Linear asymmetries and the LCA*

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Comments welcome.

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Abstract

Kayne (1994) was instrumental in putting linear asymmetries on the generative research agenda. His Linear Correspondence Axiom is seen as a restrictive, conceptually attractive proposal supported by a wealth of empirical evidence. In this paper, we take issue with this assessment. (i) We show that for every structure that violates the LCA, there is an LCA-compatible counterpart, including rightward movement structures and structures with rightward specifiers. (ii) We discuss Cinque's 2005 LCA-based analysis of word order in the extended nominal projection, demonstrating that the data in fact do not support any hypothesis stronger than a ban on rightward movement. (iii) We show that the LCA is toothless without a restrictive theory of movement, but that it can only be reconciled with the data in the absence of such a theory. (iv) We demonstrate that claims to the effect that central properties of phrase structure (such as headedness and the single-specifier restriction) follow from the LCA are incorrect. The paper concludes with an exploration of an alternative


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approach to linear asymmetries. In particular, we consider what assumptions about the human parser would derive the ban on rightward movement.

1   Introduction

Although our understanding of the hierarchical properties of syntactic representations has increased over the last half a century, there is a class of linear asymmetries that persistently elude proper analysis. One such asymmetry involves movement: rightward movement is much more restricted than leftward movement (see Ross (1967), Perlmutter and Postal (1983/1972), Bach (1971)). There are, for example, verb-second languages but no languages in which the verb has to surface in the penultimate position (see Kayne (1994, p. 50)). A second asymmetry has to do with OV- and VO-languages. These should be simple mirror images, but the expected symmetry is broken in a number of ways (see Neeleman and Weerman (1999) and the papers in Svenonius (2000), among others): the linear order of arguments is often the same rather than inverted, there appear to be no OV-languages without scrambling (see Riemsdijk and Corver (1997)), and verb clustering is strongly correlated with head-finality (for related discussion, see Haegeman and van Riemsdijk (1986); Svenonius (2007); Koopman and Szabolcsi (2000)). For further instances of linear assymetries in language,we refer the reader to Greenberg (1963); Kayne (1994, 2005a) and Cinque (1996).

It is not surprising that the problem of linear asymmetry has resisted analysis for such a long time. In order to solve any of the puzzles mentioned above, there must be some component of the grammar that refers to linear order. However, it has been part of the generative research program to remove linear statements from the theory of syntax. Thus, traditional generative syntax has no tools that can be used to analyze linear asymmetries (see Cinque (1996)).

Kayne's (1994) Linear Correspondence Axiom (LCA) was considered a breakthrough in syntactic theory, because it seemed to address exactly this shortcoming. Work in the Kaynean tradition claims that all phrases in natural language follow the template in (1), which we will refer to as the specifier-head-complement hypothesis (SHCH). Since the SHCH ties syntactic structure to a specific linear realization, it provides a foothold for syntactic accounts of the issues raised above.

(1)

$$XP$$

YP   XP

X^0 ZP

|

x
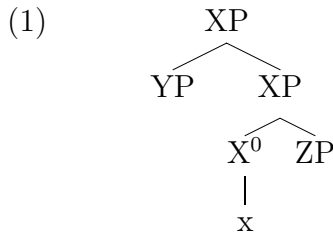
One important consequence of the SHCH is that movement must be leftward. The template in (1) implies that going right is going down, but movement goes up; thus, rightward movement is excluded. This has a clear bearing on some of the puzzles mentioned above.[1]

It is important to note that the SHCH does not by itself ban rightward movement. It does so only in conjunction with restrictions on movement (such as the restriction that the landing site of movement must c-commanded the launching site). Although the issue is noted in the literature (Kayne (1994, p. 47)), it has consequences beyond what is commonly acknowledged. The effect of rightward movement of a constituent α out of XP (that is, a gap preceding its filler) can be imitated using combinations of leftward movements. The simplest relevant derivation is schematized on the right in (2). The constituent labeled α moves leftward, followed by short (remnant) movement of XP. If the functional heads F_1 and F_2 have no phonological content, the two trees in (2) are associated with the same string. Though in (2) α is a maximal projection, it is possible to mimick rightward head movement through a very similar derivation. In other words, even to account for the observed asymmetry between filler-gap and gap-filler configurations, the SHCH must be combined with further conditions that regulate the distribution of structures like (2).

(2)   Rightward Movement (gap-filler orders):

XP α $\rightsquigarrow$ F_2P

                        XP F_2 F_1P

... t_α ...   ... t_α ... α F_1 t_{XP}
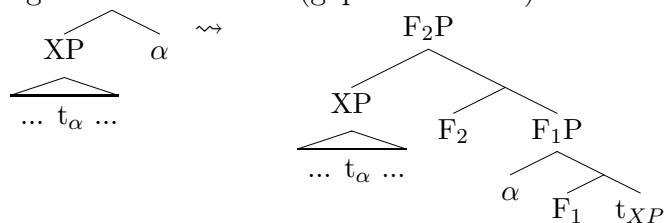
This conclusion holds across the board. All structures disallowed by the SHCH can be mimicked through movement. Short phrasal movement can create the semblance of leftward complements (see (3a)), as well as rightward

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[1]We distinguish between the LCA and the SHCH, even though the latter is generally taken to be a corollary of the LCA. We do so, because the SHCH actually does not follow from the LCA. We will show in section 5 that the two are logically independent.

specifiers (see (3b)).
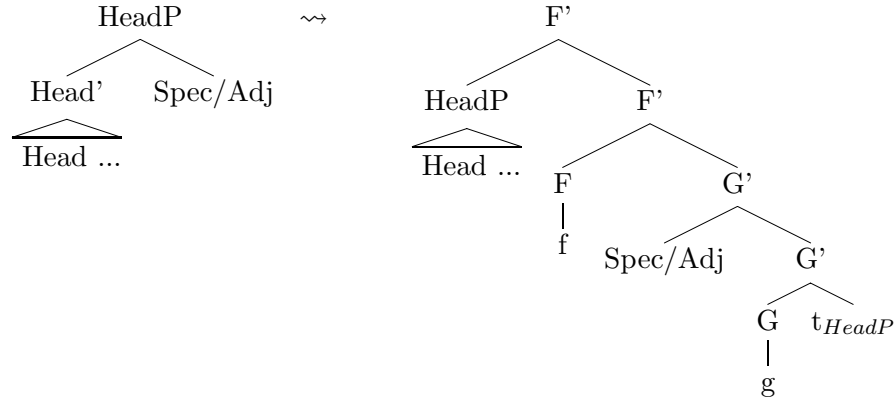
(3)　　Left Complements:

Head'　　⤳　　Head'

Complememt　Head　　Complement　　Head'

Head　t$_{Complement}$

head

(4)　　Right Specifiers and Adjuncts:

HeadP　　⤳　　F'

Head'　Spec/Adj　　HeadP　　F'

Head ...　　Head ...　F　　G'

f　Spec/Adj　　G'

G　t$_{HeadP}$

g
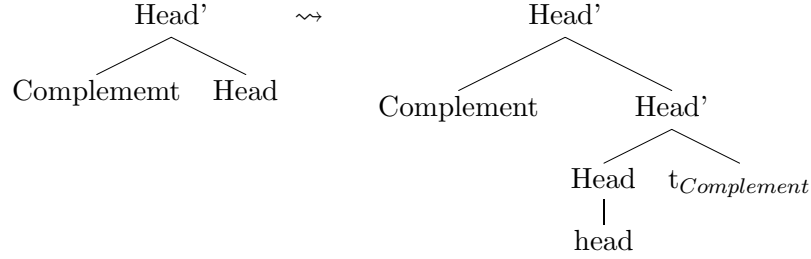
The importance of constraints on movement in deriving linear asymmetries is frequently mentioned in publications that adopt the SHCH. For example, in his discussion of relative clauses in Turkic, Kayne notes that a particular conclusion derivable from the SHCH only holds "assuming restrictions on phrasal movements of Agr that I won't try to spell out here" (Kayne, 2005a, p. 219). Similarly, Kayne (1994, p. 140 fn. 8) notes that his account of the non-existence of languages that have obligatory verb movement to the penultimate position requires "rul[ing] out derivations involving leftward movement of the finite verb to C^0, followed by leftward movement only in root contexts of IP to Spec,CP." (This derivation only gives rise to verb-last in root contexts, but something like it must presumably be part of any analysis of inverse verb-second.)

Despite the expressed awareness of the matter, work in the Kaynean tradition typically does not attempt to restrict the transformational component. Therefore, antisymmetric analyses often remain promissory notes issued on the basis of a non-existent theory of movement. There are exceptions. Koopman and Szabolcsi (2000), for instance, assume that movement out of specifiers is prohibited. However, the impact of this condition is reduced by the

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introduction of what are essentially non-cyclic derivations.[2]

Thus, much work based on the SCHC does not generate clear predictions about linear order, exactly because it is not paired with an explicit theory of movement. This in turn makes evaluation of work based on the SHCH nearly impossible. To our minds there is one notable exception: Cinque's (2005) analysis of Greenberg's (1963) universal 20 and its exceptions marries an antisymmetric phrase structure with a universally fixed hierarchical ordering of elements and, crucially, an explicit theory of movement in the noun phrase. Cinque's account therefore provides a rare test case for the merits of the SHCH.

In this paper we compare Cinque's account of word order in the noun phrase with an alternative that jettisons the SHCH, but maintains that movement is exclusively leftward. Crucially, the two theories give rise to the same typology. However, the alternative we propose has a number of advantages when we turn to issues beyond the noun phrase. In particular, our alternative is compatible with restrictions on movement that cannot be maintained if the SHCH is adopted. Thus giving up the SHCH in fact allows us to move closer to answering the questions raised by Kayne's antisymmetry program.

2 Cinque's Theory

An important early generalization concerning word order in the noun phrase goes back to Greenberg (1963), whose universal 20 (p. 87) states that "[w]hen any or all of the items (demonstrative, numeral, and descriptive adjective) precede the noun, they are always found in that order. If they follow, the order is either the same or its exact opposite." On the basis of careful typo-

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[2]The ban on the extraction from specifiers is invoked in the explanation of the freezing principle, which prohibits movement out of moved constituents. This in turn is central to Koopman and Szabolcsi's account of lexical integrity effects. The non-cyclic derivations we have in mind involve movement of a constituent X out of a complement Y before (the remnant of) Y moves to a specifier position. This sequence of operations is followed by movement of X across Y's landing site. This yields a representation indistinguishable in linear terms from one in which movement of Y precedes movement of X, the derivation banned under the freezing principle (for further discussion, see Abels (to appear)). Thus, the empirical effects of Koopman and Szabolcsi's condition are by and large restricted to base-generated specifiers. In this realm, the condition is demonstrably false. Consider (i). This example contains two constituents from which a subconstituent is extracted, the infinitival IP and the experiencer PP. Both are arguments of *seem*, so only one of them can be a complement (defined as the sister of a head), the other one has to be a specifier.

(i)   Which woman does John seem to a friend of to be smart?

logical work (by himself, Hawkins , Rijkhoff, Lu, Dryer, and others), Cinque argues that of the twenty-four logically possible orders of demonstrative, (descriptive) adjective, numeral, and noun, only fourteen are attested as unmarked word orders in some natural language. If Cinque's characterization of the data is correct, Greenberg's original formulation is both too permissive and too restrictive (at least on the interpretation proposed by Hawkins). Below we repeat Cinque's findings, including the relative frequency of the attested orders. The latter will not come into play until section 4.2.

(5) a. (i) DEM_1 NUM_2 A_3 N_4 *attested*   *very many languages*
these five young lads
   (ii) DEM_1 NUM_2 N_4 A_3 *attested*   *many languages*
   (iii) DEM_1 N_4 NUM_2 A_3 *attested*   *very few languages*
   (iv) N_4 DEM_1 NUM_2 A_3 *attested*   *few languages*

  b. (i) DEM_1 A_3 NUM_2 N_4 *unattested*
   (ii) DEM_1 A_3 N_4 NUM_2 *attested*   *very few languages*
   (iii) DEM_1 N_4 A_3 NUM_2 *attested*   *many languages*
   (iv) N_4 DEM_1 A_3 NUM_2 *attested*   *very few languages*[3]

  c. (i) NUM_2 DEM_1 A_3 N_4 *unattested*
   (ii) NUM_2 DEM_1 N_4 A_3 *unattested*
   (iii) NUM_2 N_4 DEM_1 A_3 *unattested*
   (iv) N_4 NUM_2 DEM_1 A_3 *unattested*

  d. (i) NUM_2 A_3 DEM_1 N_4 *unattested*
   (ii) NUM_2 A_3 N_4 DEM_1 *attested*   *very few languages*
   (iii) NUM_2 N_4 A_3 DEM_1 *attested*   *few languages*
   (iv) N_4 NUM_2 A_3 DEM_1 *attested*   *few languages*

  e. (i) A_3 DEM_1 NUM_2 N_4 *unattested*
   (ii) A_3 DEM_1 N_4 NUM_2 *unattested*
   (iii) A_3 N_4 DEM_1 NUM_2 *attested*   *very few languages*
   (iv) N_4 A_3 DEM_1 NUM_2 *attested*   *few languages*

  f. (i) A_3 NUM_2 DEM_1 N_4 *unattested*
   (ii) A_3 NUM_2 N_4 DEM_1 *unattested*
   (iii) A_3 N_4 NUM_2 DEM_1 *attested*   *very few languages*
   (iv) N_4 A_3 NUM_2 DEM_1 *attested*   *very many languages*

In understanding the empirical claims, it is crucial to appreciate that – in slight contrast to Cinque, who sets aside marked word orders in the better known languages but includes alternative word orders in less well-known languages – we will be dealing only with unmarked word orders.[4] When the noun phrase has an unusual information structure, this may result in otherwise unacceptable permutations (see Cinque (2005, p. 315-316 fn. 2) for comment). Beyond this, orders unattested as unmarked appear in isolated domains. In English, for example, there is a limited set of structures in which adjectives precede prenominal numerals, apparently contradicting (5bi). This order seems to be exclusive to adjectives accompanied by a degree expression, such as the superlative marker in (6). Similarly, degree expressions may force adjectives to shift across indefinite determiners, as in (7).

