

Concrete minimalism, branching structure, and linear order¹

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A cornerstone of modern generative grammar is the notion of phrase structure. Traditionally, phenomena such as movement, deletion, and scope, and to a lesser extent coordination, have been taken as evidence about the organization of phrase structure, and about the constituents that make it up. While early work on phrase structure suggested that multiple branching structures are possible, a simplifying assumption of later work was that all branching structure is binary. This assumption has made it possible to develop a range of analyses in which hierarchical structure is the foundation for the basic relationships between parts of a sentence.

In this paper I will consider the question of whether it is possible to dispense with certain aspects of branching structure in syntactic representations. In particular, I will be concerned with the branching structure that is central to the Antisymmetry Thesis (AT) due to Kayne 1994, namely the structural relationship between heads and maximal projections that serve as arguments and adjuncts to the heads. The AT accounts for linear order in terms of asymmetric c-command, which is defined only when there is binary branching. In the absence of binary branching, no linear order is defined, and thus it follows that all relevant syntactic structure is strictly binary branching.

I will argue on minimalist grounds that the fundamental syntactic asymmetry in language is not one based on hierarchical structure, but on linear order. On this view, the hierarchical structure is a reflex of the linear order and the correspondence with Conceptual Structure (CS).

The minimalist perspective calls into question much of what has been taken for granted in earlier theories of grammar. There are varieties of minimalism that must be distinguished, however. Minimalism as a general approach is simply good science - the most parsimonious account of the phenomena. If we are going to be real minimalists, we cannot choose what parts of the theory are going to be minimalist and what parts are not. So we cannot restrict ourselves to theories that have particular properties, e.g. some economy metric on abstract steps in a derivation, as in Chomsky 1995, or some particular degree of abstractness, or remain fixed on some commonly held but never empirically validated assumption, without considering the adequacy of more parsimonious alternatives.

The variety of minimalism that I will pursue is in some sense the most radical one. On this view, which I call Concrete Minimalism, I take the perspective of the language learner, who is exposed minimally to information about linear sequences of sounds and their corresponding meanings, which I will assume here to be Conceptual Structure (CS) in the sense of Jackendoff 1990. I take these to be concrete manifestations of language, as distinguished from abstract syntactic representations. From the perspective of the language learner, linear order and conceptual structure are epistemologically prior to branching syntactic structure that is not directly projected from CS. It is evidence about linear order and CS that the learner is presented with in language learning, and it is on this basis that the learner must acquire grammar. It is logically possible that there is more structure in what the grammar allows than there is in the input. The minimalist perspective requires that any additional structure, levels of representation, notational devices, etc. beyond the two concrete ones just enumerated be justified on the

¹I would like to thank Ray Jackendoff for much useful discussion about the material in this paper, for the use of his unpublished notes, and for a very productive and enjoyable collaboration over many years. Versions of this paper were presented at Tokyo Metropolitan University, the Workshop on Antisymmetry in Cortona sponsored by the Scuola Normale Superiore, and at the University of Tuebingen. I would like to thank the audiences at these presentations, and particularly Hubert Haider, Josef Bayer, Richard Kayne, Arnim von Stechow and Jan Koster, for helpful questions and discussions that have led to a number of corrections and clarifications. Naturally I am responsible for any remaining problems..

basis of compelling empirical evidence. In the case of branching structure, we must ask what work additional branching structure does, or whether linear order is sufficient to the task of explaining the facts. While it is true that structure or linear order may be taken to be primitive in a given syntactic theory, linear order is a weaker notion than branching structure in terms of expressive power, and hence should be preferred, other things being equal.

The structure of this paper is as follows. First I give a very brief motivation for Concrete Minimalism. Next I review the historical arguments for binary branching structure, arguing that the primary motivations have been theory-internal, not factual. Then I focus on a range of empirical evidence that has been adduced in the literature to demonstrate that branching is richer than the minimalist flat branching structure. I argue that to the extent that there is evidence for richer structure, it is actually evidence for CS, not syntactic structure, although I will not be able to develop this argument here. There are of course cases in which the branching is binary, but there are those in which there is multiple branching.

Unfortunately, time will not permit me to address Phillips' proposal for dealing with the apparent indeterminacy of constituency tests (Phillips to appear). Phillips proposes that syntactic structure built in the course of left-to-right processing is available for certain relations, and that it may subsequently be destroyed and reconstituted, in which case a different structure for an already processed part of the sentence can serve as input to other relations. Phillips' approach cannot deal with the fact that the constituency tests in question are not tests for syntactic constituency, but CS constituency, and so in part is a solution to a problem that does not exist.

