Syntactic Structure without Projection Labels

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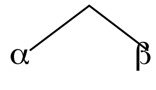
1. Projection Labels in Bare Phrase Structure

It has been taken for granted that the structure formed of lexical items needs to be represented by a label that has no phonetic content such as NP and V'. This is true also in the bare phrase structure theory proposed in Chomsky (1994) and pursued in subsequent work, where projection labels are eliminated by the use of lexical items; lexical items used as labels are not pronounced at all. There are at least two advantages of using a projection label in representing a syntactic structure: (i) it expresses constituency, and (ii) linear order is derivable by a simple algorithm. (i) is straightforward. The algorithm mentioned in (ii) is to ignore all projection labels and pronounce only terminal nodes from left to right. An exception is Kayne's (1994) ingenious attempt to deduce linear order from the configurational properties of a sentence; still, it crucially depends on non-terminal nodes that lack phonetic values. It is desirable to eliminate projection labels if (i) and (ii) are maintained.

I will concentrate on (i), setting aside (ii) for a while. According to the standard conception of syntactic structure, merging lexical items, α and β, is represented by the tree in (1), with no order assumed.

(1)


The new node γ is introduced along with two directed edges connecting it with α and β. α and β are pronounced but γ has no phonetic value. If γ is the same type as α, α is the head of the structure labeled as γ, and α selects or agrees with β. The syntactic relation is reversed if γ is the same type as β. The two cases can be distinguished without γ, as in (2a,b).

(2) a. α b. β
      | |
      β α

α selects or agrees with β in (2a) and vice versa in (2b). Compare (1) and (2a,b) graph-theoretically. A graph, denoted G=(V, E), consists of a set of nodes V and a set of ordered pairs of nodes E. The definition of (1) is more complex than those of (2a,b), which are given below:

(3) (1): G1=(V1, E1) V1= $\{\alpha, \beta, \gamma\}$. E1 $=\{\langle\gamma, \alpha\rangle, \langle\gamma, \beta\rangle\}$

$\gamma=\{\alpha, \{\alpha, \beta\}\}$ or $\gamma=\{\beta, \{\alpha, \beta\}\}$

(2a): G2=(V2, E2) V2=$\{\alpha, \beta\}$ E2=$\{\langle\alpha, \beta\rangle\}$

(2b): G3=(V3, E3) V3=$\{\alpha, \beta\}$ E3= $\{\langle\beta, \alpha\rangle\}$

(1) and (2a,b) differ in their representations of headedness. In (1), a non-terminal node γ is added to the node set V1, two ordered pairs $\langle\gamma,\alpha\rangle$ and $\langle\gamma,\beta\rangle$ constitute the edge set E1. In (2a,b), on the other hand, the node sets V2 and V3 are minimal, containing just α and β, and either of the two possible ordered pairs $\langle\alpha, \beta\rangle$ and $\langle\beta, \alpha\rangle$ constitutes the edge set. Note that $\langle\alpha, \beta\rangle$ is generally defined as $\{\{\alpha\}, \{\alpha, \beta\}\}$, and it looks very close to Chomsky's (1995:244-245) definition of the object formed from α and β of the type α: $\{\alpha, \{\alpha, \beta\}\}$. For expository convenience, Chomsky continues to employ the graphical representation of the form (1) for the object $\{\alpha, \{\alpha, \beta\}\}$, acknowledging that (1) is more complex than is absolutely necessary. If $\{\{\alpha\}, \{\alpha, \beta\}\}$ is adopted instead of $\{\alpha, \{\alpha, \beta\}\}$ as the definition of the object formed from α and β , the discrepancy between the formal definition and its

graphical representation will disappear, which seems to be a desired result.