(6)   a. *(the) most interesting five books (that John has read)
        b. *(the) highest three mountains

(7)   a. (*a) so fierce *(a) battle
        b. (*a) how big *(a) mess

These noncanonical orders are always subject to tight restrictions. In English, the degree expression must belong to a specific subclass and the determiner cannot be omitted The empirical scope of Cinque's generalizations must of course be restricted in order to accommodate these examples. However, the theory remains testable, since each class of exceptions can be defined precisely.[5]

Some further clarifications must be made about the terminology used by Greenberg and Cinque. We are not confident that the notion of adjective covers the category relevant to universal 20 and its refinement in Cinque's work. To begin with, Greenberg restricts his claim to descriptive adjectives. This is because non-descriptive adjectives like *other* do not seem to be ordered rigidly with respect to numerals (see Dryer (to appear, section 7.1.2) for commentary). Conversely, there are descriptive modifiers that seem to

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[3]Cinque characterizes this order as attested in "very few languages–possibly spurious." We discuss the status of this case below.

[4]See for example Dryer (to appear, section 2) for discussion on how to identify unmarked orders.

[5]Similar considerations arise for other languages. Czech, for example, allows Num-Dem-A-N orders, but only on a partitive reading of the Dem-A-N sequence (Pavel Caha, Vera Prochaskova, p.c.); Turkish (as pointed out by one of the anonymous reviewers) allows displacement of adjectives not only internally to the noun phrase but into the dominating verbal structure (Kornfilt (2003)). The examples given by Kornfilt suggest that here, too, the adjective must be accompanied by a degree expression, a conjecture which is confirmed by native speakers (Nil Sener and Serkan Sener, p.c.).

pattern with descriptive adjectives, but that are not adjectival. For example, passive participial phrases must follow the numeral in determinerless contexts. Thus, the relevant notion seems to be semantic. It involves *description*, rather than syntactic category. (We abstract away from this issue throughout.)

Cinque does not include articles in the class labeled Dem, but it is tempting to assign these elements a distinct position in the nominal hierarchy between demonstratives and numerals given that in languages in which demonstratives and articles precede the noun, they appear in this order (see Rijkhoff (2002)). If they follow the noun, the order is variable. This obviously echoes Greenberg's Universal 20. Nevertheless, there are several reasons not to include articles in our discussion. First, a broad typological database for articles, comparable to that for demonstratives, is not available. Second, the decision whether a certain morpheme should be classified as an article is not trivial. One faces the question whether affixal or clitic-like elements marking definiteness should be included, as well as insecurities in the functional classification of potential articles. Finally, some languages lack articles altogether, while in others articles are doubled for purely grammatical reasons, neither of which is true of the Greenbergian categories.

A final clarification concerns the border between attested and unattested orders. Not all attested orders are equally frequent. At the tail end of the range, there are orders attested in only a handful of languages. N-Dem-A-Num is found as the unmarked order only in Pitjantjatjara Eckert and Hudson (1988); Bowe (1990) and Nkore-Kiga Taylor (1985), and as an alternate order in Noni (see Hyman (1981)) and Kîîtharaka (Peter Muriungi, p.c.). On the other hand, there is at least one order classified as unattested but actually found, albeit in only a single language. According to Bakker and Papen (1996) and Rosen (2003), Num-Dem-N-A is the unmarked order in Michif. We follow Cinque in accepting the N-Dem-A-Num order as attested and setting aside the Michif order. We will return to the N-Dem-A-Num order in due course.

The idealizations made here might seem questionable to some, and it is not inconceivable that some of them are wrong. However, if the typology in (5) falls, so does any conceivable argument for the SHCH built on it. This would leave proponents of the LCA without a single worked-out proposal for deriving linear asymmetries from the SCHC. (By a worked-out proposal we mean a proposal explicit about restrictions on movement.) Since any argument against the SCHC has to tackle the strongest case for it, we are compelled to accept Cinque's typology.

The main theoretical contribution of Cinque's paper consists in a demonstration that the assumptions given below generate the fourteen attested

orders, while excluding the ten unattested ones. Notice that among Cinque's assumptions we find conditions on movement, as well as the SCHC.

(8) a. The underlying hierarchical order in the extended projection of the noun is $Agr_w \succ WP \succ Agr_X \succ X \succ Agr_Y \succ Y \succ N$ where Y hosts AP in its specifier, X hosts NumP in its specifier and W hosts DemP in its specifier;

  b. all (relevant) movements move a subtree containing N;

  c. all movements target a c-commanding position;

  d. all projections are modelled on the template (1).

Let us consider how the typology in (5) is derived.

When the noun is final within DP, the prenominal material can occur in only one order. This order is base-generated in line with the assumptions in (8a) and (8d). No movement can have taken place, because the assumptions in (8c), (8b), and (8d) imply that movement must result in a non-noun-final structure. This rules out the orders in (5ei), (5fi), (5bi), (5di) and (5ci).

(9) $[_{Agr_wP} [Agr_w [_{WP} DemP [W [_{Agr_XP} [Agr_X [_{XP} NumP [X [_{Agr_YP} [Agr_Y [_{YP} AP [Y NP]]]]]]]]]]]]$

A second class of structures is generated by moving NP to [Spec, Agr_YP], [Spec, Agr_XP], or [Spec, Agr_WP]. This will generate all orders in which the underlying sequence Dem≺Num≺A surfaces, while the position of the noun varies (that is, the orders in (5aii), (5aiii) and (5aiv)).

(10) $[_{Agr_wP} (NP) [Agr_w [_{WP} DemP [W [_{Agr_XP} (NP) [Agr_X [_{XP} NumP [X [_{Agr_YP} (NP) [Agr_Y [_{YP} AP [Y t_{NP}]]]]]]]]]]]]$

A third class of structures is generated by extending the set of movable projections to include Agr_YP and Agr_XP. If NP moves to [Spec, Agr_YP], followed by 'roll-up movement' of Agr_YP to [Spec, Agr_XP], and of Agr_XP to [Spec, Agr_WP], the mirror image of the base order is derived, as shown in (11) (this is the order in (5fiv)).

(11) $[_{Agr_wP} [_{Agr_XP} [_{Agr_YP} NP [Agr_Y [_{YP} AP [Y t_{NP}]]]] [Agr_X [_{XP} NumP [X t_{Agr_YP}]]]] [Agr_w [_{WP} DemP [W t_{Agr_XP}]]]]$

Partial roll-up movement derives the order in (5biii) (as above, without the final step of movement of Agr_XP to [Spec, Agr_WP]).

Four more orders are derived by moving agreement phrases, but leaving NP in situ. Agr_YP can move to [Spec, Agr_XP], giving rise to (5bii), and from there to [Spec, Agr_W]P, giving rise to (5eiii). Similarly, Agr_XP can move to

[Spec, Agr_WP], which generates (5dii), or (5fiii) if combined with movement of Agr_YP to [Spec, Agr_XP].

Three further orders are derived by a combination of movement of agreement phrases and NP movement internal to those agreement phrases. If NP moves to [Spec, Agr_YP], Agr_YP can surface either in [Spec, Agr_XP] or [Spec, Agr_WP]. The first of these is the partial roll-up structure discussed above, but the latter gives rise to the new order, namely the one in (5eiv). If Agr_XP moves to [Spec, Agr_WP], NP can surface in either [Spec, Agr_XP] or [Spec, Agr_YP]; both derivations are new and give rise to the orders in (5div) and (5diii), respectively.

The final admissible derivation in Cinque's system is one in which Agr_YP moves to [Spec, Agr_XP] and is subsequently stranded by NP movement to [Spec, Agr_WP]. This derives (5biv).

(12) $[_{\text{Agr}_w\text{P}}$ NP [Agr_w $[_{\text{WP}}$ DemP [W $[_{\text{Agr}_X\text{P}}$ $[_{\text{Agr}_Y\text{P}}$ t_{NP} [Agr_Y $[_{\text{YP}}$ AP [Y t_{NP}]]]] [Agr_X $[_{\text{XP}}$ NumP [X $t_{\text{Agr}_Y\text{P}}$]]]]]]]]

This exhausts the orders that can be derived in Cinque's theory. Consider why. It follows from the assumptions in (8) that all material preceding the noun must come in the base order, essentially because all other orders violate (8b), the condition that moved constituents must contain the noun. This excludes the unattested noun-final orders, as well as the orders in (5cii), (5eii) and (5fii). Finally, the orders in (5ciii) and (5civ) are ruled out, because their derivation, if otherwise compatible with the constraints in (8), requires movement of a non-constituent. Any constituent that contains N and Num also contains A. Therefore there is no way of shifting Num and N to a position preceding Dem while stranding A in a position following Dem.
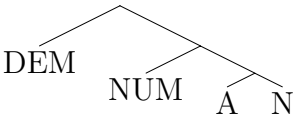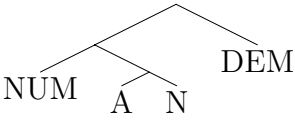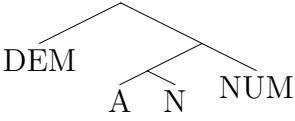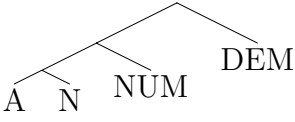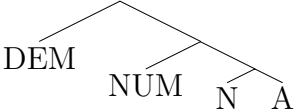
Further assumptions allow Cinque to capture the relative typological frequencies of the various orders, something to which we return in section 4.

3   The Alternative

The results described in the previous section make a significant contribution to our understanding of the syntax of the extended nominal projection. However, we do not think that they provide evidence for the SHCH. As we will show in this section, the typological pattern can equally well be derived from the assumptions in (13) (a conclusion similar to the one drawn in Ackema & Neeleman's (2002) reaction to Cinque (1996)). The first three of these are identical or equivalent to the first three assumptions made by Cinque. The fourth assumption replaces the SHCH. It is weaker than its competitor, because it limits the linear asymmetry of syntax to movement.

(13)   a.   The underlying hierarchical order of Dem, Num, A, and N in
            the extended nominal projection is Dem≻Num≻A≻N, where ≻
            indicates c-command;
       b.   all (relevant) movements move a subtree containing N;
       c.   all movements target a c-commanding position;
       d.   all movements are to the left.

If the SHCH is abandoned in favour of (13d), we can base-generate eight
of the fourteen attested linear strings, simply by allowing cross-linguistic
variation in the linearization of sister nodes in the hierarchical structure
described by (13a) (seven of these orders are derived through movement
in Cinque's system). In the trees below, the non-terminals in the extended
projection of the noun are left unlabeled and the demonstrative, numeral and
adjective are not introduced by dedicated functional heads. This is because
nothing in our argument hinges on the label of the nodes in the extended
projection of the noun or the inventory of functional heads (we return to
this issue below). The same is true of further structure that one might deem
necessary for a proper account of nominal syntax, such as the agreement
heads proposed by Cinque. The reader is invited to resolve these issues in
his or her favorite way.

(14)   a.

           DEM
               NUM   A   N

       b.

           NUM   DEM
               A   N

       c.

           DEM
               A   N   NUM

       d.

           A   N   NUM   DEM

       e.

           DEM
               NUM   N   A

f.

NUM   N   A   DEM

g.

DEM   N   A   NUM

h.

N   A   NUM   DEM
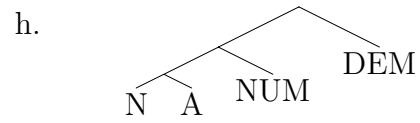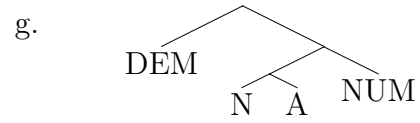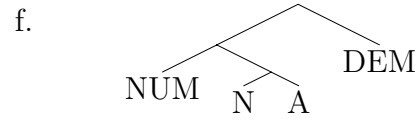
The remaining six orders are derived by leftward movement of a constituent containing the noun:

(15)   a.

DEM   N   NUM   A t_N

b.

N   DEM   NUM   A t_N

c.

A   N   DEM   NUM $t_{[A\,N]}$

d.

N   NUM   A t_N DEM

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e.

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        N
    DEM
        t_N  A  NUM
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f.

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    N  A
        DEM
            NUM  t_[N A]
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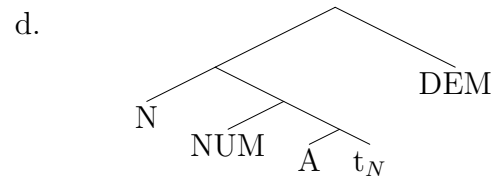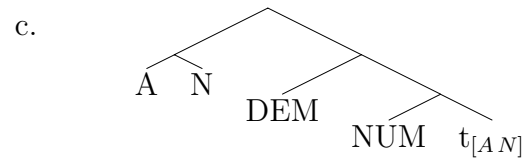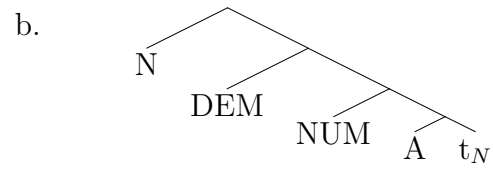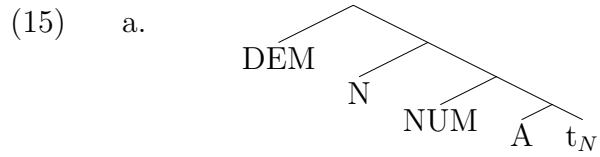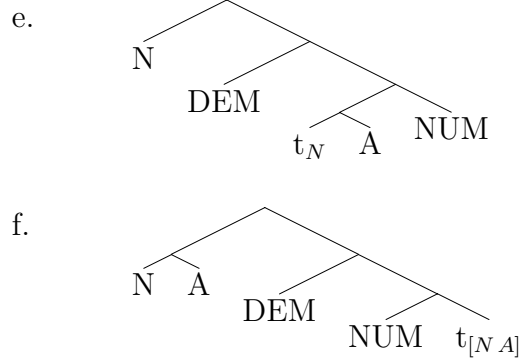
There are other derivations involving movement, but these do not yield additional linear strings. For example, (5biii) can be base-generated (as above) or derived from (5bii) by short movement of N, as in (16).