1. The minimalist perspective

In Culicover 1999 I presented an extended argument that learners must be capable of acquiring grammars of considerable complexity and idiosyncrasy. This argument is based on the observation that the grammars of native speakers incorporate knowledge of constructions that range in generality from the very specific to the very general. Native speaker judgments appear to be just as categorical for very idiosyncratic cases as they are for very general cases. I suggest that the learner is Conservative, in that it does not generalize beyond the natural boundaries of the evidence that it is exposed to. It is Attentive, in that it incorporates into its knowledge of language every datum that is consistent with or supported by its overall experience. If we allow that a learner can generalize when the evidence warrants it, we have the basis for an explanation of how it is possible for learners to know that something is impossible when they have not been explicitly instructed that is it, that is, where there appears to be explicit knowledge but poverty of the stimulus. The general principle is, everything is impossible unless it is required. This minimalist principle produces constraints such as Subadjacency and the Keenan-Comrie Accessibility Hierarchy, when paired with an account of the complexity of mapping from strings into conceptual structure. See Hawkins 1994 for some important proposals about what such an account must look like.

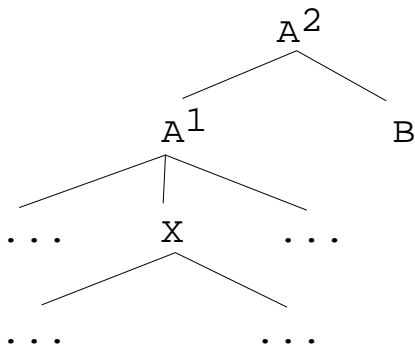
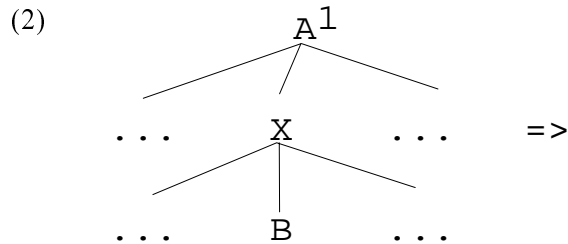
Another facet of this minimalist perspective is that we should make minimalist assumptions about what kinds of information the learner needs to have access to in order to acquire the grammar, consistent with the observed phenomena. It appears that the absolutely minimal assumption is that the learner has access to the sound and the meaning. The sound can be represented for our purposes as strings of words, and the meaning as Conceptual Structure representations; I take Jackendoff's proposals for granted regarding the latter. I will call a theory that only admits of these representations "Concrete Minimalism." So the question becomes, is it possible for the learner to acquire the grammar (in fact an arbitrary grammar of a natural language) given just this information? That is, is the learner a Concrete Minimalist? I am pursuing this question in the form of a computational simulation of language acquisition with my colleagues at the University of Warsaw.

There is a related question that we also have to attend to which is in fact prior to the question of what kind of information is sufficient for language acquisition. It is whether it is possible to characterize knowledge of language, i.e. grammar, in Concrete Minimalist terms. It is apparent that if we cannot account for the known grammatical phenomena we cannot have a successful account of how language is acquired. I will focus today on the question of whether Concrete Minimalism is adequate as a theory of grammar and argue that it is, to the extent that evidence can be brought to bear on the question.

2. The origins of binary branching

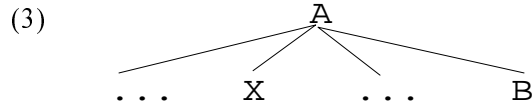
2.1. Chomsky adjunction

In the early days of generative grammar, phrase markers were not restricted to binary branching. The first systematic use of binary branching appears to have been Ross' (Ross 1967) use of what he called "Chomsky-adjunction", adapted from Chomsky's own practice. By assumption, the derived structure of attaching a constituent B to A involved the creation of a new node of type A that branches to the original A and B, as in (1).



While Chomsky-adjunction appears to create structure, such structure has no empirical consequences if the A-over-A Condition (Chomsky 1964) is assumed. Suppose that A^1 satisfies the conditions for some rule R . If A^1 satisfies these conditions, then A^2 does.² Therefore by the A-over-A Condition, R will have to apply to A^2 . In effect, the derived structure in (1) is equivalent to the flat structure in (2).

²Unless, of course, one of the conditions is that of not containing B. [Is this ruled out by a stipulation against negative conditions? In current terms, the trace of B would rule out the possibility that such a condition could hold. - PWC]



In the case of (2), the material corresponding to A^1 in (1) is not a constituent and therefore there is no need for the A-over-A Condition to prevent **R** from applying to it.

