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A Null Theory of Phrase and Compound Stress

1 Introduction

Since the publication of Chomsky, Halle, and Lukoff 1956, it has generally been assumed that (surface) constituent structure is the fundamental determinant of phrase (and sentence) stress. A natural question is whether, in addition to syntactic constituency and principles of Universal Grammar, we need some language-specific phonological rule as well.

The various generative treatments that have been proposed in the literature all have, either explicitly or implicitly, claimed that we do in assuming some form of Chomsky and Halle’s (1968) Nuclear Stress Rule.

Here, I would like to explore the possibility that no language-specific proviso is necessary and that the (unmarked) pattern of phrase stress can be entirely determined on the basis of surface syntactic constituent structure, given the word stresses and the general principles of grid construction defined in Halle and Vergnaud’s (1987) refinement of Liberman’s (1975) metrical grid theory.

If correct, the argument will imply that there is no such thing as a Nuclear Stress Rule of English as distinct from a Nuclear Stress Rule of German—more generally, no such thing as a Nuclear Stress Rule. Any difference in the patterns of phrase, and sentence, stress between two languages should instead follow from their respective constituent structure, as determined by purely syntactic parameters such as the head-initial or head-final character of their phrases.¹

The argument will be made on the basis of rather limited evidence, essentially a comparison of English, German, and Italian. At this preliminary stage, a more careful analysis of a few syntactically better known languages may be safer, and more revealing, than a superficial survey of several typologically different languages, even though some suggestive typological data will be cited (see section 8).

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¹ By the same token, no language-specific Compound Stress Rule exists either if the null theory of phrase stress extends to compounds, as I indeed suggest in section 9.
Given the crucial role that the metrical grid theory plays in the argument, I begin by briefly sketching the theory in the form given to it by Halle and Vergnaud (1987).

2 The Metrical Grid Theory

Within the metrical grid theory, which develops an idea of Liberman (1975), stress is represented in a separate autosegmental plane, like tone. The autosegmental line for stress is a sequence of abstract positions (conventionally marked with asterisks) associated with the potentially stress-bearing positions on the central line of phonemes, as illustrated in (1).

\[
\begin{align*}
\ast & \quad \text{t} \quad \text{o} \quad \text{r} \quad \text{m} \quad \text{e} \quad \text{n} \quad \text{t} \\
\end{align*}
\]

As with other phonological entities, this formalism permits, among other things, a local computation of phenomena that appear nonlocal on the phoneme line.

Not every potentially stress-bearing unit (e.g., a syllabic nucleus) represents a stressed position, on the phoneme line. One way to mark those that actually do is to set up an additional line on the stress plane where only such units receive an asterisk, as illustrated in (2) with the word *serendipity*, whose first and third syllabic nuclei only are stressed.

\[
\begin{align*}
\ast & \quad \text{s} \quad \text{e} \quad \text{r} \quad \ast \quad \text{e} \quad \text{n} \quad \ast \quad \text{d} \quad \ast \quad \text{i} \quad \ast \quad \text{p} \quad \ast \quad \text{i} \quad \text{t} \\
\ast & \quad \text{l} \quad \text{i} \quad \ast \quad \text{n} \quad \ast \\
\end{align*}
\]

If one of these units carries a stress more prominent than the others (as is the case with the third syllabic nucleus of *serendipity*), then it alone will receive an asterisk on a still higher line 2 (not indicated in (2)).

Since at most three degrees of stress (besides zero stress) are distinguished among stressed syllables in noncompound words, only three lines (besides line 0) will be needed to represent the main stress of individual words (see Halle and Vergnaud 1987).

Within this basic formalism, Halle and Vergnaud show that, by recognizing the existence of constituents on each line, and their heads (marked on the next higher line), it is possible to "rationalize" the considerable variety and apparent capriciousness of the patterns of word stress in the languages of the world. These can, in fact, be seen as arising from different settings of the same few parameters and rules of constituent bound-
ary construction: whether a constituent on line L is bounded or unbounded (± BND); head-terminal (in which case the further choice is between right-headedness or left-headedness) or not (± HT); constructed from left to right or from right to left.

By way of illustration, consider one of the various possibilities that follow from Halle and Vergnaud’s parametric theory. The stress pattern of Maranungku, where stress falls on all odd-numbered syllables counting from the beginning of the word, with the leftmost bearing main stress, is obtained by means of the parameter settings in (3), interacting with the general principles of grid construction in (4).

(3) a. Line 0 parameter settings: + HT, + BND, left, left to right
b. Line 1 parameter settings: + HT, − BND, left
(4) a. Construct constituent boundaries on line L.
b. Locate the heads of line L on line L + 1.

The representative stress pattern of the language is thus the metrical grid (5) (where indication of the plane and the phoneme line is omitted).