(16)

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    Dem                    ⤳        Dem
        A  N  Num                        N  A  t_N  Num
```
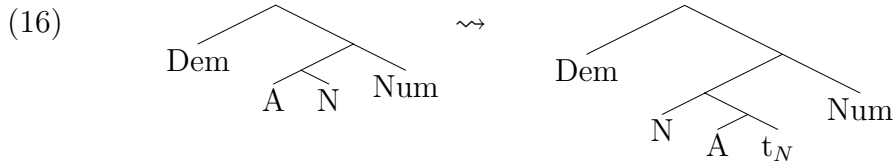
The ungrammaticality of the ten unattested orders follows in essentially the same way as in Cinque's system. This is very clear in the case of noun-final structures. Since movement is uniformly leftward and must affect constituents containing the noun, noun-final orders must be base-generated. But among the base-generated structures, all of which are given in (14), only (14a) is noun-final. Therefore, any permutation of Dem, Num, and A is ruled out in noun-final structures.

This argumentation carries over to all prenominal material. Elements preceding the noun must occupy their base position, and their linear order must consequently reflect the hierarchy in (13a).

Finally, the orders (5ciii) and (5civ) are excluded because their derivation can only satisfy the constraints in (13) if a non-constituent is moved. Given that any constituent that contains N and Num also contains A, there is no way of shifting Num and N to a position preceding Dem without taking A along.

We conclude that in order to derive Cinque's typology of word order in the noun phrase, it is sufficient to assume that movement is uniformly leftward. The stronger assumption that projections are uniformly right-branching, the SHCH, is unwarranted as it does not further limit the set of derivable strings.

There are other, more minor, assumptions that play no role in restricting the typology. These involve the number and the nature of landing sites

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for movement. Formally, given the hierarchy and the conditions in (8) or (13), the set of fourteen strings representing attested orders is closed under permutation by movement. So, adding landing sites does not give rise to new well-formed strings. Suppose, for example, that any node in a base-generated tree admits free (possibly multiple) adjunction. Then, the conditions on movement in (13) still guarantee that the set of derivable orders is limited to those attested. Similarly, Cinque could either allow multiple specifiers in each functional projection[6] or multiple Agr projections or both to freely host moved constituents.

The remaining assumptions, however, are crucial. Dropping any of them would make it possible to generate unattested word orders. Thus, relaxing (13a) would incorrectly allow prenominal material to appear in permuted orders as illustrated in (17a).[7] The same problem arises if movement of constituents excluding the noun was allowed; the order in (5di) could be derived either by separate movements of Num and A or by movement of N followed by remnant movement of the phrase containing Num, A, and the trace of the noun. This is illustrated in (17b). The c-command requirement on movement is well motivated on independent grounds. In the domain under discussion, revoking it would rule in the two orders N-Num-Dem-A and Num-N-Dem-A, as illustrated for the former in (17c). Most importantly for our present purposes, lifting the ban on rightward movement has the undesirable consequence of allowing scrambled noun-final orders (among other things). This is illustrated in (17d) for (5di).

(17) a. unattested: Num≪A≪Dem≪N
         [NUM [A [DEM N]]]
      b. unattested: Num≪A≪Dem≪N
         [NUM [A [DEM [t_{NUM} [t_A N]]]]] or
         [[NUM [A t_N]] [DEM [N $t_{[NUM[At_N]]}$]]]
      c. unattested: N Num Dem A
         [Dem [Num [A N]]] ⤳ [Dem [[N Num] [A t_N]]]
         ⤳ [[N Num] [Dem [$t_{[NNum]}$ [A t_N]]]]
      d. unattested: Num≪A≪Dem≪N
         [[[NUM [A t_N]] DEM] N]

---

[6]For the question of the LCA compatiblity of multiple specifiers and adjuncts see Chomsky (1995b), Cinque (1996), and section 5 below.

[7]Incidentally, Brugè (2002) assumes that the structure in (17a) represents the underlying universal hierarchy and that demonstratives sometimes surface in this low underlying position. The text discussion indicates that Brugè's hierarchy is incompatible with the cross-linguistic record.

Of course, the theory we have suggested has fewer restrictions than Cinque's and therefore the number of derivations that it allows are a superset of the set of derivations allowed in Cinque's approach. This is in fact the basis for the claim that Cinque's findings ought not to be construed as an empirical argument for the SHCH, since the extra derivations and structures allowed on the assumptions in (13) do not give rise to additional orders. Consequently, the SHCH does not carry any of the empirical burden. The data follow entirely from the fixed underlying hierarchy of elements in the extended nominal projection and from restrictions on movement.

This illustrates the point made above in section 1: Restrictions on the base component, such as the SHCH, are toothless in the absence of restrictions on transformations. Note that it is not the number of movements that count, as is apparent from the closure property mentioned above. What is crucial is the types of movement allowed. This will become important when we compare the two analyses of word order in the noun phrase. We will demonstrate that holding on to the SHCH requires a qualitative extension of movement theory. In other words, some of the movements required by the SHCH violate conditions on movement well motivated in empirical domains beyond the noun phrase.

4   Comparing the two Theories

In the previous section we showed that the SHCH makes no relevant contribution in deriving Universal 20 and its exceptions: all unattested word orders can be ruled out by a fixed hierarchy of merger and conditions on movement. So, at this point we have two theories that are equivalent in their weak generative capacity. It is not clear, however, that the two theories are equivalent in any stronger sense. We will explore this issue by asking three questions. (i) Do the structural differences between the two theories favor Cinque's account over our alternative? (ii) Can Cinque's account of the cross-linguistic frequencies of the various attested orders be construed as an argument for the SHCH? (iii) Do the 'extra' movements necessary to achieve compatibility with the SHCH require a qualitative extension (that is, a weakening) of movement theory compared to our alternative. The answers are 'no', 'no', and 'yes', respectively. On balance, then, our account turns out to be the more restrictive.

4.1 Constituency and c-command

Recall that for every representation ruled out by the SHCH there is an SHCH-compatible structure that yields the same string. Although the trees erected over that string seem very different, they share a number of properties. If we consider the overt material and traces in a traditional representation and compare how those are grouped together under the SHCH, we find that gross constituency is identical. This becomes obvious if we remove from the SHCH-compatible representations in (2), (3), and (4) all material forced by the SHCH (that is, functional heads and traces of short movement). The trees involved in this exercise are given in (18). The input and output trees are homomorphic as far as dominance relations are concerned. The output trees are, moreover, isomorphic to the traditional trees in (2), (3), and (4). This fact should dissuade proponents of the LCA from arguing against our theory on the basis of constituency: the theories are simply too similar to be distinguishable in this respect.

(18)   a.   Rightward Movement:

$$
\begin{array}{ccc}
\text{F}_2\text{P} & \rightsquigarrow & \text{F}_2\text{P}
\end{array}
$$

Tree (left):
- F_2P
  - XP
    - ... t_α ...
  - F_2
  - F_1P
    - α
    - F_1
    - t_{XP}

Tree (right):
- F_2P
  - XP
    - ... t_α ...
  - α

b.   Right Heads:

$$
\text{Head'} \quad \rightsquigarrow \quad \text{Head'}
$$

Tree (left):
- Head'
  - Complement
  - Head'
    - Head
      - head
    - $t_{Complement}$

Tree (right):
- Head'
  - Complememt
  - Head
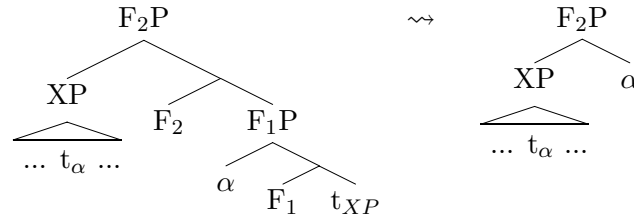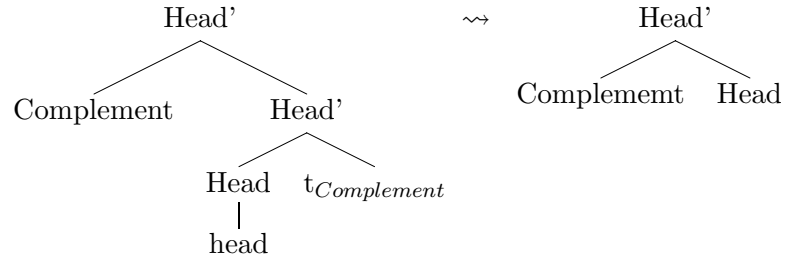
c.   Right Specifiers and Adjuncts:
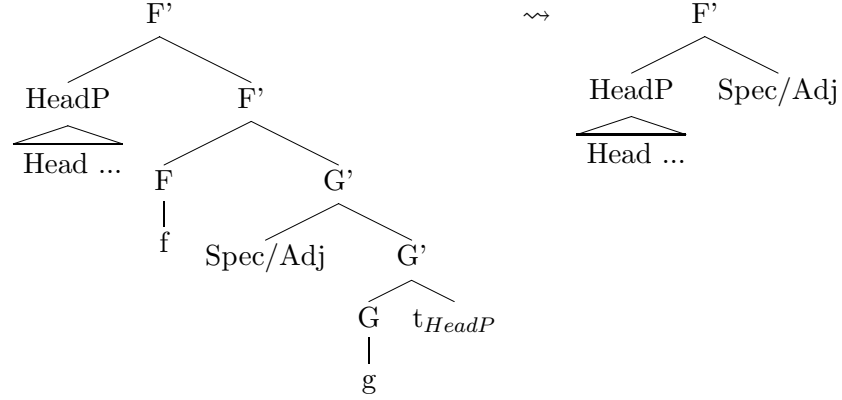
We illustrate this point for two Cinquean derivations, the one that gives rise to the N-A-Num-Dem order and the one that produces N-Dem-A-Num. We have resized the reduced trees to fit Cinque's in size and set them using dotted lines in (19) and (20). The dotted trees arise by repeated mechanical application of the procedure sketched in (18). They are isomorphic to the representations we assigned to the N-A-Num-Dem and N-Dem-A-Num orders in (14h) and (15e). This correspondence holds of the representations we assigned to all of the attested orders, but we will leave it to the reader to verify this.

(19)

(20)

AgrₜₕP ... (tree diagram with nodes: Agr_W P, Agr_W P, NP, NP, Agr_W, WP, WP, DemP, DemP, W, Agr_X P, Agr_X P, Agr_Y P, Agr_Y P, t_NP, t_NP, Agr_Y, YP, Agr_X, XP, AP, Y, t_NP, AP, NumP, X, t_Agr_Y P, NumP)
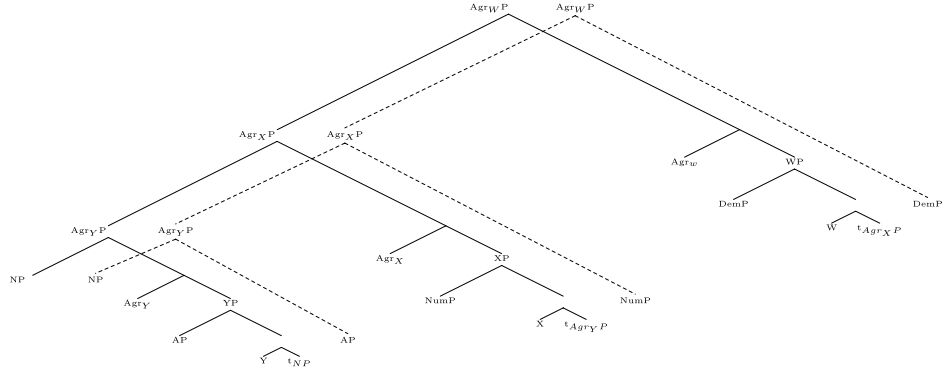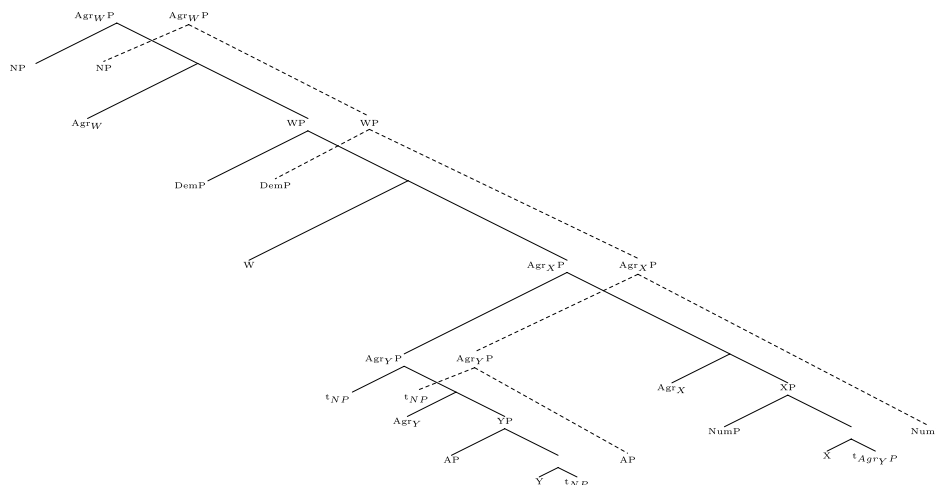
It would be wrong to think that traditional theories and theories based on the SHCH are notational variants. The extra material (heads and traces) present in SHCH-compatible representations is not without consequences. For one thing, it leads to contrasts in the set of c-command relationships accrued in the course of the derivation. In our representation for the N-A-Num-Dem order, each element c-commands everything to its left.[8] In Cinque's representation the same c-command relations hold in the base structure, i.e., under reconstruction. However, these c-command relations are destroyed by the movements that guarantee SHCH-compatibility. Moreover, on the definition of c-command employed by Kayne, the movements that create roll-up structures give rise to additional c-command relations absent in traditional analyses.

Let us briefly consider these issues, starting with c-command relations created by movement. Kayne (1994) is based on a definition of c-command that distinguishes between segments and categories and that is designed to allow adjuncts (which include specifiers) to c-command out of the category they are adjoined to. The implication for a structure like (20a) is that NP will c-command AP, NumP, and DemP in the surface representation. This property is shared with other noun-initial structures, but absent when the noun is final. Therefore, the antisymmetric view takes N-A-Num-Dem to form a natural class with, say, N-Dem-Num-A, but not with Dem-Num-A-N,

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[8]Notice that N also c-commands A. This final c-command relationship is only present in the minimal structural representation given in (14). If additional functional structure separates A and N, no c-command from N to A would obtain. We leave the matter open and abstract away from this slight complication in the main text. (Compare the discussion above (14).)

given that in the latter NP does not c-command the elements that accompany it. In contrast, the traditional view groups Dem-Num-A-N together with N-A-Num-Dem (in neither order does NP c-command its modifiers), and sets these orders apart from N-Dem-Num-A, in which the noun's c-command domain is expanded by movement.

Movement also destroys c-command relations. Consequently, certain c-command relations preserved throughout the derivation in our theory are destroyed in SHCH-based accounts. Whenever a pair of items does not appear in the canonical Dem-Num-A-N order, Cinque's analysis predicts that in the surface representation the element merged later fails to c-command the element merged earlier. For a large class of cases, this is not true of our alternative, simply because no movement takes place. For example, in the N-A-Num-Dem order all original c-command relations have been destroyed on Cinque's analysis, while in our account surface c-command follows the hierarchy of merger.

Testing these contrasting characteristics is not a trivial matter, but one could imagine that removing c-command relations removes interveners that would otherwise lead to a violation of relativized minimality (along the lines of Collins' (2005) approach to raising in English) and that adding c-command relations might add interveners. Similar predictions can potentially be derived from other phenomena sensitive to c-command, such as the licensing of negative polarity items, scope, or binding. We are not aware of any effects of this type, but it seems to us that the burden of proof is on proponents of the SHCH, who should be committed to showing that the additional material and operations required for SHCH-compatibility has testable consequences.

In the nominal domain, the destruction of c-command relations through SHCH-related movement is limited to specifiers/adjuncts. Beyond the noun phrase, however, we find similar effects with complements. If we compare the two representations in (3), the head c-commands the complement throughout the derivation in the traditional head-final tree, but not in its antisymmetric counterpart. There, the head c-commands its complement only in the underlying structure. The lack of surface c-command gives rise to the expectation that the scopal properties of head-initial and head-final structures should differ radically. The opposite prediction is made under the traditional theory of phrase-structure, as both orders have identical hierarchical structures. As far as we know, the scope of modal verbs in head-final structures is as predicted by the traditional analysis: modals further to the right take scope over modals further to the left. The SHCH appears to make the wrong prediction. There are obvious ways of removing this prediction from the theory, but the price one pays for this is one of decreased testability.

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Of course, proponents of the SHCH should try to *increase* the testability of their theory. The most obvious way of doing this would be to establish a firm link between the movements required for SHCH-compatibility and other phenomena. Agreement, for example, has been linked to uncontroversial cases of movement in Romance past participle constructions and Arabic subject fronting (see Kayne (1989); Aoun et al. (1994)). In view of this, one could attempt to correlate the relevant movements with agreement in the noun phrase. The hypothetical correlation is incorrect, as agreement is found in uncontroversially base-generated structures (such as the German noun-phrase). The point, however, is not that this putative prediction is wrong; the point is that we are not aware of any attempts to derive predictions of this type from the SHCH.

4.2 Frequencies

Cinque does not only account for the observed word orders in the noun phrase, but also deals with their relative frequencies.

It is a fact of logic that one cannot derive statistical predictions from a non-statistical theory. Therefore, providing an argument for any particular grammatical analysis on the basis of frequency information is an arduous task. The first step in constructing such an argument must consist in pairing the proposed analysis with a theory of markedness. The latter identifies grammatical structures as favored or disfavored, and thus generates statistical predictions. Unfortunately, little is known about this aspect of the language faculty. An independently motivated theory of markedness, which would allow us to test hypotheses about the grammar, is no more than a distant hope. Consequently, the only way frequency data can be brought to bear on grammatical analyses is the following: Given two rival analyses, A and B, if analysis A allows the construction of a simpler theory of markedness than analysis B, this can be taken as an argument for analysis A.

Cinque pairs his SHCH-based grammar with the following theory of markedness.

(21)   a.   Parameters of movement:
            (i)   No movement (unmarked), or
            (ii) Movement of NP plus pied-piping of the *whose picture* type[fn ommitted] (unmarked), or
            (iii) Movement of NP without pied-piping (marked), or
            (iv) Movement of NP plus pied-piping of the *picture of who* type (more marked still).
            (v) Total (unmarked) versus partial (marked) movement of

NP with or without pied- piping (in other words, NP raises all the way up, as in ([5d,l,p,t,x]), or just partially, as in ([5b,c,k,n,o,r,s,w]), around its modifiers).

In our assessment, this system reliably distinguishes three levels of frequency, assigning each word order to the correct class. (Cinque in fact makes a five-way distinction: very many languages, many languages, few languages, very few languages and very few languages – possibly spurious. We do not think that the distinctions at the lower end of the scale follow from the proposed theory of markedness, nor do they seem statistically reliable.) The fact that an SHCH-based account of word-order in the noun phrase can be paired with a theory of markedness does not by itself constitute an argument for that account. Indeed, our own analysis can be coupled with a theory of markedness that is equally successful in assigning each of the attested orders one of three frequency levels. This theory is given in (22).

(22)   a.   Movement within the extended projection of the noun is marked;
         b.   Directionally uniform branching is less marked than non-uniform branching;
         c.   Going down in an extended projection of N, switching from junctures in which the right sister contains the lexical head to junctures in which the left sister does is less marked than switching from junctures in which the left sister contains the lexical head to junctures in which the right sister does.

The third factor allows an alternative, linear, formulation:

(23)   Gaps in the functional sequence are unmarked on the left side of the lexical head, but marked on the right side of the lexical head.

We call structures that are marked according to (22b) *twists* and structures that are marked according to (22c) *kinks*. Thus, every kink is a twist, but not the other way around. Our analysis of two most frequent orders (Dem-Num-A-N and N-A-Num-Dem) involves no movement, no kinks and no twists. The next two most frequent orders (Dem-Num-N-A and Dem-N-A-Num) involve no movement or kinks, but do require a twist. All remaining orders require movement or kinks or both, and are consequently rare or very rare.

     Cinque himself does not construe his theory of markedness as an argument for the SHCH. However, if one were to evaluate it as such, one would need to address two questions: First, is the proposed theory of markedness simpler than the alternative given in (22)? And if so, does the reduced complexity crucially depend on movements required for SHCH-compatibility?

We begin with the second question, assuming for the moment that the first question can be answered affirmatively. Within Cinque's proposal, there appears to be a single, rather weak, generalization over regular movement and movement required for SHCH-compatibility. If this generalization stands up to further scrutiny, the SHCH might be said to allow a simplification of the theory of markedness. The generalization in question states that movement stopping short of the highest potential landing site is more marked than movement all the way to the top, (21av). If we consider movement without pied-piping, the noun-initial order N-Dem-Num-A is found in few languages while the noun-medial order Dem-N-Num-A is found in very few languages. If we look at corresponding cases of pied-piping by the specifier, the noun-initial order N-A-Num-Dem occurs in very many languages while the noun-medial order Dem-N-A-Num occurs in many languages. So, for these two comparison points, regular movement patterns with movement required for SHCH-compatibility.

Of course, there is a large contrast between the frequency of the two types of movement. One would have to hypothesize that this is due to other factors are responsible. Indeed, Cinque suggests that movements required for SHCH-compatibility (*whose brother*-type pied-piping) are unmarked when compared with to regular movements (movements without pied-piping, or with pied-piping of the *brother of who* type). Needless to say, this undermines any attempt to unify the two movement types with respect to the theory of markedness.

The strength of the potential argument for the SHCH is weakened further by the fact that the statistical profiles of regular movement and movement required for SHCH-compatibility can only be compared at two points. This is because the third type of movement, pied-piping by complement, is not considered able to satisfy the totality requirement.[9] Moreover, pied-piping by specifier cannot target the lowest landing site, because there is no material to be pied-piped.

In sum, there might be a generalization over regular movement and movement required for SHCH-compatibility, but the effect is weak and the data supporting it limited.

We now turn to our first question: Is Cinque's theory of markedness simpler than our own? Questions of simplicity are notoriously hard to answer. The mere fact that Cinque's theory of markedness contains two statements more than ours does not necessarily make it more complex. For example, it

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[9]This emerges from the list of cases that Cinque suggests satisfy the totality requirement. It includes no case of pied-piping by the complement to the topmost position, [Spec, $Agr_W P$]. A structural formulation of the totality requirement would therefore have to demand that NP c-commands Agr_W^0 under Kayne's 1994 definition of c-command.