2.2. Unambiguous paths

The impetus for the move to binary branching appears to be located largely by the proposals of Kayne 1983. Kayne explores the question of why c-command should be implicated in the identification of an antecedent for an anaphor. He suggests that if α c-commands β then the path from β to α does not lead to anywhere other than α when it goes down from the node dominating both α and β . Kayne calls this an “unambiguous path”. If unambiguous path is substituted for c-command, and if c-command is implicated in such relations as government and binding, then in order for there to be an unambiguous path there must be binary branching. While n-ary branching is not ruled out in principle, on this view, the constituents in such a structure cannot be governed, which severely limits the utility of such a structure in natural language.

All of the data that Kayne adduces in support of uniform binary branching is consistent with binary branching, but does not require it. The logic is as follows: if the structure is X^0 [NP YP] and the expression is ungrammatical, this may be because the X^0 does not govern across the boundary. For example:

- (4) a. *John’s belief [(of) Mary to be a genius]
 b. *their obligation of John to join the army [Kayne 1983,(84)]

But there are counterexamples. They fall into two categories. On the one hand there are nominalizations that are impossible but do not involve object raising; on the other hand there are nominalizations that are fine where the subject cannot be understood as an object of the head. I will give a couple of examples of each.

- (5) a. *Kim’s conviction of Chris to leave
 cf. Kim convinced Chris to leave.
 b. *Leslie’s induction of Sandy to join the army
 cf. Leslie induced Sandy to join the army.
- (6) a. Lee’s anticipation of there being a disaster
 cf. Lee anticipated there being a disaster
 b. Marty’s recognition of it being obvious that there was a serious problem with the theory
 cf. Marty recognized it to be obvious that there was a theory problem with the theory.

While it is not clear why some of these cases are ungrammatical, it appears that there cannot be a principled explanation in terms of the standardly assumed branching structure for complements whose subjects do not receive a θ -role from the higher head. The problem, it appears, lies with the N-NP-to-VP construction, and not with the branching structure.

2.3. Learnability

More recently, Haegeman 1992 has suggested that binary branching is to be preferred over other

branching possibilities on the grounds of simplicity and learnability. However, Culicover 1997 argues that learnability issues arise only when there is a choice of branching possibilities. For example, for a sequence $X^0 A B$ there are in principle three branching configurations:

- (7) a. $[X^0 A B]$
 b. $[[X^0 A] B]$
 c. $[X^0 [A B]]$

But if the theory stipulates one type of branching (e.g. binary branching, or no branching), then the task for the learner is significantly simplified. The single type of branching could be binary branching (with some additional stipulation about the position of the head relative to its complements), or no branching.

2.4. Minimalism

Collins 1997 argues for binary branching on the grounds that it follows from minimalist principles applied to the application of Merge in the Minimalist Program of Chomsky 1995. But as Johnson and Lappin 1999 point out, any operation of any sort, including but not limited to Merge and even linguistic operations, is minimally binary. Furthermore, any complex operation can be reformulated as a set of binary operations (as shown by Curry). Showing that this is the case does not lead to the conclusion that more complex operations do not exist.³

As far as I can determine, there has been no other discussion of binary branching on principled or factual grounds in the literature. The uniform assumption of binary branching in derivational approaches to syntax has made it possible for theorists to hold this issue constant and focus more productively on other issues. However, in the context of current minimalist perspectives, it seems clear that any set of assumptions that entails more structure than is required on empirical grounds should be subjected to closer scrutiny.⁴

Now I will turn to the empirical evidence for branching structure, and in particular, binary branching structure. There are six major kinds of evidence. First there are proforms, such as VP ellipsis. The evidence suggests that the antecedents of proform are not syntactic constituents, but CS constituents. Second there is deletion, such as Gapping, Pseudogapping, and Bare NP Ellipsis. The range of possible deletions does not provide evidence for particular branching structure, although it is always possible to find a branching structure that will correspond to the deleted material if we allow constituents to be moved out in such a way that they isolate the deleted material. Hence we do not have strong evidence here for branching structure. The third is movement, and here we find that what moves is determined on the basis of a string that contains a head, and does not require branching structure. The fourth is based on relations involving c-command that depend on the topology, such as binding. We can show that the evidence is actually contradictory, in that different tests yield different branching structures; the consistent analysis is one based on CS relations and linear order. A fifth category of evidence is concerned with justifying binary branching for structures where n-ary branching appears most natural, in particular, ditransitives. A sixth category of evidence involves theory-internal considerations that correlate constituent order with the distribution of empty functional heads and the requirement that

³Thanks to Shalom Lappin and Ray Jackendoff for helpful discussion on this point.