(5) * . . . . line 2
(* . * . *) line 1
(* *)(* *)(*) line 0

The grid is obtained by means of the parameter settings (3a–b) and the rules that construct constituent boundaries (4a–b) in the following way. First, line 0 is constructed by marking with an asterisk all (potentially) stress-bearing elements in the word (taking a five-syllable word as representative). Then, a constituent structure is imposed on this line by applying rule (4a) in accordance with the parametric values indicated in (3a). In this way, bounded (binary) constituents are constructed left to right (the last being a defective constituent). Given the positive value of the head-terminal parameter and the “left” value of the headedness parameter, a head for each constituent is located via (4b) on the next higher line (line 1) over the asterisk adjacent to the left boundary of the constituent. Then, a constituent structure is imposed on line 1 by again applying rule (4a) in accordance with the parametric values indicated in (3b). An unbounded constituent is thus built, comprising all three asterisks on line 1. Given the positive value of the head-terminal parameter and the “left” value of the headedness parameter, a head for the constituent on line 1 is located on line 2 over the asterisk adjacent to the left boundary of the constituent in line 1. The correct representation of the stress pattern of Maranungku words, with the appropriate degrees of stress, is thus derived.

Different choices of the same parameters (in possible interaction with the further choices mentioned in footnote 2, and others) give rise to the stress patterns found in the

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Footnote:

2 Abstracting from a number of further choices and refinements required by some languages, such as whether the initial (or final) segment of the word is extrametrical; whether the heads of the constituents in a lower layer are “predetermined” (e.g., all the vowels of closed or long syllables, as in Koya), or simply determined by the parameters and rules of constituent boundary construction (as in Maranungku); and so on.
other languages. (For detailed discussion, see Halle and Vergnaud 1987, Halle and Kenstowicz 1991.) In this approach, differences in degrees of stress are expressed in terms of the different heights of the associated asterisk columns, as seen.

Having briefly sketched Halle and Vergnaud’s (1987) theory of the stress contours of single words, I next consider how they propose to extend the theory to the stress contours of phrases (and sentences).

3 The Nuclear Stress Rule: A Metrical Version

As is well known, when words are combined into phrases, the stress contours of the individual words are largely unaffected, the effect of the combination being merely the assignment of greater prominence to the main stress of one constituent over that of the others. In English (and Italian) the constituent whose main stress is enhanced under normal conditions is the rightmost. This is essentially what Chomsky and Halle’s (1968) Nuclear Stress Rule of English was meant to express.

Halle and Vergnaud (1987:264) propose to incorporate the rule into the formalism of their theory as follows (see their (80)):

(6) Nuclear Stress Rule
   a. Parameter settings on line $N$ ($N \geq 3$) are $[-BND, +HT$, right].
   b. Interpret boundaries of syntactic constituents composed of two or more stressed words as metrical boundaries.
   c. Locate the heads of line $N$ constituents on line $N + 1$.

The effect of this rule will be to add new lines to the metrical grid, one for each new phrase computed, from the most embedded one to the root sentence. The language-specific proviso of the rule is represented by the parameter settings in (6a).

By way of illustration, consider the derivation of the stress contour of the sentence *Jesus preached to the people of Judea* (Halle and Vergnaud 1987:265):

(7) 
   . . * . * . * line 6  
   ( . . * ) . . * line 5  
   ( . . * ) . . * line 4  
   * * ( * * ) line 3  

[Jesus [preached to the [people of Judea]]]

The first metrical constituent built on the basis of (6b) is that corresponding to *people of Judea*. In accordance with the principle of the cycle, (metrical) constituents that contain unerased brackets, such as *[preached to the [people of Judea]]*, cannot be computed until after the innermost constituent is computed (and its brackets erased).³

³ Also note that constituents one of whose elements is a stressless word, such as a preposition or article, are systematically skipped (Halle and Vergnaud 1987:264). In certain cases prepositions can be accented (see Cruttenden and Faber 1991).
The head of the constituent is located on line 4 by applying (6c). Then a metrical constituent is created on line 4, and so forth. Noting that the procedure as such does not reflect the stress contour of the sentence correctly (with Jesus bearing more stress than preached, and the latter bearing more stress than people), Halle and Vergnaud (1987:265) propose to supplement it with the following convention:

(8) **Stress Equalization Convention**

When two or more constituents are conjoined into a single higher-level constituent, the asterisk columns of the heads of the constituents are equalized by adding asterisks to the lesser column(s).

This has the effect of introducing asterisks in place of some of the dots of (7).4

In their theory, then, the stress contour of phrases and sentences is determined by means of the same rules and parameters utilized for determining the stress contour of individual words.

4 A Null Theory of Phrase Stress

Halle and Vergnaud's extension of their theory of word stress to phrase stress raises two conceptual questions:

(9) a. Are phrase stress systems as numerous and diverse as word stress systems, as the different settings of the [+BND, ±HT, left/right] parameters would lead one to expect?

b. Is it an accident that the Nuclear Stress Rule gives prominence to the rightmost constituent of a phrase in languages like English or Italian, which are essentially right-branching (i.e., have increasing depth of embedding to the right)?5

Suppose, for the sake of argument, that it is no accident that the Nuclear Stress Rule gives prominence to the rightmost constituent of a phrase in right-branching languages (the branching direction of the language actually implying the same direction in stress prominence). If this is so, there is an immediate implication for the other question too. Only two general types of phrase stress systems should exist according to whether the language is left- or right-branching. Right-branching languages should show the effects of the Nuclear Stress Rule, and left-branching languages should show the reverse (essentially, the effects yielded by the Compound Stress Rule of English, which gives prom-

4 There being no upper bound on depth of embedding, no upper bound exists on the number of stress distinctions either. As speakers may "make fewer distinctions than are provided by this procedure," Halle and Vergnaud (1987:266) suggest a Grid Simplification Convention. On this question, also see Chomsky and Halle 1968:23.