might be that three of Cinque's five statements are required independently of the typology of noun phrases. Cinque suggests that there is independent evidence for the ranking in (21aii) and (21aiv). If this is true, and it is not true of any of the statements in (22), it would be fair to say that Cinque's theory comes out as simpler.

Note, however, that the two most frequent word orders (Dem-Num-A-N and its mirror image) receive a unified treatment in our account, whereas a disjunctive statement is required in Cinque's theory of markedness. The relevant disjunction is that between the statement that lack of movement is unmarked (see (21ai)), and the conjunction of the statements that total movement is unmarked and that pied-piping by the specifier is unmarked (see (21av) and (21aii) respectively). In our view, the fact that it has to resort to such a complex statement to characterize the two most freqent orders does not bode well for the theory of markedness in (21).

We conclude that frequency data do not provide an argument for the SHCH. Cinque's theory of markedness is not obviously simpler than ours, and even if it were, it is not obvious that this would be due to the SHCH.

4.3 Restrictions on Movement

So far we have shown that there is no particular advantage in adopting the SHCH. There is an important disadvantage, however, that convinces us that this hypothesis should be abandoned: The movements required to reconcile the SHCH with the attested word orders stand in the way of a restrictive theory of movement. The problem manifests itself in at least two ways, each associated with a different type of movement employed by Cinque. The movements in question are the very local movement that derives roll-up structures and the movement of NP in (12), which strands pied-piped material in an intermediate position.

Very local movement is problematic in the light of Saito and Murasugi (1993); Bošković (1997) and Abels (2003a,b). Those works advance an anti-locality condition on movement according to which no complement can re-combine through movement with a projection of its selecting head.[10] Abels (2003b) argues that this condition has the following rationale: A head and its complement are in a local relation in the base structure (they c-command each other). No different relation is established by recombining the complement with a projection of the head. Therefore, there can be no trigger of such local recombination.

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[10]Grohmann (2000) suggests an even more radical anti-locality constraint. Kayne (2005b, p. 272, 331) also assumes that the "complement of a given head H can never move to the Spec of H."

For any category that permits extraction only through an escape hatch, anti-locality predicts that the complement of that category will resist movement. For example, there is good evidence that extraction from CP must proceed through [Spec, CP]. Therefore, the complement of C^0 should be un-extractable. Indeed, fronting of IP seems to be impossible (as stated in Den Dikken's 1995 IP Immobility Principle). This is striking, since extraction out of IP is possible:

(24) a. ✓What do you think that Mary has read?
   b. ✓Nobody thought that anything would happen.
   c. ✓That anything would happen, nobody thought.
   d. *Anything would happen, nobody thought that.

The pattern recurs in a number of environments. Thus, preposition stranding is blocked in languages in which movement out of PP needs to proceed through [Spec, PP]. In contrast, movement out of the complement of PP is unproblematic. Similarly, VP can never strand the phase-head v, although extraction out of VP is, of course, allowed. (These two cases are discussed at length in Abels (2003b).) There are other categories that arguably require extraction through an escape hatch and that display the same behavior. In English, NP cannot move and leave behind the determiner, but extraction from NP is unproblematic. More strikingly, perhaps, English has two types of degree expression: one a functional head selecting AP, the other a modifier that adjoins to AP as well as to other categories (see Neeleman et al. (2004)). Stranding of modifying degree expression is possible, but movement of AP stranding a degree head is ungrammatical. Extraction out of AP is fine in both structures. We list the structures to be ruled out by anti-locality in (25a-e).

(25) a. *$[_{CP}$ IP [C^0 t_{IP}]]
   b. *$[_{PP}$ DP [P^0 t_{DP}]]
   c. *$[_{vP}$ VP [v^0 t_{VP}]]
   d. *$[_{DP}$ NP [D^0 t_{NP}]]
   e. *$[_{DegP}$ AP [Deg^0 t_{AP}]]
   f. ✓$[_{XP}$ α [X^0 $[_{YP}$ ... t_α ...]]]
    where X ranges over C, P, v, D, and Deg.

The structures discussed so far are head-initial, but the same pattern is found with complements that precede the head. Thus, the IP Immobility Principle also applies to Japanese, Korean and Turkish, and the ban on preposition stranding is as common with postpositions as it is with prepositions. Needless to say, extraction from IP and from the complement of postpositions is

unproblematic (see Sener (2006) for an illustration based on Turkish post-positions). The set of structures that violate anti-locality should therefore be extended with those in (26a-e).
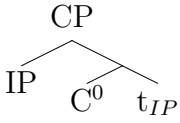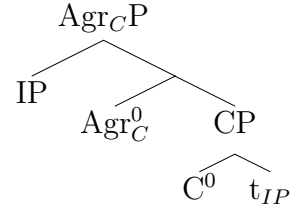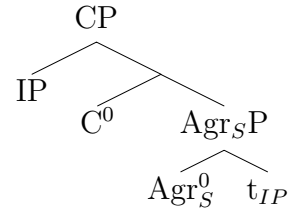
(26)   a. *$[_{CP}$ IP [t_{IP} C^0]]
        b. *$[_{PP}$ DP [t_{DP} P^0]]
        c. *$[_{vP}$ VP [t_{VP} v^0]]
        d. *$[_{DP}$ NP [t_{NP} D^0]]
        e. *$[_{DegP}$ AP [t_{AP} Deg^0]]
        f. ✓$[_{XP}$ α [$[_{YP}$ ...t_α ...] X^0]]
            where X ranges over C, P, v, D, and Deg.

As far as we can tell, the anti-locality constraint cannot be formulated in a meaningful way in theories based on the SHCH. To account for clause-final complementizers, anti-symmetric theories must adopt one of the structures in (27). The problem with (27a) (suggested in Kayne (1994)) is that it violates the anti-locality condition. Obviously, giving up this condition reduces the immobility of IP to a mere stipulation. If the anti-locality thesis is maintained, (27a) must be rejected in favor of either (27b) or (27c) (see Koopman (2005) and Kornfilt (2000a,b)). In the structure in (27b) the escape hatch for extraction from the CP-domain must be [Spec, Agr$_C$P], rather than [Spec, CP]. This has the unfortunate consequence that the account of IP's immobility is lost. The structure in (27c) adheres to the standard assumption that [Spec,CP] is the escape hatch and allows movement to this position without violating anti-locality. But from [Spec,CP] further movement of IP ought to be possible, in violation of the IP immobility principle. Thus, in SHCH-based theories the anti-locality constraint must either be abandoned, or be voided of its empirical content.[11]

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[11]Proponents of antisymmetry face an additional question in this area. Kayne (1994) cites lack of obligatory *wh*-movement in complementizer-final languages as possible evidence for (27a). However, if (27b) is adopted, there is an additional potential position following IP and preceding C^0. If that position were used for *wh*-movement, head-final languages would have rightward *wh*-movement. Thus, the question must be answered why [Spec, CP] is systematically empty.

In Kayne (1999, 2004), a different account of head-finality is proposed (see Borsley (2001) for discussion). Certain prepositions and complementizers are assumed to be merged in a VP-external position and combined with their apparent complements through movement; this makes the proposal substantially similar to (27c) and vulnerable to the same objections. Along the way, a number of remnant movements occur. We leave it to proponents of such analyses to demonstrate how the IP immobility principle, the ban against P-stranding, and the word order typology in the NP can be made to follow. As they stand, these proposals are not sufficiently worked out to allow evaluation.

(27) a.
```
        CP
       /  \
     IP    \
         C⁰   t_IP
```

b.
```
          Agr_C P
         /     \
       IP       \
           Agr_C⁰    CP
                    /  \
                  C⁰   t_IP
```

c.
```
          CP
         /  \
       IP    \
           C⁰    Agr_S P
                 /     \
             Agr_S⁰    t_IP
```

Essentially the same paradoxical situation presents itself in the case of un-strandable postpositions.

We now turn to a second restriction on movement incompatible with the derivations proposed in Cinque's paper. We may take the noun to be the target of all movements that derive unmarked orders, and construe movements of larger chunks of structure as instances of pied-piping. Cinque is quite explicit about this; indeed, it is hard to see what else could explain why movement is limited to subtrees containing the noun. With this in mind, consider again the structure in (12), in which material pied-piped by an initial step of movement (of $Agr_Y P$ to [Spec, $Agr_X P$]) is subsequently stranded (by movement of NP to [Spec, $Agr_W P$]). The problem is that similar derivations are systematically ruled out in other domains. Postal (1972), for example, observed that prepositions pied-piped under *wh*-movement cannot be stranded in intermediate positions, as shown in (28).[12] Movement under relative clause formation is subject to the same restriction, as (29) illustrates.

(28) a. ✓[PP With which friend] did you say t_{PP} that Mary went to the movies t_{PP}?
     b. ✓[DP Which friend] did you say t_{DP} that Mary went to the movies with t_{DP}?

---

[12]Du Plessis 1977 claims that such derivations exist in Afrikaans, but the analysis is dubious according to Den Besten (p.c.), who analyzes the relevant data as involving parentheticals. Den Besten shows that Du Plessis' analysis cannot account for the position of the verb in the examples involving putative intermediate stranding.

c. *[DP Which friend] did you say [PP with t_{DP}] that Mary went to the movies t_{PP}?

(29) a. ✓ the famous rock [DP pictures of which] I think t_{DP} that Bill must have seen t_{DP} before

b. ✓ the famous rock [DP which] I think t_{DP} that Bill must have seen pictures of t_{DP} before

c. *the famous rock [DP which] I think [DP pictures of t_{DP}] that Bill must have seen t_{DP} before

At the very least, the derivation Cinque proposes complicates the generalization that pied-piped material cannot be stranded. It will therefore be harder to develop an explanation of the relevant data. In contrast, the more conservative analysis of the N-Dem-A-Num order in (5biv) does not rely on stranding and consequently does not give rise to the same complication. This is a second example, then, of the SHCH leading to a less restrictive theory of movement.[13] [14] This is undesirable, in view of the argument made in section 1 that any theory of phrase structure must be accompanied by a restrictive theory of movement.

Notice that Cinque classifies the crucial order (N-Dem-A-Num) as attested, but possibly spurious. Since part of our argument against the SHCH rests on its existence, we should take a closer look at the languages that display it: Pitjantjatjara, Nkore-Kiga, Noni and Kîîtharaka. The latter two have the relevant order as an alternate to N-Dem-Num-A, which suggests that we should put these languages to one side. (Bowe, 1990, 29-54, 111,

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[13]Some analyses of quantifier float assume stranding of pied-piped material. Sportiche (1988), in particular, argues that quantifier and DP are generated as a constituent, and that the quantifier can be stranded, not only in its base position, but in any A-position through which the DP passes. However, there are several alternative accounts of quantifier float. Bošković's (2004) proposal comes very close to Sportiche's without allowing stranding of pied-piped material. Other authors have argued that floating quantifiers are base-generated as adverbs, rather than as part of the associated DP (see, for instance, Bobaljik (1995) and Janke and Neeleman (2005)).

[14]Assuming that pied pipers never strand their pied pipees, the predictions of our theory and of Cinque's theory diverge as soon as more than four elements are taken into consideration. Suppose that there are five hierarchically ordered elements. If pied pipers may strand their pied pipees, then the order in (i) can be derived as in (ia). A theory without such stranding cannot generate (i) from the base hierarchy 1>>2>>3>>4>>5. We are not aware of such orders, but the issue should be investigated since the fate of Cinque's theory depends on their existence.

(i) 5 1 4 2 3

a. [5 [1 [[4 t_5] [2 [3 $t_{[4\ 5]}$]]]]]

146-150) claims that in Pitjantjatjara the order in question is the only admissible one. She does not illustrate this claim, but in Eckert and Hudson's 1988 textbook on Pitjantjatjara examples like those in (30) can be found. The morpheme glossed SubjT is an ergative case marker appearing at the end of a subject DP and repeated in case of apposition, as shown in (30c). Therefore, material to the left of this morpheme can safely be taken to belong to a single extended nominal projection. The examples in (30a) and (30b) establishe the sub-orders N-Dem-A and N-A-Num, respectively. An example of the N-Dem-A-Num can be found in (30c), on the reasonable assumption that *many* behaves like a numeral. (Eckert and Hudson (p. 130-134) treat numerals and quantifiers as adjectives of quantity and give a single rule for positioning them among the nominal modifiers.)[15]

(30) a. Tjitji pala tjukutjuku -ngku   -ni̱ ungu
          child that small   -SubjT -me gave
          That small child there gave (it) to me. (Eckert and Hudson,
          1988, p. 89)
      b. Kuḻa̱ta wa̱ra kutjara nyara   mantjila!
          spear   long two   yonder get
          Get the two long spears over there! (Eckert and Hudson, 1988,
          p. 132)
      c. Tjitji tju̱ta -ngku   katingu, tjitji panya   puḻka tju̱ta
          child many -SubjT took   child that.known big   many
          -ngku
          -SubjT
          The children took it, you know those big children (Eckert and
          Hudson, 1988, p. 139)

The last language mentioned by Cinque as having the N-Dem-A-Num order is Nkore-Kiga. This language has been studied even less than Pitjantjatjara, but potentially provides an additional argument for the necessity of the stranding derivation within the antisymmetric framework. There appears to be only one source, Taylor (1985), to which all claims about Nkore-Kiga can be traced.[16] Taylor (p. 55) characterizes word order in the Nkore-Kiga noun phrase as follows (we omit categories not relevant to the present discussion).

(31)   noun – demonstrative adjectives – pure adjectives/appositives – quan-

---

[15]The morphemes analyzed as demonstratives can stand alone. They are therefore not clitics and hence not subject to special ordering restrictions.

[16]Cinque bases his claims about Nkore-Kiga on Dryer (to appear) and Lu (1998). Dryer (to appear) cites Taylor (1985) as his source and Lu (1998) cites Rijkhoff (1990), who in turn cites Taylor (1985).

tifiers – verbal adjectives

Some of the orders mention in (31) are illustrated in the following example. (We have adjusted Taylor's gloss to do justice to the morphological complexity of the pure adjective *ekihango* and the verbal adjective *ekirikutukura*. We have also added *red* to the translation.)

(32) ekitabo kyawe ekyo eki- hango ekimwe eki- riku-   tukura
      book   your that 7- large one   7-   partic.contin- be.red
      ekiri   aha meeza nikyo
      which.is on table itself
      that selfsame single large red book of yours on the table

Taylor's (p. 55) discussion of the order in the noun phrase clearly suggests that the order in (31) is the neutral order. It is not "rigidly adhered to," but it is "preferred". Taylor (p. 75) further explains that for pure adjectives the alternate N-Dem-Num-A serves to emphasize these elements. This order is therefore marked, and hence irrelevant to our concerns. What is potentially very important, though, is Taylor's class of verbal adjectives, characterized as "stative verbs, which assume relative participial forms when used attributively and which are marked for one of two aspectual distinctions" (see Rijkhoff 1990, p. 18). This characterization suggests that verbal adjectives might be taken to be reduced relative clauses (reduced in comparison to full relative clauses, which can be tensed).

Cinque notes in several places that reduced relative clauses occupy a position above numerals. If so, the Nkore-Kiga data provide an additional argument for the necessity of stranding derivations of the type in (12). In order to generate the observed word order, NP would have to roll up around A, Num, and the verbal adjective before being subextracted to its final position in front of Dem. No intermediate stranding is necessary under our own account here.

A similar argument might be based on the example from Moro in (33) (taken from Dryer (to appear, p. 39)). The order of multiple adjectives has been observed to yield to a generalization reminiscent of universal 20. Plank (2003, p. 11-12), for example, claims that in prenominal position size adjectives predominantly precede color adjective, while after the noun both orders are found. This suggests the hierarchy $A_{size} \succ A_{color} \succ N$ (see Cinque (1994, p. 96), Lu (1998, p. 65) and Scott (2002, p. 114); see also Truswell (to appear)). If this is correct, an antisymmetric analysis of the example below would require roll-up movement around the adjectives, followed by subsequent stranding.

(33) maj- anda ildi   irʈəjin   l-   amənu
      man- PL   this:NC_{10}.PL three:NC_{10}.PL NC_{10}.PL- black
      l-   oʈra
      NC_{10}.PL- big
      these three big black men

There can be little doubt, then, that the SHCH necessitates stranding in intermediate positions. Again, no intermediate stranding is necessary under our account.

To sum up, we have argued in this section that there is no independent evidence for the additional structure required for SHCH-compatibility in Cinque's analysis of the noun phrase. We have also shown that while the cross-linguistic frequency of orders supports a weak generalization in line with the SHCH, a disjunction is needed to describe the two most frequent word-order types. Finally, we have demonstrated that the SHCH leads to an undesirable qualitative extension of the theory of movement.

5 The LCA and phrase structure theory

We now turn to a conceptual evaluation of the LCA. The antisymmetric template for projections combines a number of a priory unrelated properties. It features a unique head, a unique specifier and a unique complement; it is binary branching; and it is ordered with the specifier in initial and the complement in final position. If these properties cooccur by stipulation, the theoretical interest of the SHCH would be minimal. The attraction of the LCA is that it is meant to explain the various properties of the Specifier-Head-Complement template. Projections simply could not take any other form. As Kayne (1994, p. 131) writes: "What is primitive in UG is the LCA, from which follow familiar X-bar-theoretic properties such as (1) the need for a phrase to have a head, (2) the impossibility for a phrase to have more than one head, (3) the limitation to one specifier per phrase, (4) the limitation to one sister complement per head, and (5) the requirement that a complement not be a bare head." We scrutinize these claims in the present section.

The reader may have noticed that the requirement of binary branching is not mentioned in the above quote. Indeed, Kayne does not argue that binary branching as a general property of phrase structure follows from the LCA (although he does list a range of special cases in which ternary branching is excluded (on p.9, p.117-118 and p.136, fn.28)). In much of the subsequent literature, however, a derivation of the requirement of binary branching is

included in the LCA's achievements (see, for example, Chametzky (2000, p. 107-109)). We therefore include it in our discussion of the LCA below.

The contribution of the LCA to the theory of grammar seems rather more limited to us than Kayne suggests. Consider, to begin with, the notion of headedness. In $\overline{X}$-theory and subsequent theories of phrase structure, the head of a phrase is defined in terms of labels. As Chametzky (2000, p. 5) puts it: "X-Bar Theory is a theory of the what and why of the labelling of nodes in a phrase marker." The head of a phrase is the category from which the phrase inherits its label.

Any derivation of headedness must therefore start out assuming that labeling is totally free and derive the proper restrictions on labeling from other properties of the grammar. If Kayne is right in claiming that the LCA derives headedness, it must be the case that it forces every category to dominate a single node from which it inherits its label. The fact of the matter is that the LCA does nothing of the sort.

The definition of 'head' employed by Kayne (1994, p. 11) reads as follows: "Let us call a nonterminal that dominates no other nonterminal a *head*." What Kayne claims in chapter 2 of his book is that it follows from the LCA that no head in this sense can have a head as its sister and that no non-head in this sense can have a non-head as its sister. In other words, structures like those in (34) are ruled out. ((34a) is a structure with two Kaynian heads and (34b) is a structure with two Kaynian non-heads.[17]

(34)   a. *