⁴Given the interaction between branching and the number of nodes in a tree, it seems that there is no uniform minimalist position. Simplifying the branching possibilities makes the tree more complex, and vice versa. It seems that in the absence of an independently justified measure of complexity on the basis of which we can take a particular minimalist position, the most that we can say is that the question is an empirical one.

certain features be discharged under agreement. In such cases it is possible to argue that the hierarchical structure is simply a way of encoding relations that are stateable in terms of linear order, with no loss of generality or explanatory force.

I will argue that a full consideration of the actual facts shows that there is much less internal structure to the major phrasal categories than has been standardly assumed. However, because time is limited I will not be able to give detailed arguments in every case. I will focus on the structure of VP, although many of the same arguments can be made using evidence from DP as well.

3. Branching structure in VP: VP ellipsis

VP ellipsis has traditionally been invoked to argue for binary branching in VP. VP ellipsis is exemplified by (7).

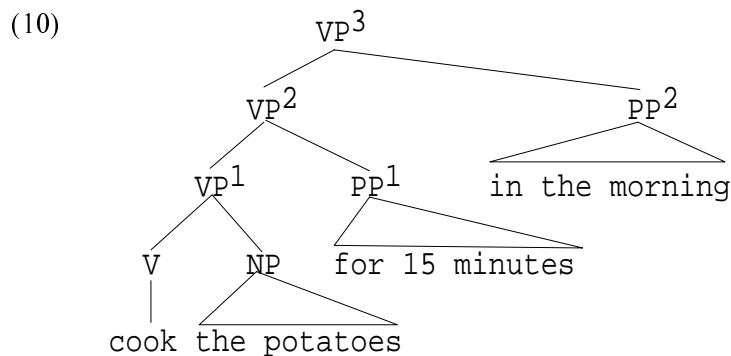
- (8) a. John will major in physics, and Mary will ~~major in physics~~ too.
 b. Mary intends to major in physics, but John doesn't intend to ~~major in physics~~.

For the sake of the discussion I will treat VP ellipsis as a type of (empty) proform, (as argued by Lobek 1999, for example).⁵ Other instances of material left out of VP are more plausibly analyzed as deletion, but nothing crucial hangs on the distinction here, which I am using simply for organizational purposes.

The standard evidence for this branching structure in VP is based on the fact that it is possible to do ellipsis on the subparts of the VP that are headed by V. On the view that ellipsis, as a type of anaphora, corresponds to a syntactic constituent, such evidence constitutes evidence for internal constituency. For example,

- (9) Mary will cook the potatoes for 15 minutes in the morning, and Susan
 a. will cook the potatoes for 15 minutes in the morning.
 b. will [_{VP} pro] in the evening. (pro = cook the potatoes for 15 minutes)
 c. will [_{VP} pro], too. (pro = cook the potatoes for 15 minutes in the morning)

The structure would be something like (9).



But it is certainly not necessary to assume that that anaphora depends on syntactic constituency. There is even evidence that it is wrong. Consider the following.

⁵In fact, there have been diverse analyses for the same phenomena and certainly for different phenomena, involving movement, deletion, empty pro-forms and the like; see Lappin and Benmamoun 1999 for a useful survey of some of the main proposals.

- (11) a. John ate the cake and Mary did the same .
the same thing
likewise
it, too
the opposite
something else
- b. John broke the window and Mary did the same to the table top.
the same thing
likewise
it
the opposite
something else
- c. John broke the window with a hammer, and Mary did the same to the table top.
the same thing
likewise
it
the opposite
something else
- d. John thought that Mary would win the race, and Bill thought the same
the same thing
likewise
it
the opposite
something else
- of Susan

It is clear that *the same*, *the same thing*, *something else* and so on need not have antecedents that correspond to syntactic constituents. Given that it is possible for an anaphor to have a non-syntactic antecedent, there is no basis for concluding on the basis of ellipsis that there is a particular syntactic structure. It is entirely plausible that the true structure is present in CS, where the various subparts of the VP correspond to objects in the semantic representation.

That this is a correct conclusion is shown by the behavior of verbs such as *put*. A verb like *put* does not allow V-NP to be the antecedent of an anaphor.