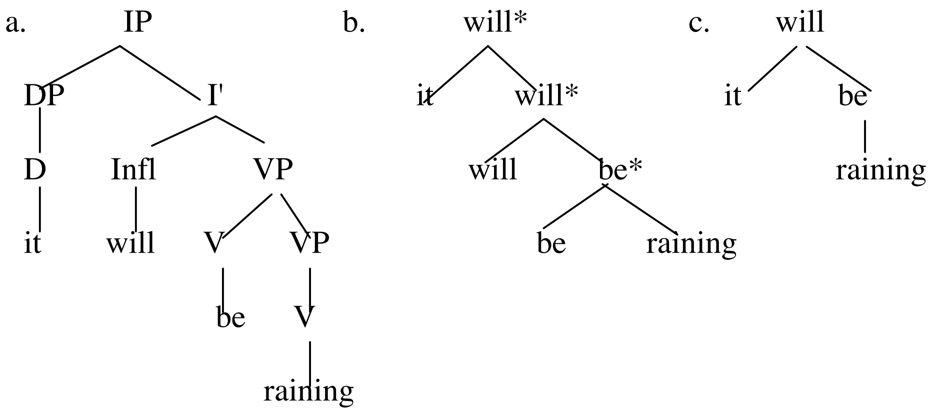
Structural representations built as in (2a,b) will be referred to as lexical graphs.

2. Constituency, C-command and Other Syntactic Relations

Lexical graphs can capture constituency and other important syntactic relations expressed in standard tree representations. Take (4) for example. Its traditional and minimalist representations are (5a,b), while its lexical graph is (5c).

(4) It will be raining.

(5)



The non-branching nodes in (5a) are eliminated in (5b), and the remaining projection nodes are represented by lexical items as labels, which are asterisked to distinguish them from those that have phonetic content. The node *be** expresses important syntactic relations: *be* and *raining* are sisters; they form a constituent; and the constituent they form is the same type as *be* rather than *raining*. The lower *will** has analogous functions. The upper *will** captures the fact that *it* forms a larger structure with the constituent that is of the same type as *will*, and that the resultant structure is also the same type as *will*. The asterisked nodes are removed in (5c), where the relations of selection and agreement as well as the headedness are represented by directed edges.

The four nodes in (5c) correspond to the four minimal projections in (5b). The upper will* and be* in (5b) correspond to the subgraphs rooted by *will* and *be* in (5c), respectively. More generally, a constituent of the type α can be defined as α itself or a subgraph that consists of all the nodes α dominates. One constituent that falls out of this definition is the lower *will** in (5b), which corresponds to the intermediate projection I' in (5a). This is a welcome result, since an intermediate projection is syntactically and semantically invisible as Chomsky (1994:10) claims.

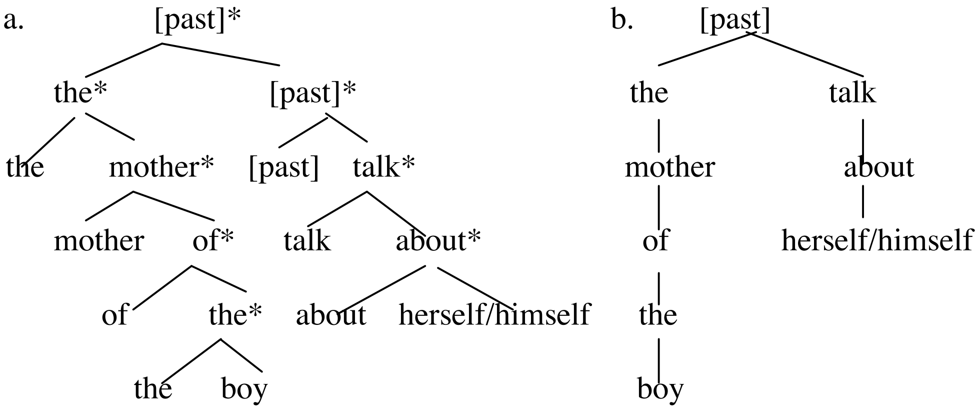
Head-movement, which is strictly local, affects two nodes connected by a single edge. In a lexical graph, the subject is adjacent to the Infl just like the object is adjacent to the verb. Assuming the standard tree representation like (5a), Kayne (1984:chapter 10) and Haegeman (1994:585) argue that cliticization of the object to the verb is upward and syntactic, but cliticization of the subject to the Infl is downward due to the intermediate node I' and hence must be analyzed as a PF-operation. If a lexical graph is adopted, this conclusion can be circumvented since the problematic intermediate node I' is absent, as discussed above.