```
          X
         ╱╲
        Y   Z
        |   |
        y   z
```

        b. *

```
           X
          ╱╲
         Y   Z
         |   |
         W   V
         |   |
         w   v
```
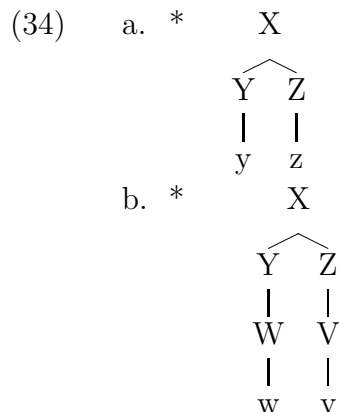
What is allowed is the structure in (35), in which X immediately dominates only one Kaynian head.

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[17]We will follow a convention tacitly adopted by Kayne. If two nodes in a tree have different labels, they belong to different categories. For Kayne, this only becomes important after the category-segment distinction is introduced in chapter 3, but then it is crucial.

(35)

```
              X
             ╱╲
           Y   Z
           |   |
           y   W
               |
               w
```
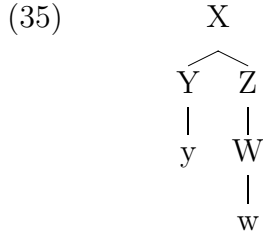
Kayne's result depends in no way on the values of X, Y, Z, and W in the trees above; it is purely geometrical.[18] Consequently, the well-formed tree in (35) can be specified in such a way that it meets the $\overline{X}$-theoretical requirement of headedness, as in (36a), but also in ways that violate this requirement, as in (36b-c).[19]

(36)   a.