- (12) *John put the potatoes in the pot, and Bill did the same in the sink.
the same thing
likewise
it
the opposite
something else
pro

It is plausible (and traditional) to suppose that the Location must be included in the semantic representation of the event with such verbs. Making this assumption allows us to provide a uniform account of the failure of VP anaphora without appeal to the internal structure of VP. Notice, incidentally, that the Theme is actually outside of this core representation.

- (13) John put the potatoes in the pot, and Bill did the same to the carrots.
the same thing
likewise
it
the opposite
something else

At least superficially, V-Location does not correspond to a constituent of VP. This explains why we cannot have VP-ellipsis on *put NP*.

- (14) *John put the potatoes in the pot, and Bill did *pro* in the sink.

The question of branching structure does not enter in.

The relationship between the V and the Location seems to hold for all verbs of positioning, even those that can stand alone without Location, unlike *put*.

- (15) a. Mary inserted the diskette.
b. Mary inserted the diskette into drive a:, and John inserted the diskette into drive b:
c. *Mary inserted the diskette into drive a:, and John did [_{VP} pro] into drive b:
d. Mary inserted the diskette into drive a:, and John did the same thing with a chocolate bar.
- (16) a. Mary interjected her comments.
b. Mary will interject some comments into the conversation, and John will interject some comments into the discussion session.
c. *Mary will interject some comments into the conversation, and John will [_{VP} pro] into the discussion session.
d. Mary will interject some comments into the conversation, and John will do likewise with animals sounds.
- (17) a. Mary interposed an umbrella.
b. Mary interposed an umbrella between the door and the door jamb, and John interposed a baseball bat between the bicycle and the wall.
c. *Mary interposed an umbrella between the door and the door jamb, and John did [_{VP} pro] between the bicycle and the wall.
d. Mary interposed an umbrella between the door and the door jamb, and John did the same thing with his left thumb.
- (18) a. Mary put the book away.
b. Mary put the book away on the shelf, and John put the book away in the briefcase.
c. *Mary put the book away on the shelf, and John did [_{VP} pro] (away) in the briefcase.
d. Mary put the book away on the shelf, and John did the same with the secrets stolen from the Pentagon.
- (19) a. Mary repositioned the bicycle.
b. Mary repositioned the bicycle against the fence, and John repositioned the bicycle against the garage.
c. *Mary repositioned the bicycle against the fence, and John did against the garage.
d. Mary repositioned the bicycle against the fence, and John did the same with his BMW.

It therefore appears that the conceptual structure of V-Theme-Location is

(20) [_αV - Location] - Theme

and that in a full VP with all three, an anaphor can only pick out V-Location, not V-Theme. But anaphora can pick out V-Theme only in cases where Location is missing, as in (14d)-(18d). But V-Theme is the putative syntactic constituent, while V-Location is not. This is a typical instance of a syntax/semantics mismatch of the sort discussed by Culicover and Jackendoff 1997 and Culicover and Jackendoff 1999. Of the two, the structure that plays a role in anaphora is the semantic one.

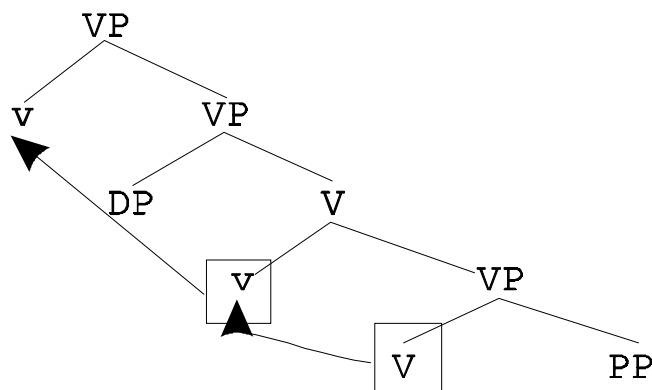
4. Branching structure in VP: Deletion

There are a variety of deletion constructions, including gapping, pseudo-gapping, and bare NP ellipsis.

- (21) a. Chris gave a magazine to Sandy, and Leslie, a book to Marty.
b. Chris will give a magazine to Sandy, and Leslie will a book.
c. Chris gave a magazine to Sandy, and not a book.

In the gapping example (20a) *a book to Marty* is not a constituent. It appears reasonable to believe that gapping is interpreted on the basis of the congruence of corresponding strings, and not in terms of some internal branching structure. In the pseudo-gapping examples (20b), what is missing in the right conjunct is *give to Sandy*. On the face of it this is not a constituent, although some analyses do propose that the PP is actually a sister to the V and the direct object is higher in the structure (e.g. Lasnik 1999)..

