Word Order Typology in Graph-Theoretical Linearization of Bare Phrase Structure

Since the seminal work of Kayne (1994), the issue of syntax – phonology mapping has been one of the important research topics in the minimalist program. Kayne proposed Linear Correspondence Axiom (LCA) that maps asymmetric c-command relations in syntactic structures into linear precedence relations of terminal words. The asymmetric c-command is defined in terms of the “first category node,” crucially relying on a non-branching projection. It entailed the universal Specifier-Head-Complement order, with massive reordering movements in the so-called “head-final” languages, which often seem not to be motivated other than by the need of getting the correct word orders. Chomsky (1995a, b) partially adopts LCA in his theory of Bare Phrase Structure (BPS) while keeping the phrase structures linearly unordered in the narrow syntax. One problem for BPS to fully adopt LCA is the fact that a head and its complement mutually c-command each other, and hence no linear order can be determined if the complement is a simplex terminal unless some non-branching projection is postulated as in Kayne (1994).

In this paper, I develop a graph-theoretical approach (Yasui 2003, Kural 2005, inter alia) that can effectively be applied to unordered syntactic structures of BPS, without positing extraneous movement that are not well-motivated. I argue that graph-theoretical linearization is a promising approach, in that its formal aspects are well-studied, and more importantly that word order variations can be derived from a single structural representation.

In graph theory, there are several well-known procedures for traversing tree structures. Applied to a syntactic tree such as (1), the preorder traversal (2a) yields the sequence (3a), the inorder traversal (2b) the sequence (3b), and the postorder traversal (2c) the sequence (3c), respectively. Simply collecting the terminal words from (3a-c) produces exactly the same sequence (4), which is good enough for English, but uninteresting. Kural (2005), however, observes that there are linguistically significant patterns in (3a-c) in the relative ordering of phrasal nodes (5a-c), respectively. Replacing the phrasal nodes (5a-c) with the category label of their heads yields (6a-c), which coincide with the three typologically dominant word orders, VSO, SVO, and SOV, respectively. Proposing a terminal-extraction algorithm embedded in the three traversal methods (2a-c), Kural (2005) argues that tree traversal linearization can produce cross-linguistic variations in word order without recourse to excessive movement.

Ingenious as it is, however, there are two major problems in Kural (2005), one empirical and the other theoretical. The empirical problem is concerned with wh-movement as in (7). Its preorder traversal yields the sequence (8a), and its categorial reduction (8b). An English gloss version will be (9) in which the moved wh-phrase is preceded by the complementizer, which does not seem to be attested in any VSO languages. The theoretical problem has to do with the directionality mentioned in the traversal algorithms (2a-c), and the assumption that the syntactic structure is an ordered tree as in (1), which cannot be adopted directly into BPS.

Given these, I propose to modify the traversal algorithm as in (10). In BPS, tree structures are assumed to be unordered. Thus, BPS Traversal (10) refers to child nodes and subtrees as consanguineal (blood-children) or affine (step-children). If the parent node is of the same category, they are consanguineal (blood-children), i.e., head projections. Affine subtrees are either specifiers, adjuncts, or complements. Applying the BPS Traversal (10) to the structure (11) yields the categorial reduction (12a-c), which correspond to (13a-c), respectively. The conditional clause in the recursive step ① in the BPS Traversal (10) may be parameterized to be dropped, and in such cases, the inorder extraction yields the S(I)OV(C) order (14), instantiating the word order pattern of Vata (Koopman 1983), in contrast with the wholesale “head-final” SOV(I)(C) order such as in Japanese.

Selected References:
(1) CP
   C
   IP
   Ø
   DP
   I
(2) Tree Traversals
   VP
   the
dog
will
V
DP
b. Inorder: Visit the node.
   bite
   D
   NP
   the
   man
   b. Inorder: Extract the head.
   Which
   man
   I
   C
   NP
   DP
   I
   (3) a. Preorder: {CP, C, Ø, IP, DP, D, the, NP, dog, I’, I, will, VP, V, bite, DP, D, the, NP, man}
   b. Inorder: {Ø, C, CP, the, D, DP, dog, NP, IP, will, I, I’, bite, V, VP, the, D, DP, man, NP}
   c. Postorder: {Ø, C, the, D, dog, NP, DP, will, I, bite, V, the, D, man, NP, DP, VP, I’, IP, CP}

   (4) {Ø, the, dog, will, bite, the, man}

   (5) a. Preorder: {CP, IP, DP, NP, VP, DP, NP}
   b. Inorder: {CP, DP, NP, IP, VP, DP, NP}
   c. Postorder: {NP, DP, NP, DP, VP, IP, CP}

   (6) a. {C, I, D, N, V, D, N} (C)(I)SVO
      b. {C, D, N, I, V, D, N} (C)(S)IVO
      c. {N, D, N, D, V, I, C} SOV(I)(C)

   (8) a. {CP, DP, D, which, NP, man, C’, [C, I, will, C, Q], IP, DP, D, the, NP, dog, I’,
       twill, VP, V, bite, twh}
      b. {C, D, N, I, D, N, V}

   (9) {will + Q which man the dog (t_will) bite (t_wh)}

   (10) BPS Traversal
       Starting from the root, at a given node N:
       a. Preorder: Extract the head.
          ① If a child is consanguineal but childless, recursively traverse that child. Otherwise, recursively traverse its affine subtree.
       b. Inorder: Extract the head.
          ② Recursively traverse its consanguineal subtree.
       c. Postorder: Extract the head.

   (11) QP
       which_P
       Q
       Which
       man
       Q
       t_P
   (12) a. Preorder: {QP, which_P, man, will, t_P, the_P, dog, bite_P, t_will_P}
       b. Inorder: {which_P, man, Q_P, will, the_P, dog, t_P, bite_P, t_will_P}
       c. Postorder: {man, which_P, will, dog, the_P, t_will_P, bite_P, t_P, Q_P}

   (13) a. {Q which man will (t_will) the dog bite (t_will)}
       b. {which man Q will the dog (t_will) bite (t_will)}
       c. {man which will dog the (t_will) bite (t_will) Q}

   (14) {man which will dog the (t_will) bite Q}