The configuration of a lexical graph alone does not distinguish a specifier from a complement. If syntactic structure is built first by satisfying selectional requirements, followed by agreement or formal feature checking, a specifier and a complement can be distinguished based on their derivational histories. Alternatively, a specifier, if it is not an expletive, results from Move or internal Merge; it is connected to the category selecting it and also to the one inducing agreement with it. I will assume that a specifier can be identified by its derivational history or its double-connectedness in a lexical graph.

Next, consider how c-command can be defined in a lexical graph. (6) shows a typical contrast in reflexive binding, and its bare phrase structure and lexical graph are (7a,b), respectively.

(6) The mother of the boy talked about herself/*himself.

(7) a.

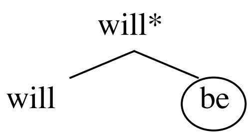


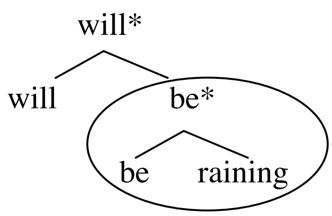
In (7a), the upper *the** is immediately dominated by the root, which dominates the reflexive, but the lower *the** is immediately dominated by of*, which does not dominate the reflexive. Applying the same definition of c-command to (7b) can account for the contrast; the upper *the* c-commands the object but the lower *the* does not. Note that in the subject of (7a), the upper *the* c-commands *of*, the lower *the* and *boy*, while it is not the case in (7b). Long-distance binding, which hold between phrases, is attested in many languages, but heads are not known to be related non-locally. This supports the present theory; a head fails to c-command distant heads within its complement.

3. Some Problems Caused by Projection Labels

Earlier theories assumed syntactic structure to be built up in a top-down manner by rewriting rules, followed by lexical insertion. A bottom-up structure building is adopted in the bare phrase structure theory. Phillips (2003) proposes an incremental structure building, which is a kind of top-down system. The presence of these conflicting proposals on the order of structure building might suggest that the selectional/agreement requirements of lexical items can be satisfied in any order. This conclusion is acceptable to the approach sketched above but would be problematic if constituency is expressed by projection nodes.

Going back to (4), the four lexical items are originally unconnected. A connected graph is formed by establishing an edge between those in a selection or agreement relation. For example, *be* is connected to *will*, which selects a bare verbal form, *raining* is connected to *be*, which selects a progressive verbal form, and the expletive *it* is finally connected to *will*, which agrees with a nominative DP. This order would cause a violation of cyclicity in the traditional and bare phrase structure theory, as illustrated below:

(8) a.


b.


(8a) is not problematic at all, but adding *raining* results in replacing *be* in (8a) with the graph rooted by *be** in (8b). To avoid this, Frampton and Gutmann (1999, 2000) propose that a syntactic derivation should start by introducing a lexical item that selects nothing first; *raining* in the case of (4). This stipulation is not necessary in the formation of lexical graphs.[1]

Phillips' incremental theory allows a constituent at one stage of the syntactic derivation to become a non-constituent later, and it is intended to resolve the contrast in (9a,b) among others.

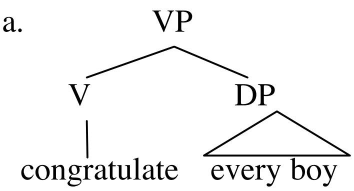
(9) a. Mary said she would congratulate every boy, and congratulate every boy she

did at his graduation.

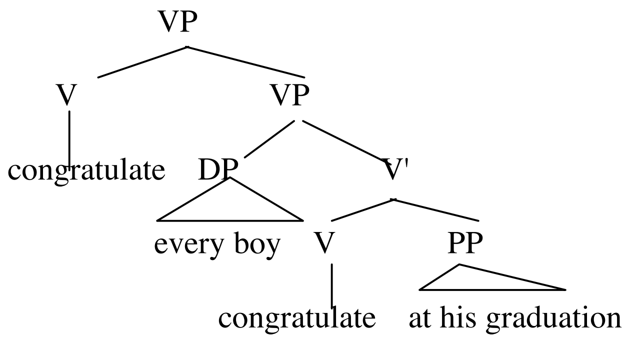
b. *Mary congratulated every boy at his graduation, and Sue did at his 21st birthday.