```
              VP
             ╱╲
           V   NP
           |   |
           v   N
               |
               n
```

        b.

```
              PP
             ╱╲
           V   AP
           |   |
           v   N
               |
               n
```

        c.

```
              A
             ╱╲
          VP   V
           |   |
           v   C
               |
               c
```
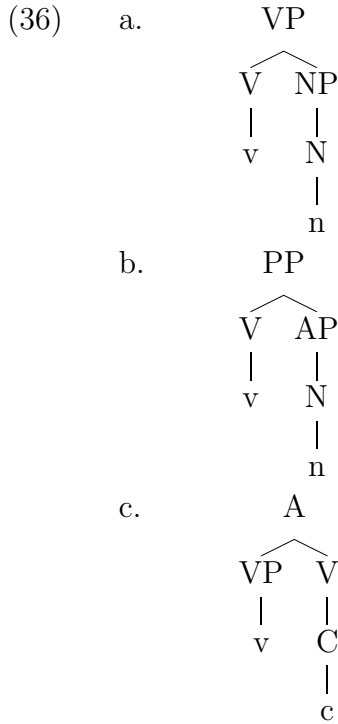
We conclude that headedness, as commonly understood, is not a corollary of

---

[18]The claim that labels play *no* role needs to be modified slightly. In chapter 3 of the book Kayne introduces the notion of a segment. A segment is implicitly defined as a node with the same label as its mother or daughter. This requires the following modification of the claim in the text: The result depends in no way on the values of X, Y, Z, and W in the tree in (35), as long as no mother-daughter pair shares the same label. See also fn. 17.

[19]Kayne's (1994, p. 41) treatment of *ouvre-boîte* invokes the structure $[_N [_V$ ouvre $] [_{NP} [_N$ boîte]]], which is indeed not headed in the $\overline{X}$-theoretical sense.

the LCA. This was already pointed out in Chametzky (2000, p. 103), but the point bears repeating in view of frequent claims that the LCA derives $\overline{X}$-theory.

The fact that the LCA does not give us a theory of labeling has consequences beyond the issue of headedness. It implies, as we will now explain, that the ban on multiple specifiers/adjuncts cannot be derived.

The starting point for Kayne's argument that the LCA rules out multiple specifiers (that is, structures like (38)) is the definition of c-command given in (37). On this definition, (38) is ruled out by the LCA, because X asymmetrically c-commands W, while U asymmetrically c-commands Y. This means that the terminals under X must precede the terminals under W, while the terminals under U must precede those under Y. As it is impossible to satisfy both requirements, the structure is ungrammatical.[20]

(37)   X c-commands Y iff X and Y are categories and X excludes Y and every category that dominates X dominates Y. (Kayne, 1994, p. 18)

(38)
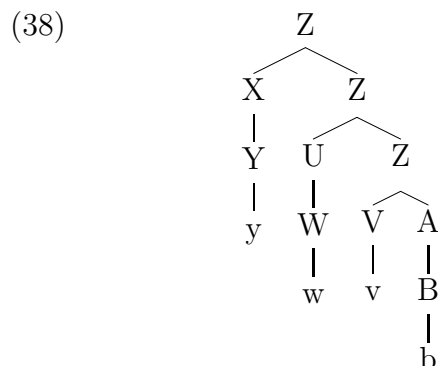
The contradictory ordering restrictions obtain because the nodes immediately dominating X, U, and V have the same label. But as we have seen, the LCA does not give us a theory of labeling. If specifiers/adjuncts are defined as categories whose mother and sister are non-heads that have the same label, the structure in (39) has two specifiers and is fully LCA-compatible. Since U no longer c-commands Y, one of the contradictory ordering statements no longer holds either.[21]

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[20]Cinque (1996, p. 450 fn. 8) points out that this discussion of (38) hinges on a technical detail in the definition of c-command and that (38) could be allowed if c-command were defined as follows: "X c-commands Y iff X and Y are categories and X excludes Y and every *segment* that dominates X dominates Y."

[21]It cannot be claimed that the tree in (39) can be ruled out because it contains a non-branching, label-changing projection, since precisely such structures are crucially appealed to in Kayne's treatment of headedness (compare (34a) and (35) above).

(39)

```
                 M
              ┌──┴──┐
              X     M
              │     │
              Y     Z
              │   ┌─┴─┐
              y   U   Z
                  │  ┌┴─┐
                  W  V  A
                  │  │  │
                  w  v  B
                        │
                        b
```
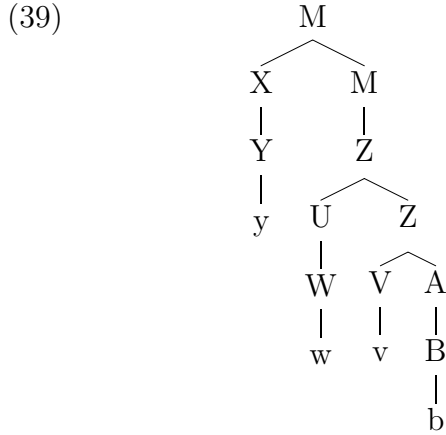
There are instantiations of the tree in (39) that are perfectly conventional. For example, Z could be specified as V', and M as V", resulting in the tree in (40).

(40)

```
                 V"
              ┌──┴──┐
              X     V"
              │     │
              Y     V'
              │   ┌─┴─┐
              y   U   V'
                  │  ┌┴─┐
                  W  V  A
                  │  │  │
                  w  v  B
                        │
                        b
```
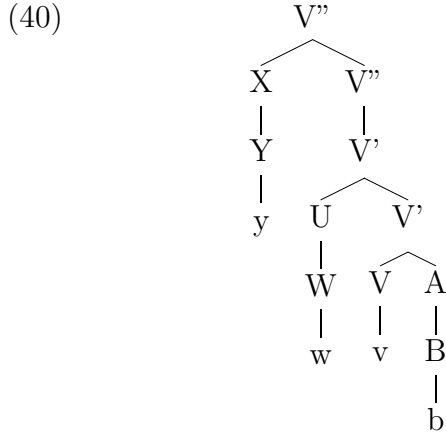
What (40) demonstrates is that even if we grant headedness in the $\overline{X}$-theoretical sense, the LCA only derives the ban on multiple specifiers on the assumption that there are exactly two bar levels: X^0 and XP. But this assumption itself does not follow from the LCA. All the LCA derives is that per bar level, there can be only a single specifier/adjunct.

Even this is not completely true. Kayne (1994, p. 31-32) argues that adjunction of a head (in his sense) to a non-head (in his sense) is only allowed under very special circumstances, essentially at the root of the tree (see his section 4.3). However, the structure in (41), closely modeled on a structure given by Kayne on page 31, is LCA-compatible and involves adjunction of a simplex category (M) to a complex one (P). It can be freely embedded and, crucially, may contain a second element (U) adjoined to the non-head P.

34

(41)

```
                    N
                  /   \
                 K     O
                 |     |
                 k     P
                      / \
                     M   (P)
                     |   /  \
                     m (U)   P
                        |   / \
                       (V) R   S
                        |  |   |
                       (v) r   T
                               |
                               t
```
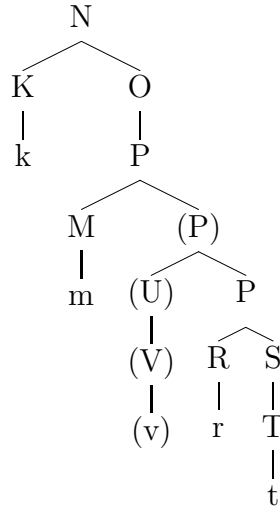
The fact that the LCA does not limit the number of specifiers/adjuncts is not insignificant. For one thing, it shows to be incorrect a claim made at the very beginning of Kayne's book (p. xiv-xv) and repeated in footnotes 14 (p.141) and 22 (p.143). Kayne argues that the LCA predicts that there can be no language in which ev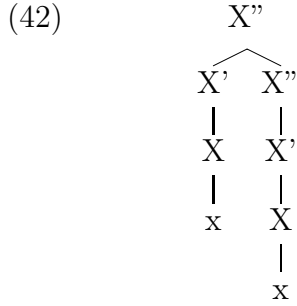ery head in every phrase is final. This is because head-finality can only be derived through movement. The ban on multiple specifiers limits the number of potential landing sites to one per projection. Given that elements like subjects, indirect objects, and modifiers are base-generated as specifiers/adjuncts, there are simply not enough free landing sites for all complements to move to. Therefore, at least some heads must precede their complements. This claim is unfalsifiable if heads are allowed to remain silent, as acknowledged by Kayne (p. xv). But in addition to being unfalsifiable, it is false, as the LCA does not actually derive the ban on multiple specifiers.[22]

Once we realize that the LCA does not restrict the number of bar-levels, it is easy to show that is also does not derive the condition that a phrase can have no more than one head. In the tree in (42), the top node has two heads (in the $\overline{X}$-theoretical sense); yet, the tree satisfies the LCA.

---

[22]The claim that strict head-finality is banned under the LCA is false also for another reason: Kayne's claim that right-headed structures can only be movement derived under the LCA turns out to be erroneous. Thus notice that the structure in (i) is licit under the LCA. In (41) head-finality is achieved by left-adjoining a phrase to a head.

(i)   [XP [YP [Y y]] [XP [X [ZP [Z z]] [X x]]]]

Incidentally, (i) also disproves Kayne's (1994, p. 19) claim that the LCA derives "without stipulation the fact that a nonhead cannot be adjoined to a head."

(42)
```
                X"
              ╱‾‾╲
            X'    X"
            │     │
            X     X'
            │     │
            x     X
                  │
                  x
```

Next we show that the LCA does not rule out ternary branching, at least not in the general case. As already mentioned, Kayne never makes any claim to this effect, contrary to what is generally believed. The class of LCA-compatible ternary-branching structures is not discussed in Kayne's monograph, but it seems to us it must include the tree in (43). We have labeled this tree so that it represents an unergative verb, simultaneously combined with its subject and a bare adverbial. Of course, there are many other instantiations of the abstract scheme underlying (43) (see below).

(43)
```
                    V'
                 ╱‾‾│‾‾╲
            Adv    N'    V'
             │      │     │
            adv     N     V
                    │     │
                    n     v
```
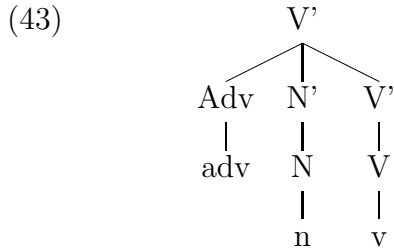
To see why the LCA does not rule out (43), consider what c-command relations hold in this structure. On the definition employed by Kayne, the category Adv asymmetrically c-commands categories N and V, while N' asymmetrically c-commands V. The categories Adv and N' irrelevantly c-command each other, and the two-segment category V' does not exclude any of the material, hence it does not c-command any nodes. Thus, the LCA dictates that Adv precedes N and V, and that N precedes V. These ordering restrictions are not contradictory, and hence (43) converges as Adv-N-V.[23]

The general scheme underlying (43) is given in (44). It is important to note that in this scheme Y is a head on Kayne's definition. If so, its two internally complex sisters qualify as complements, at least on a definition of complement as the phrasal sister to a head. Thus, the claim that the LCA

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[23] Although we will not demonstrate this here, it follows from the LCA that the structures in (43) and (44a) cannot be embedded as a complement unless the root node (V' in (43)) first projects a further bar-level in a non-branching manner, as in (39) (see also fn. 21).

derives the ban on multiple complements cannot be maintained either.[24]

(44)   a.

