen-Wilson, 1975; Frazier, 1978; Levelt, 1989; Tanenhaus et al., 1995; Ferreira, 1997). An incremental left-to-right structure building mechanism is therefore a necessary component of the language faculty, independent of the grammatical considerations raised here. It should also be noted that the non-incrementality of standard models of grammar provided one of the primary arguments for separation of grammatical

and processing systems in the 1960s and 1970s (cf. Fodor, Bever & Garrett 1974; Levelt 1974). If the current proposal is correct, then this particular argument for separation of grammar and processing systems disappears.

From the perspective of a general theory of the language faculty, therefore, the innovation of left-to-right structure building is not really an innovation at all; it is something that we already know to be available. All that is novel is the claim that this property of syntax does substantially more explanatory work than is generally assumed.

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