If the string *congratulate every boy* is a constituent and *did* can be interpreted as its copy in (9a,b), binding of *his* by *every boy* should be equally possible or impossible; the fact is that it is possible only in the partial VP fronting case in (9a). The string *congratulate every boy* in the clause-initial position of the second conjunct of (9a) is analyzed as (10a), which is clearly a constituent.

(10) a.



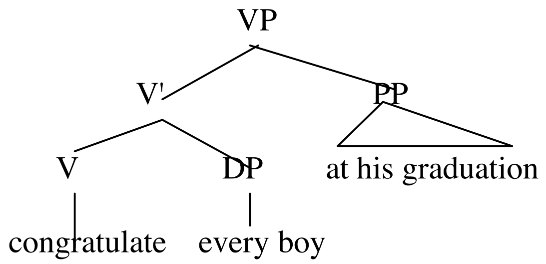
b.



Adding the PP modifier will destroy its constituency, as shown in (10b), where a shell structure is created by copying the verb and combining it with the PP adjunct in a counter-cyclic fashion. (9a) is acceptable since *congratulate every boy* is a constituent of the form (10a) at the point where it is copied. Adding the PP adjunct subsequently as in (10b) destroys the constituency, but it is not problematic at all. On the other hand, when *did* in the second conjunct of (9b) looks for a VP constituent as its antecedent, the string *congratulate(d) every boy* in the first conjunct has already become a non-constituent as described in (10b); hence, it cannot be copied.

Phillips acknowledges that *congratulate every boy at his graduation* can also be analyzed as the left-branching structure in (11), which is presumably more widely assumed than the right-branching structure in (10b).

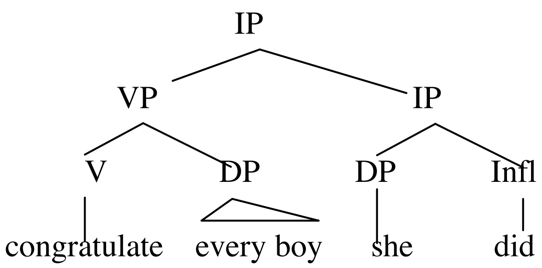
(11)



Congratulate every boy is a constituent in (11), and nothing should prevent it from being an antecedent of *did*. Phillips attributes the failure of *every boy* in (11) to bind *his* to the node V'; the object may not bind into the adjunct PP. Note that the strict c-command relation holds between the object and *his* in the right-branching structure in (10b). In brief, Phillips argues that (9b) is unacceptable because *congratulate every boy* is a non-constituent in (10b) and *every boy* may not bind *his* in (11).

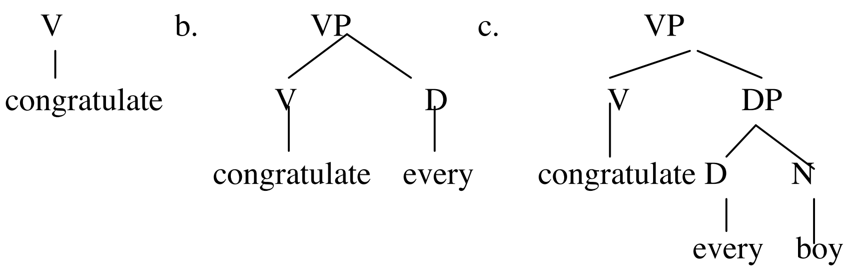
The above account crucially depends on the formation of (12) for (9a).

(12)



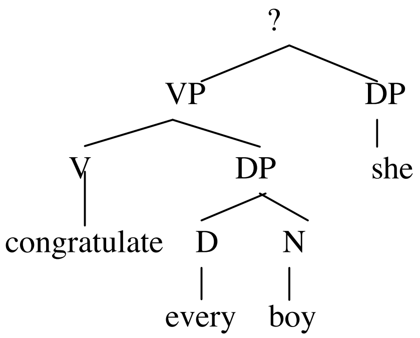
(12) is assumed to be built incrementally from left to right. The first three steps in (13a-c) are unproblematic.