```
              X
        ┌─────┼─────┐
        Y     U     X
        │     │     │
        y     V     K
              │    ╱──╲
              v   ........
```
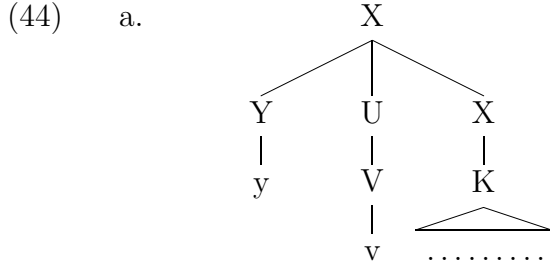
Let us return to the quote given at the beginning of this section. Contrary to what Kayne claims, the LCA does not derive the need for a phrase to have a head in anything like the $\overline{X}$-theoretical sense – headedness follows from the independent assumption that mother nodes inherit their categorial labels from their daughters. Contrary to what Kayne claims, the LCA does not derive the impossibility for a phrase to have more than one head – the single-head restriction depends on the theory of categorial projection which is logically independent of the LCA. Contrary to what Kayne claims, the LCA does not derive the limitation to one specifier per phrase – this follows from the independent stipulation that there are only two distinct bar levels. And contrary to what Kayne claims the LCA does not derive the limitation to one complement per head – this follows from the independent assumption that trees are binary branching. The LCA therefore does not make inevitable the combination of properties stated in the Specifier-Head-Complement template. This does not mean that one cannot adopt this template, but one cannot do so while claiming conceptual superiority over more conventional theories of phrase structure, such as the one advocated in this paper.

---

[24]We may finally ask what additional assumptions are needed to derive from the LCA that all movement that goes up in the tree is leftward. We think (i) shows that the LCA does not derive this. (ia) is a regular case of leftward movement of YP while (ib) is an LCA compatible structure with rightward movement of YP. It is grammatical because Y projects. Two solutions are possible: Either we assume that moved constituents cannot project or we assume that movement is not only upward in the tree but to a c-commanding position in the technical sense. Both conditions would rule out (ib), but the LCA by itself does not.

(i)   a.   Leftward Movement
           [$_{XP}$ YP [$_{XP}$ [$_X$ x] [$_{ZP}$ t$_{YP}$ [$_{ZP}$ [$_Z$ z] WP]]]]
      b.   Rightward Movement
           [$_{YP}$ [$_{XP}$ [$_X$ x] [$_{ZP}$ t$_{YP}$ [$_{ZP}$ [$_Z$ z] WP]]] YP]

37

6 Processing and Rightward Movement

As we have shown, the typology of word order in the extended nominal projection can be derived from the following assumptions:

(45) a. The underlying hierarchical order of Dem, Num, A, and N in the extended nominal projection is Dem≻Num≻A≻N, where ≻ indicates c-command;

   b. all (relevant) movements move a subtree containing N;

   c. all movements target a c-commanding position;

   d. all (relevant) movements are to the left.

The first three assumptions are shared between our approach and Cinque's. The fourth comes in place of the SHCH. In this section we will address the question why this condition should hold.

We do not think that a syntactic explanation can be given, mainly because there is little if any evidence that linear order plays a role in syntax. We therefore feel that an explanation should be sought in a component of the language faculty for which left-right asymmetries are independently motivated. One possibility is to develop an account that relies on the linearization of syntactic structures at PF.[25] The formulation of the required rule is trivial: junctures created by movement are linearized with the moved category leftmost. The question is why such a rule should hold. Why should PF impose an ordering on a moved constituent and its sister if in general there is variation in the ordering of sister nodes in base-generated structures?

Another possibility would be to attribute asymmetries in movement to the parser. This is the line we will pursue here, following the spirit of work by Ackema and Neeleman (2002), though not the technical details of their proposal. The parser needs to recover hierarchical structures from input strings that are presented to it incrementally. As a result of this, there is an inherent asymmetry in the parsing process: bits of the input presented to the parser earlier on can be associated with a structure before substrings presented later. This is what makes it attractive to try to account for left-right asymmetries in terms of parsing.

We should emphasize that the aims of this section are modest. Given that there is no generally agreed theory of parsing, we cannot hope to show that (45d) follows from independently motivated principles. Rather, we will

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[25]Several authors have adopted the LCA but reinterpreted it as rule of linearization that operates at the PF interface (see Chomsky (1995a), Nunes (2004), Epstein et al. (1998), Moro (1997)). It is possible that a weaker version of these theories covering only the case of movement can be developed.

explore what assumptions about parsing would have to be made in order to derive (45d) from the inherent directionality of the parsing process. To our mind, these assumptions are reasonable, but it would be disingenious to claim more than that.

We should also ask the reader for some patience, as we will need a few pages before we can reap the benefits of our assumptions.

Given that the general purpose of the parsing process is to achieve an interpretation of the input as soon as possible, it is hardly surprising that early structure building is the hallmark of the human parser. In line with this, it is often claimed that the parser has no look-ahead capacity (see Frazier and Rayner (1982), Gorrell (1995), and references mentioned there). What this means is that at any stage of the parsing process, the parser must commit to an analysis of the input it has received. This commitment entails that the parser cannot decide to hold unstructured linguistic material in short-term memory (compare Just and Carpenter (1992)), for allowing it to do so would be tantamount to granting it access to its right context.

In order to explain the left-right asymmetry in movement, we have to make more specific assumptions about the representations the parser produces. We assume that these are trees expressing precedence and immediate dominance. This is not sufficient, however, since syntactic structures encode more information than just dominance. In particular, although the number of functional projections has steadily grown, syntactic structures are still organized in so-called 'extended projections' of a unique lexical head (Grimshaw (1991, 2005)). We assume, in line with this, that the parser needs to represent headedness (in this sense) in addition to constituency. It does so in terms of statements that determine immediate domination between extended projections. We will use > and < to represent such statements in tree structures.

Consider the tree structures in (46). The first expresses that the extended projection of A is immediately dominated by a node belonging to the extended projection of B. The second tree expresses the reverse, i.e., the extended projection of B is immediately dominated by a node belonging to the extended projection of A.

(46)   a.   >
                 ⌒
               A   B

       b.   <
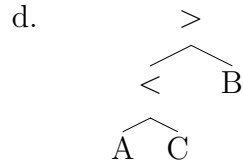   ⌒
               A   B
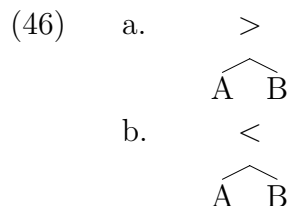
As more of the input is parsed, trees will grow. An important condition on tree growth is that information represented at an earlier stage of the parse must be preserved at later stages. This strict preservation of information is the formal expression of the early commitments made by the parser. In practice this means that the relations between the extended projections of A and B in a representation like (46a) must be maintained. This will always be the case if the tree is expanded at the root, so both (47a) and (47b) are possible continuations of the parse in (46a).

(47)   a.
```
          >
         / \
        >   C
       / \
      A   B
```
       b.
```
          <
         / \
        >   C
       / \
      A   B
```
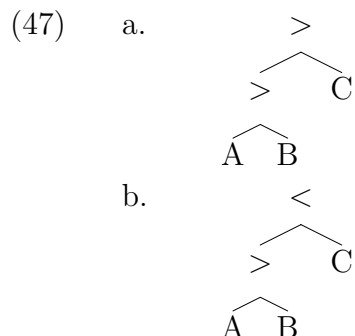
It is impossible however to insert a node between the root and either A or B which is labeled in such a way as to contradict the information contained in (46a). Thus, (48a) and (48c) are not possible continuations of the parse in (46a), because they express that A is immediately dominated by a node in the extended projection of C rather than B. In contrast, (48b) and (48d) are possible continuations of (46a) because the new node C belongs to the extended projection of either B or A, as required.

(48)   a.
```
          >
         / \
        A   >
           / \
          B   C
```
       b.
```
          >
         / \
        A   <
           / \
          B   C
```
       c.
```
          >
         / \
        >   B
       / \
      A   C
```

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d.

```
        >
       /\
      <  B
     /\
    A  C
```
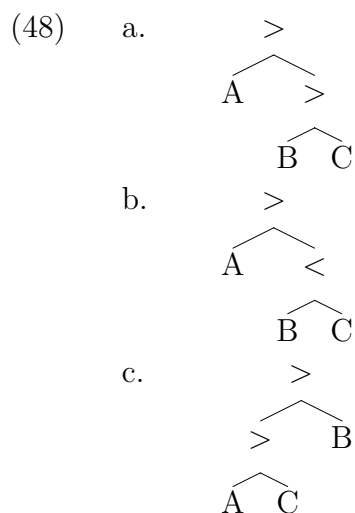
The requirement that information be preserved throughout the parse sometimes forces the parser to postulate empty branches at the right edge of the tree. Suppose for example that the extended projection of A cannot be part of the extended projection of B. Then the parser must either assume that the right context of the current parse contains an element whose extended projection hosts both A and B, as in (49a), or it may pursue the hypothesis that A and B are embedded in different extended projections, in which case it needs to postulate two empty branches, as in (49b).

(49)   a.
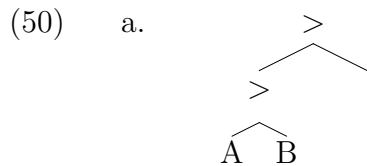
```
        >
       /\
      A  >
        /\
       B
```

b.

```
        >
       /\
      A    >
          /\
         >
        /\
       B
```
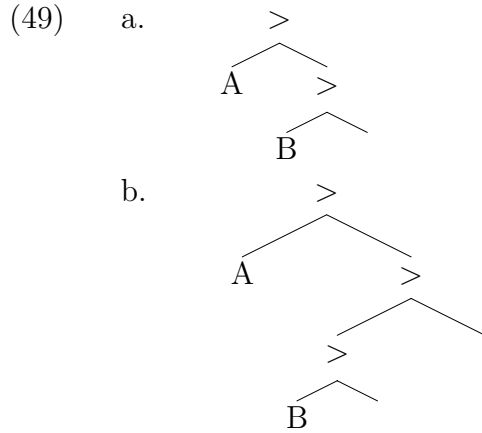
We can exploit the fact that incomplete parses may contain empty branches and define complete parses as those that lack empty branches (no commitment is made to further structure). Incomplete parses therefore always contain at least one empty branch at the right edge (there is a commitment to further structure). This implies that the trees in (46) must be altered slightly if they are to allow further growth. As given, they represent finished parses. For example, the transition from (46a) to (48b) could be corrected as in (50).

(50)   a.

```
        >
       /\
      >
     /\
    A  B
```

b.

```
            >
          /   \
        >       \
      /   \
     A      <
          /   \
         B     C
```
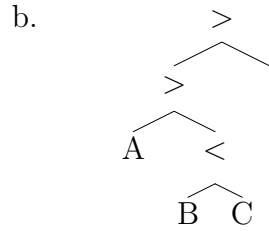
As explained, an empty branch represents a commitment to further material. In a reasonable theory of parsing, fulfillment of commitments cannot be postponed indefinitely. This makes it attractive to further restrict the occurrence of empty branches. We therefore propose that empty branches are tolerated only at the right edge of the current parse tree. The transition from (51a) to (51b) is thus ruled out. (The bidirectional arrow in the tree is intended to indicate that headedness plays no role in the argument.)

(51)   a.
```
        < >
       /   \
      A
```

b.
```
                    < >
                   /   \
              < >        \
             /   \
        < >        B
       /   \
      A
```
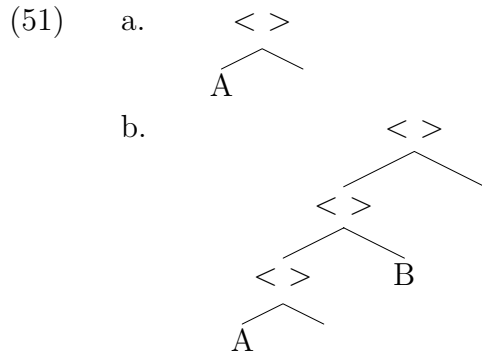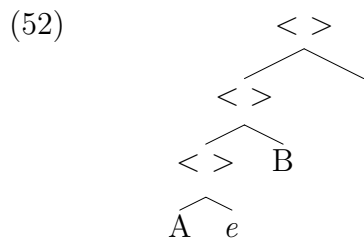
(51a) makes a commitment that a sister of A will be found in the right context. That commitment can no longer be met if B is added at the root of the tree, as in (52b). This situation, where a branch remains radically empty, must be distinguished from one in which an abstract lexical item is inserted as a sister of A, as in (52).

(52)
```
              < >
             /   \
        < >        \
       /   \
  < >        B
 /   \
A      e
```

While (51b) expresses a commitment that there will be a sister of A to its right, a promise which cannot be kept, (52) identifies the sister of A as a particular lexical item that happens to have no phonological realization,

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e. (The abstract lexical item *e* might be a silent version of English *one* or *do so*, which would give rise to empty-headed noun phrases or verb phrases respectively.)

Crucially, traces, unlike *e* above, are not abstract lexical items but copies of their antecedents.[26] This implies that the parser cannot save a representation like (51b) by inserting a 'trace', unless it has previously identified an antecedent for it (the category that provides the original for the copy). This implication of the copy theory of movement is known in the literature as the filler-driven strategy to the resolution of movement dependencies: the parsing of movement dependencies requires the identification of category as having moved prior to the insertion of a copy (see Frazier (1987, 1993); Frazier and Flores d'Arcais (1989); Gibson (1998)).

In line with this strategy, we propose that the parser buffers constituents which – it hypothesizes – have moved. Such buffering entails a commitment to insertion of a copy when a suitable position for the foot of the chain has been identified. It also entails that further processing of the moved constituent is postponed until the copy has been inserted. We will indicate buffering by the parser through a box drawn around moved material.[27]

We are now ready to spell out the predictions the proposed parser makes with regard to movement. As we will show, it follows that difficulties arise if the parser is presented with a string created by (non-string vacuous) rightward movement of a constituent containing the lexical head of an extended projection stranding (parts of) that extended projection. In contrast, leftward movement of such constituents is unproblematic, as is rightward and leftward movement of full extended projections:

(53)

	complete extended projection	incomplete extended projection
Leftward movement	✓(54a)	✓(54c)
Rightward movement	✓(54b)	* (54d)

We will demonstrate this prediction by considering the tree growth required to parse the following structures.

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[26]Any implementation of this idea will suffice. Traces can be partial or complete copies or identical to their antecedent (as in the multi-dominance theory of movement). We speak of copies here for simplicity only.

[27]Buffered material is material that the parser is still working on. In line with this, the buffer may itself contain a final empty branch. This buffer-internal empty branch will of course be non-final in the overall structure. Buffering is the parser's way of treating movement dependencies and buffer-internal final empty branches are the parser's way of dealing with certain types of remnant movement. See footnote 29.

(54)   a.

```
            Z
          /   \
        X       Z
              /   \
            Z       Y
          /   \
        Z      X̶
```

   b.

```
            Z
          /   \
        Z       X
      /   \
    Z       Y
  /   \
Z      X̶
```

   c.

```
            Z
          /   \
        Z       Z
      /   \   /   \
    Z  X  Y    Z̶
               /  \
             Z̶     X̶
```

   d.