(22)



Such analyses do not make crucial use of the branching structure, since they allow reordering and restructuring through movement. Hence any evidence can be made consistent with any structure simply by moving things around until the part of the structure that is deleted in the right conjunct is isolated.

Example (20c), again, is not evidence for internal structure because what is deleted is an arbitrary subpart of the VP in the right conjunct. This can be seen by looking at a fuller range of examples.

- (23) a. Chris gave a magazine to Sandy, and not a book.
b. Chris gave a magazine to Sandy, and not a book to Leslie.
c. Chris gave a magazine to Sandy, and not Leslie.
d. Chris gave a magazine to Sandy, and not Leslie to Marty.
etc.

So whatever is going on in this construction, there is no evidence that it is constrained by any particular internal structure of the VP.

5. Branching structure in VP: Movement

The classical evidence from movement regarding internal structure comes from VP topicalization, exemplified below.⁶

- (24) They said that John would win the race at some point, and [win the race]_i he did [t_i [just after 5 o'clock]].

It appears that in this case, the sub-VP *win the race* has been moved from the larger VP *win the race just after 5 o'clock*. This type of movement is taken as evidence that the VP does not have a completely flat structure. I do not have time to discuss this construction in detail, but note simply that there are subparts of the VP that can undergo VP topicalization that cannot undergo VP ellipsis.

- (25) a. *They said that John would put the ice cream somewhere, and he did in the freezer.
b. They said that John would put the ice cream somewhere, and put the ice cream he did in the freezer.
- (26) a. *They said that Mary would eat the vegetables somehow, and she did raw.
b. They said that Mary would eat the vegetables, and eat the vegetables she did raw
- (27) a. *Mary gave Bill a magazine, and Susan did ~~give Bill~~ a fantastic illustrated book about syntactic theory.
b. They said that Mary would give Bill something interesting for Christmas, and give Bill/him she did a fantastic illustrated book about syntactic theory.

The contrast shown in these examples suggests that VP ellipsis works by finding an antecedent in conceptual structure for a [_{VP} pro], while VP topicalization is simply a discontinuous VP, whose interpretation is established along the lines sketched out above. In the case of VP topicalization, the interpretation of the partial VP need not correspond to a legitimate CS object, in contrast with the [_{VP} pro].

6. Topological relations in VP

I turn next to indirect evidence in support of branching structure. Much of this evidence takes the form of relations between disjoint parts of a sentence that are presumed to be subject to a c-command constraint, which is defined in terms of branching structure. Again, because time is limited I will simply note some crucial examples. The traditional view is that a quantifier must c-command a pronoun that it binds; the following show that this cannot be right.

- (28) a. Mary talked to every policeman on the force_i about his_i political attitudes.
b. Mary talked to every policeman on the force_i after he_i retired.
c. Mary_j talked to every policeman on the force_i without PRO_j offending him_i.

The branching of the PP that contains the quantifier phrase blocks standard c-command. A plausible alternative approach, and the only possible one in various minimalist approaches, is that there is a

⁶ Emonds 1976 argued that constituents move to the right over adverbs, producing structures such as

- (i) Mary t_i apparently [speaks French]_i

Given that there are many other possible accounts for the placement of adverbs, I will not address this proposal in detail.

dominance relation that holds between the quantifier phrase that precedes the pronoun and the representation of the pronoun at CS.⁷

There is also evidence from parasitic gaps, exemplified by familiar examples like the following.

(29) These are the files that I filed t_i without reading pg_i .

The property that we are concerned with here is that the true gap, marked as t_i here, cannot be the subject of a clause that contains the P-gap.

(30) *These are the files OP_i that t_i confused me when I read pg_i

If the P-gap is in a constituent that is adjoined higher than the subject, then the sentence is grammatical.

(31) These are the files OP_i that Mary claimed t_i would confuse me without first familiarizing herself with pg_i .

This phenomenon has been subsumed under the constraint that the true gap cannot c-command the P-gap. This is called the Anti-c-command condition (ACC).

If the ACC is correct then it can be used as a diagnostic for structure. For instance, given a VP of the form

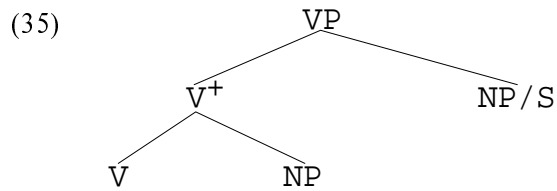
(32) [_{VP} V XP YP],

the ACC makes different predictions depending on whether or not XP and YP are sisters, on the one hand, or YP is outside [V XP] on the other hand. The following examples appear to show that they are not sisters.