(13) a.



The label of the structure formed at each step is decided by one of its inputs: the verb *congratulate*. The top projection label of (12) also reflects the category of *did*. What is problematic is the step between (13c) and (12), which should look like (14).

(14)



At the point where the subject is added, the whole structure should be labeled presumably as IP, but none of the inputs belongs to the category INFL. This kind of categorial indeterminacy would arise more extensively if the incremental theory is extended to head-final languages; an INFL-bearing item appears only after arguments and adjuncts are incrementally introduced.

4. PF-interpretation of Lexical Graphs

To account for (9a,b) based on the theory advocated so far, it is necessary to offer algorithms to deduce PF-interpretations from lexical graphs. I argued in Yasui (2003) that SVO and SOV orders can be derived from properly modified versions of depth-priority tree traversal algorithms, and I formalized them in the programming language C in Yasui (2004). I will present the basic ideas here.

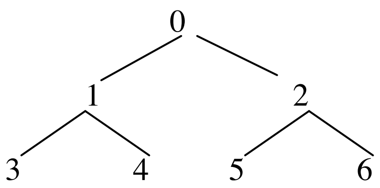
A depth-priority traversal starts from the root; it goes as deep as possible until reaching some leaf node, giving priority at a branching node to some of its child nodes, typically the leftmost one; it comes back to the branching node and traverses the other children nodes if any; the remaining nodes are traversed recursively in the same manner. A tree is traversed in the same way, but its nodes are pronounced in different orders. The pronunciation conditions for inorder and postorder traversals to be adopted here are (15a,b).

(15) a. Inorder (SVO): Pronounce a given node when it does not immediately dominate a unpronounced specifier node.

b. Postorder (SOV): Pronounce a given node when it does not immediately dominate unpronounced nodes.

(15a,b) presuppose that a specifier is distinguishable in a lexical graph, which, I acknowledge, is a non-trivial issue. (15a) says that a head is pronounced after its specifier and before its complement, while (15b) says that a head is pronounced after both of them. The binary-branching tree in (16) will illustrate how (15a,b) work.

(16)



The left and right child of each node are its specifier and complement. Traversing (16) according to (15a,b) results in (17a,b), where each node is pronounced in the underlined position.

[Ed./Comp.: From here to the end of the text, underlining should be set as underlining]

(17) a. 0-1-3 -1-4-1-0-2-5-2-6-2-0

b. 0 -1-3-1-4-1-0-2-5-2-6-2-0

I will not go further into (15b) here.

Traversing (5c) and (7b) in accordance with (15a) produces the sequences of traversed nodes in (18a,b), respectively.

(18) a. will-it-will-be-raining

b. [past]-the-mother-of-the-boy-the-of-mother-the-[past]-talk- about-herself

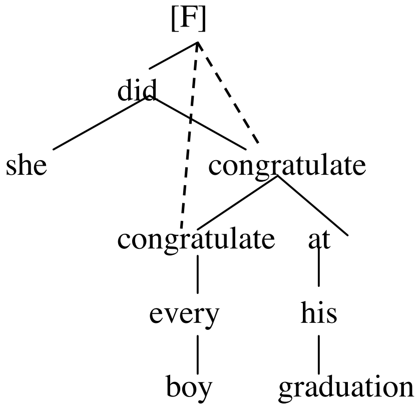
If the predicate-internal subject analysis is taken, there should be one more directed edge from *talk* to the upper *the* in (7b). Pronouncing the subject twice can be avoided by applying (15a) only to unpronounced nodes.

Going back to (9a,b), I will adopt the left-branching structure (11) equally for (9a,b) to account for the fact that the fronted or elided part can be V' or the whole VP. I will also assume that VP-fronting is triggered by a functional category, call it [F], on a par with [WH] assumed for wh-movement. The lexical graph analysis of the second conjunct of (9a) under these assumptions is (20a), and that of (19a,b) is (20b).