```
            Z
          /   \
        Z       Z
      /   \   /   \
    Z̶    Y  Z    X
  /   \
Z̶     X̶
```
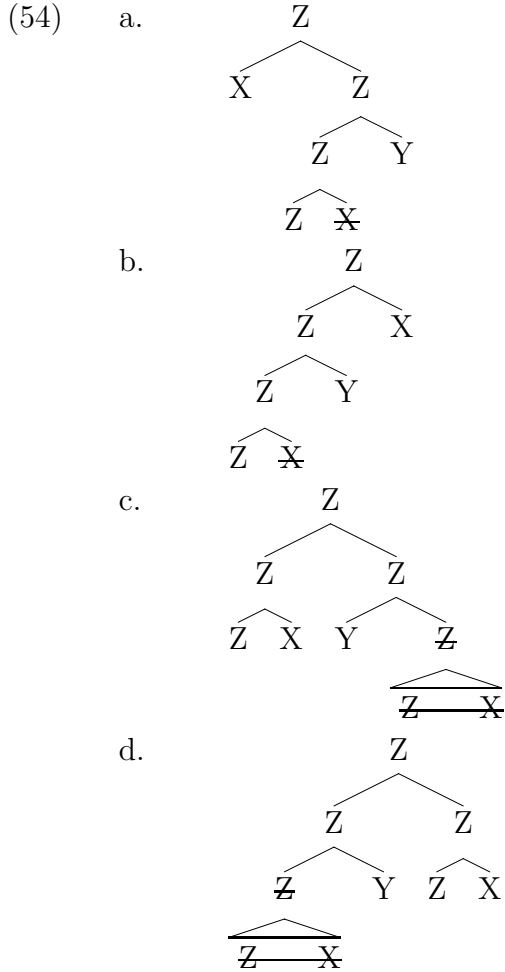
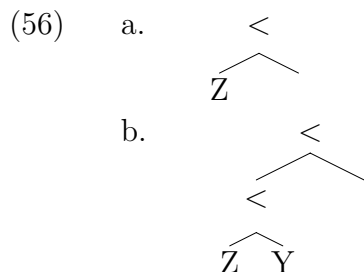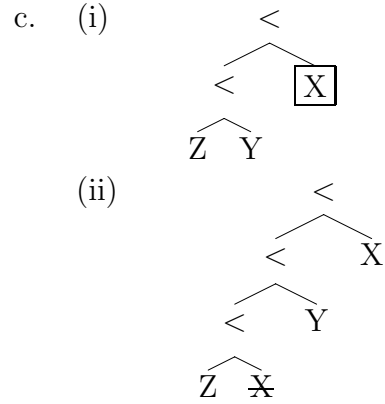Example (54a) represents leftward movement of a complete extended projection. We will call this type of movement phrasal for the remainder of this section. Of course, the string X Z Y permits many other possible parses, but we are not concerned here about how the parser decides on which parse(s) to pursue. All that matters here is that there is a successful path to the structure with which we try to associate the string.

Example (55) shows that the relevant string can be assigned the intended structure by the parser. In the first step, X is identified as a moved category in the extended projection of a lexical head that is yet to come. The second step identifies the relevant head as Z and commits to further structure in Z's extended projection. In the third step, a copy of X is inserted as Z's sister and X is removed from the buffer. The fourth step completes the parse by filling the remaining empty branch with Y. The three transitions meet the requirement that tree growth is information-preserving.

(55)   a.
$$>$$
$$\boxed{X}$$

b.
$$>$$
$$\boxed{X} \quad <$$
$$Z$$

c.
$$>$$
$$X \quad <$$
$$<$$
$$Z \quad \cancel{X}$$

d.
$$>$$
$$X \quad <$$
$$< \quad Y$$
$$Z \quad \cancel{X}$$
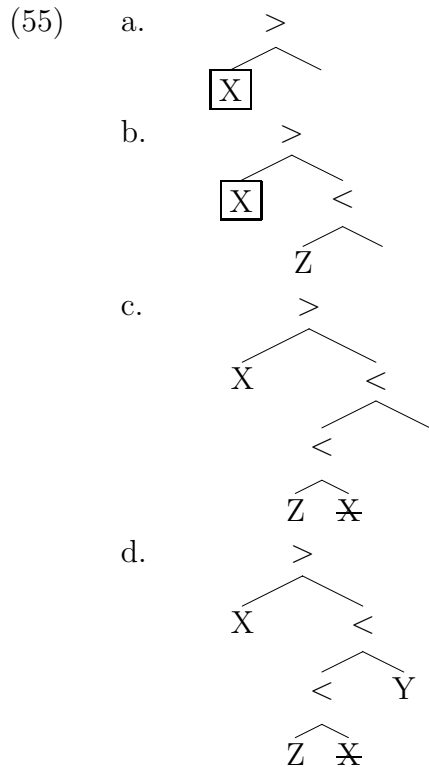
Example (56) shows the tree growth required for rightward phrasal move-
ment. Steps (56a) and (56b) and the transition between them are trivial. For
ease of exposition we have broken down the transition from (56b) to the final
structure into two steps. Upon encountering X the parser assumes that it
is a moved category and therefore undertakes to insert a copy. In the case
at hand the copy is immediately inserted in the parser's left context as Z's
sister. This expansion of the tree is admissible because commitment that Y is
part of the extended projection of Z is preserved. (This type of stretching of
Z's extended projection was discussed above in connection to the transition
from (46a) to (48b); note that the parallel between the two cases is structural
only, as linear order diverges).

(56)   a.
$$<$$
$$Z$$

b.
$$<$$
$$<$$
$$Z \quad Y$$

c.   (i)

```
          <
        /  \
      <     [X]
     / \
    Z   Y
```

(ii)

```
              <
            /  \
          <      X
         / \
        <   Y
       / \
      Z   X̶
```

Example (57) represents the case of leftward movement of an incomplete extended projection. In step (57b) of the parse, the complex constituent containing the lexical head Z is buffered, that is, it is hypothesized to have moved. After subsequent processing of Y, a copy of the boxed constituent is inserted, providing the head of the extended projection in which Y occurs. Again, no commitments made earlier have to be overridden in the crucial transition from (57c) to (57d).

(57)   a.

```
      >
     / \
    Z
```

b.

```
              >
            /   \
    +-----------+
    |     <     |
    |    / \    |
    |   Z   X   |
    +-----------+
```

c.

```
                >
              /   \
    +-----------+    >
    |     <     |   / \
    |    / \    |  Y
    |   Z   X   |
    +-----------+
```

d.

```
            >
          /   \
        <       >
       / \     / \
      Z   X   Y   ↙
                 / \
                Z̶   X̶
```
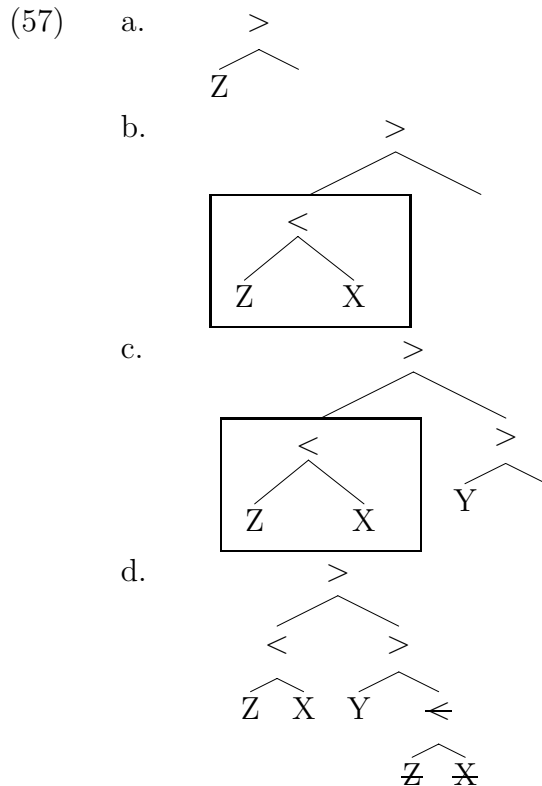
Finally, (58) presents the substantially different case of rightward move-ment of an incomplete extended projection. The steps in (58a) and (58b) are self-explanatory. As before, we break down the next and crucial step into two parts. In the first, the parser hypothesizes that the subtree consisting of the lexical head Z and its sister X has moved. Hence, the commitment is made to insert a copy of this subtree. Structure (58c-ii) represents an attempt at doing so in the parser's left context, preceding Y, a member of Z's extended projection. The transition to this tree is illicit. In (58a) through (58c-i), the labeling of the root node expresses that Y's extended projection is an immediate part of the category to its right. The labeling of the node inserted between Y and the root in (58c-ii) contradicts this earlier commitment, as that node does not belong to Y's extended projection.

(58)　　a.

b.

c.　(i)

(ii)
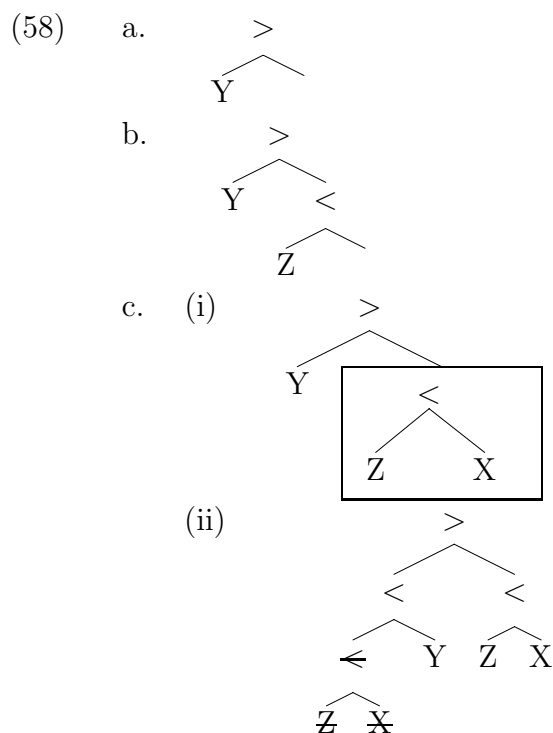
Other attempts at successfully parsing rightward movement of incomplete extended projections could be based on an early commitment in the parser to Y being contained in the extended projection of a category to its left. In effect, such attempts prefabricate a position for the insertion of a copy of a constituent containing the lexical head. One way in which such a position could be prefabricated would be by insertion of an abstract lexical item to the left of Y, as in (59).

(59)

```
              <
           /     \
        <          <
       / \        / \
      e   Y    [ Z   X ]
```
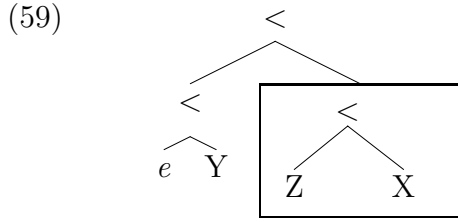
However, the transition from (59) to (58cii) is inadmissible, as the content of the node preceding Y is changed from what we have represented as e to a copy of $[_< Z\ X\ ]$. This particular problem could be circumvented by positing an empty branch on Y's left, as in (60), but doing so would violate the condition that empty branches occur only at the right edge of the parse tree.[28]

(60)

```
              <
           /     \
        <          <
       / \        / \
          Y    [ Z   X ]
```
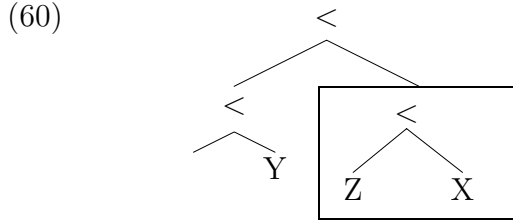
We conclude that, on assumptions about parsing that seem reasonable, the inherent left-right asymmetry of the process can be used to explain why rightward movement of incomplete extended projections is problematic. This is clearly relevant to the ban on rightward movement in the domain of the extended nominal projection. After all, movement in the nominal domain must target incomplete extended projections containing the lexical head, as stated in (13b).[29]

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[28]The problem discussed here does not present itself if rightward movement of the incomplete extended projection is string-vacuous. This is because a reversal of the order of Y and $[_< Z\ X\ ]$ in (58cii) makes it possible to maintain the hypothesis that Y is part of the extended projection of the constituent to its right. However, non-string-vacuous movement of this type is always going to lead to the problems discussed in the main text.

[29]For the sake of completeness we should point out that the semblance of rightward movement of an incomplete extended projection can be created through a two-step derivation involving leftward movement of that incomplete extended projection followed by remnant movement of a now headless constituent containing the trace of the first movement:

(i) $[\ [_Z\ Y\ \overline{[_Z\ Z\ X\ ]}\ ]\ [_Z\ [_Z\ Z\ X\ ]\ \overline{[_Z\ Y\ [_Z\ Z\ X\ ]}\ ]\ ]\ ]$

Although we will not demonstrate this here, such structures can be parsed by the system we have proposed as long as we allow buffered material to contain empty branches at their right edge. However, such derivations could never occur in the extended nominal projection because the remnant-movement operation runs afoul of the assumption in (13b).

There are two interpretations of the parsing account of the ban on rightward movement.

The first is that the grammar in principle allows both rightward and leftward movement, and that the former is ruled out in the relevant cases because it leads to unparsable structures. On this view, the parser's commitments are absolute and retraction of such commitments is impossible. (If so, garden-path effects do not result from revision of early commitments but from abandonment of the current parse in favor of an alternative, a set-up that fits in naturally with ranked parallel or serial parsing.)

The second interpretation does not hold the parser directly responsible for ruling out rightward movement, but takes the parsing difficulties described above as motivation for a grammatical principle stating that a moved constituent must be linearized at PF as preceding its sister. The idea behind this interpretation is that grammars may contain principles that increase the chance of successful parsing.

We will not attempt to force a decision between these options here.

Concluding Remarks

Two main conclusions can be drawn from the discussion in this paper. First, the claim that base-generated structures follow the SHCH (which is usually taken to follow from Kayne's (1994) Linear Correspondence Axiom) is empirically vacuous, at least within the nominal domain. The structures allowed by Cinque's (2005) LCA-based theory are identical in gross constituency to those generated by our more conservative alternative. Although we cannot demonstrate this here, we believe that this conclusion holds more generally.

Second, in order to capture the typological patterns uncovered by Cinque, (certain types of) movement must be exclusively leftward. Although a ban on rightward movement was originally argued to follow from the LCA, we have shown that this is not true, except in the most legalistic sense. Every rightward-movement structure can be paired with an LCA-compatible remnant-movement structure that shares its gross constituency.

These conclusions lead us to reject the LCA, especially in view of evidence that the LCA stands in the way of a restrictive theory of movement. However, whether we reject the LCA or not, the question presents itself why movement in the nominal domain should be leftward. We have shown that a parsing explanation might be available. On fairly uncontroversial assumptions about parsing, it follows that rightward movement of incomplete extended projections is hard to process.

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