- (33) a. Who_i did you persuade t_i [that you had voted for pg_i]?
a person who_i you persuaded t_i [that you would never vote for pg_i]
b. Who_i did you convince t_i [that you had voted for pg_i]?
a person who_i you convinced t_i [that you had voted for pg_i]
- (34) a. Who_i did you show t_i [embarrassing pictures of pg_i]?
a person who I showed t_i [embarrassing pictures of pg_i]
b. Who_i did you send t_i [a letter about pg_i]?
a person who I sent t_i [a letter about pg_i]

If t_i and the sentence containing the P-gap were sisters, the trace would command the parasitic gap and (32a) would be ungrammatical; similarly for the other a-examples. Hence the ACC leads to the conclusion that the verb and the NP argument adjacent to it form a constituent, as in (34)

⁷See Culicover 1993 for an account along these lines formulated in terms of LF. The relation of O-command of Pollard and Sag 1994 also captures the CS relation.



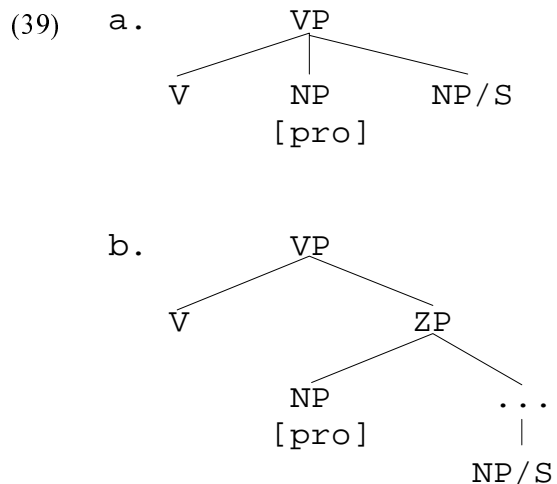
C-command is also believed to play a fundamental role in Binding theory.

- (36) a. *He_i firmly believes that John_i will be elected president.
 b. His_i mother firmly believes that John_i will be elected president.

Condition B of the Binding theory holds that a pronoun cannot c-command its antecedent, which accounts for the grammaticality judgments in (35). When we test Condition B against the configuration illustrated in (32)-(33), the judgments suggest that the first complement c-commands the second complement.

- (37) a. *I persuaded him_i [that you had voted for John_i].
 b. *I convinced him_i [that you had voted for John_i?]
 (38) a. *I showed them_i [embarrassing pictures of the neighbors_i?]
 b. *I sent her_i [a letter about Mary_i?]

In order for this c-command relation to hold, either the two complements are sisters of the verb, or the two complements form a constituent that is a sister of the verb. (38) illustrates the two possibilities, where the first NP is the pronoun.



Comparison of these structures with the one in (34) that we got from parasitic gaps shows that there is a contradiction. The contradiction disappears if c-command is not relevant either for binding or for parasitic gaps, which would then be stated in terms of CS and linear order. I will not try to work out the details here but I believe that this alternative is a feasible one.

An additional well-known observation about binding and c-command is that c-command makes the wrong predictions for the binding of reflexives (Condition A) in double object constructions; see Barss and Lasnik 1986.

- (40) a. Mary showed John_i himself_i.
 b. *Mary showed himself_i John_i.

The requirement that the antecedent must c-command the reflexive yields the conclusion that the structure is (38b), since in the flat structure, each NP c-commands the other. But, as seen, the examples in (33) constitute evidence to the contrary. One way to resolve the contradiction is to assume that the structure is flat and that the linear order plays a crucial role in determining the antecedent of the reflexive. In fact we see that this must be correct when we consider examples involving HNPS in the VP.

- (41) a. *John showed a beautiful picture of herself_i to Mary_i.
 b. John showed to Mary_i a beautiful picture of herself_i.
 (42) a. *John showed herself_i as a young girl to Mary_i.
 b. John showed to Mary_i herself_i as a young girl.

What seems to be crucial here is first, that *Mary* is an argument of *show*, second, that *Mary* is in the same clause as the constituent that contains the reflexive, and third, that *Mary* is to the left of the reflexive. The relation of c-command does not seem to enter in at all. Similar facts hold for Stylistic *there* Insertion.

- (43) a. *A picture of its_i owner hung on the wall of every restaurant_i.
 b. There hung on the wall of every restaurant_i a picture of its_i owner.