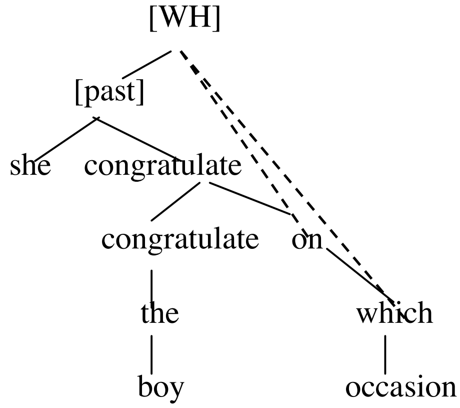
(19) a. (I wonder) on which occasion she congratulated the boy.

b. (I wonder) which occasion she congratulated the boy on.

(20) a.



b.



Intuitively, [WH] searches downward for a constituent with a wh-feature. In (20b), it picks up the subgraph headed by *on* (PP) or by *which* (DP).[2] Traversing (20b) according to (15a), thus, gives the two sequences of traversed nodes in (21a,b).

(21) a. [WH]-on-which-occasion-which-on-[WH]-[past]-she-[past]-congratulate-congratulate -the - boy ==> (19a)

b. [WH]-which-occasion-which -[WH]-[past]-she-[past]-congratulate-congratulate-the- boy -the-congratulate-congratulate-on ==> (19b)

Analogously, (19a) has the PF-interpretation in (22) in addition to (9a).

(22) Congratulate every boy at his graduation she did.

[F] in (20a) looks for a VP with some emphatic feature relevant to it; and the constituent in question can be the subgraph headed by the upper instance of *congratulate*, or the one headed by the lower instance. Inorder traversal of (20a) yields (23a,b).

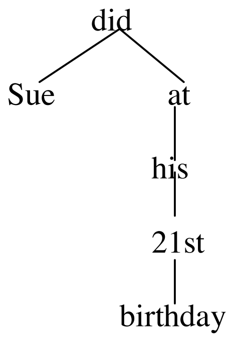
(23) a. [F]-congratulate-every-boy-every-congratulate-[F]-did-she-did-congratulate-at-his- graduation ==> (9a)

b. [F] -congratulate-congratulate-every-boy-every-congratulate-congratulate-at-his- graduation - his - at - congratulate - [F] - did - she - did ==> (22)

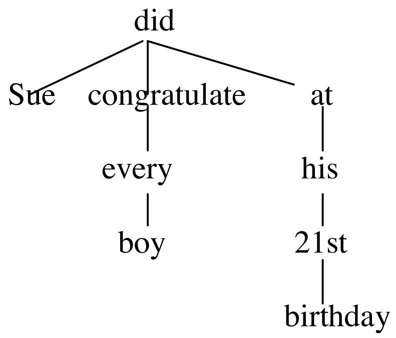
Congratulate is underlined twice in (21) and (23); I assume that only the first instance has phonetic effect.

As for binding of *his* by *every boy* in (20a), I will adopt m-command instead of strict c-command: the two instances of *congratulate* are regarded as constituting one branching node. This implies that *his* binds *every boy* in (9b). Moreover, it should not be problematic to copy *congratulate every boy*, which is a constituent, into its second conjunct. I will assume the second conjunct of (9b) to be analyzed as (24a):

(24) a.



b.



(24a) is pronounced according to (15a): did-Sue-did-at-his-21st-birthday. At some interpretive level, *congratulate every boy* is copied into the second conjunct as in (24b). *Every* in (24b) is immediately dominated by *congratulate*, which does not dominate *his*; hence the failure of *every boy* to bind *his*.

I have outlined a theory of syntactic structure without projection labels and applied it to the contrast in (9a,b). Other consequences of the present theory are presented in Yasui (2003, 2004), especially on word order flexibility attested in Japanese and other head-final languages.

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[1] If a specifier is identified by its derivational history, as mentioned in Section 2, selectional requirements must be satisfied before agreement requirements.

[2] I assume the wh-feature of *which* can be percolated up to *on* in (19a).