7. Ditransitives

One direct consequence of the move to binary branching is that there must be branching structure in VPs wherever there are two arguments of the verb, as in *give Mary a book*. Kayne 1983 develops an extended argument based on nominalizations for a [V [NP NP]] structure of ditransitives. He argues that the failure of nominalizations such as (43a) has the same explanation as that of (43b), namely the presence of an S node between the head noun and the complements.

- (44) a. *Mary's gift of the letter by her teacher
 (cf. Mary was given the letter by her teacher.)
 b. *Mary's belief a genius by John.
 (cf. Mary was believed a genius by John.)

The assumed structure is that of (44), where the N fails to govern across the S boundary.

- (45) [_{NP} NP_i N [_S t_i X]]

But Kayne also considers the possibility that the objects moved to possessor in these nominalizations must be Themes, where Theme is associated with Direct Object (Anderson 1977). He rules this possibility out on the grounds that there is no "simple definition of Direct Object", since the Direct Object is sometimes the NP immediately following the V, and sometimes it is the second NP. But in the context of recent proposals about argument structure and linking, the variable conditions for assigning Theme are not a serious obstacle to the alternative that Kayne rejects. That is, Theme can be identified without requiring that it be exclusively linked to a syntactically characterized Direct Object argument. Beyond this concern that Kayne raises there does not appear to be any reason to hold to the structure [V

[NP NP]].

Larson 1988 argues that the two arguments are in different positions in a right branching shell structure, along the lines sketched in (45).

(46) $[_{VP} v [_{VP} NP [give NP]]]$

For a critique of Larson's proposal, see Jackendoff 1990 (and Larson 1990 for a reply). The VP-shell approach has the virtue of correlating right-branching with c-command. However, if we can refer directly to linear order in order to constrain binding, it is not clear what the contribution of c-

8. Minimal asymmetries

The last type of argument that I would like to mention concerns the theory internal motivation for branching structure. It is common in the Principles and Parameters and related approaches to 'explain' constituent order in terms of attraction of a constituent to an empty head. The empty heads are ordered hierarchically, there is a principle that determines their linear ordering, and this produces a linear ordering on the constituents that are attracted to them. It is easy to see that if we have two constituents A and B, we can state a left-to-right ordering on A and B by the following set of statements. We let [A] and [B] denote characteristic features of A and B respectively.

- (47) a. There exist H_A with features[A] and H_B with features [B].
b. H_A c-commands H_B .
c. For all α, β , if α c-commands β then α precedes β (Kayne 1994)

In concrete minimalist terms, we can state the same ordering as follows.

(48) A precedes B.

Statement (47) of course does not account in itself for any scopal relationships between A and B that might be captured by the c-command relation assumed for H_A and H_B . Such relationships would have to be captured by the interaction between the linear ordering, the argument structure and other aspects of the CS representation.

9. Conclusions

I have argued that in the final analysis there is a conflict between the logic of minimalism and the assumptions upon which many accounts of branching structure, including the AT, are based. I have surveyed the history of binary branching and the empirical and theoretical arguments in favor of it and have found that in the best case binary branching does the same work as linear order and CS hierarchical organization, both of which I assume to be minimally required in a Concrete Minimalist syntactic theory. In the worst case binary branching makes the wrong or contractory empirical claims. I conclude, therefore, that

- The right kind of minimalism is a concrete minimalism.
- The AT is without explanatory force since it functions over structures that are at best unmotivated and at worst wrong.

This raises the question of why does AT seem to work at all? There are several reasons.

- It incorporates (as a stipulation) something that is fundamental in a concrete minimalist account: linearity. AT incorporates the left-to-right asymmetry of time.
- Linear order is asymmetrical, in the sense that for $A > B > C$ in a string, B and C are not equally proximate to A. This linear asymmetry can be encoded into hierarchical structure but can also be stated directly, as it is in a concrete minimalist theory.
- In the unmarked case, operators take scope to the right. (Perhaps there is a functionalist basis for this?)
- There is a hierarchical structure inherent in the subject-predicate structure of CS, and in recursive structures. So we are going to get ‘precede and command effects’.
- There are many naturally occurring binary function/argument structures in Conceptual Structure.
- It is always possible to introduce functional heads that encode the linear relationships (cf. Rochemont and Culicover 1997); see also Cinque 1996 and Cinque 1997).
- There may be a computational bias in favor of uniform branching direction (although this does not select right branching over left branching); see Hawkins 1994 and Kirby 1999.

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