5 Question (9b) in fact is not particular to Halle and Vergnaud's theory, but applies to any theory comprising (some version of) the Nuclear Stress Rule.
inence to the main stress of the leftmost constituent). Languages with mixed branching should combine properties of the two "pure" systems.\(^6\)

However, if the effects of the Nuclear Stress Rule (and of its reverse) depend entirely on the direction in which depth of embedding develops, then the rules become redundant. They merely recapitulate what follows from purely syntactic parameters. Hence, they should be eliminated, at least if a way exists to link the direction in which stress prominence is assigned within a phrase to the branching direction of the phrase. What I would like to suggest is that such a link is implicit in Halle and Vergnaud's procedure of grid construction: an additional distinctive advantage of the metrical grid notation over such alternatives as the metrical tree notation, which apparently cannot derive the same result (see section 5 for some discussion).

What is apparently necessary and sufficient is the combination of Halle and Vergnaud's (6b), simplified as in (10a); (6c), repeated here as (10b); the principle of the cycle, (10c), essentially in its original formulation; and the condition that there be no gap in an asterisk column, (10d).

\[(10a)\]
\[
\text{Interpret boundaries of syntactic constituents as metrical boundaries.}\]
\[
\text{b. Locate the heads of line } N \text{ constituents on line } N + 1.\]
\[
\text{c. Each rule applies to a maximal string containing no internal boundaries.}\]
\[
\text{d. An asterisk on line } N \text{ must correspond to an asterisk on line } N - 1.\]

Let us consider first a couple of simplified abstract cases to illustrate the working of (10)—namely, (11a–b) (or (12a–b) in tree format), where A, B, C are arbitrary syntactic maximal projections and the asterisks indicate the main stress of the words that constitute their heads.

\[(11a)\]
\[
a. [A * [B * [C *]]]\]
\[
\]

\(^6\) One may note, incidentally, that some of the parametric options that seem appropriate at the word stress level could in any event turn out to be irrelevant at the phrase stress level. So, for example, if Kayne's (1984) strict binary-branching hypothesis is correct, as seems likely, the ±BND parameter could be dispensed with along with the ±HT parameter.

\(^7\) (10a) differs from Halle and Vergnaud's (6c) in that it makes reference to constituenthood, irrespective of whether the constituent contains only one or more than one stressed word (the most general interpretation, in any case). As will become clear, this simplification is crucial to obtain the correct results.

One may also note that this formulation is entirely consonant with the notion of head and projection discussed by Halle and Vergnaud themselves (pp. 8–9).

\(^8\) This condition is nothing but Prince's (1983:33): "requirement that a column must have entries at every level up to its peak," which is instrumental in accounting for why stress retracts in \textit{antique chair} (< \textit{antique dealer}). As far as I can tell, it entails, though it is not equivalent to, Halle's (1985) Landing Site Constraint ("When an asterisk is moved it lands on the highest column of asterisks that is in its domain. If there is more than one such column it lands on the nearest of these").

This condition also appears to account for the curious exception to the Rhythm Rule noted by Halle and Vergnaud (1987:235, 270), according to which the rule fails to apply in words where the potential landing site lacks stress (\textit{serene summers} vs. \textit{fifteen summers} < \textit{fifteen summers}); for there is no way for the topmost asterisk of the second syllable of \textit{serene} to move over the first syllable without violating the requirement that there be an asterisk on the immediately lower line.
(11a)/(12a) and (11b)/(12b) represent right- and left-branching structures, respectively, with each constituent nested in the next higher one. Application of (10) gives rise to the grids (13a–b) (lines below line 3 are omitted).

(13) a.  
( .  .  * )  
( .  ( .  * ) )  
( *  (*  (*)) )  

b.  
( *  .  . )  
( ( *  . ) )  
( (((*)  *)) *)  

line 6  
line 5  
line 4  
line 3  

Consider how. The combination of (10a) and (10c), the principle of the cycle, dictates that the first metrical constituent to be computed is the innermost (to the right in (13a), and to the left in (13b)). (10b) then requires us to locate the head of this constituent on the next higher line (line 4). Since the constituent has only one position, the asterisk on line 4 can only be located in the same column as this position. On the next cycle, (10b) will again demand that the head of this constituent be located on the next line up (line 5). The innermost constituent of line 4 has two positions, but only one of them is an asterisk. So, by (10d), we have no choice. The head (on line 5) of the constituent on line 4 can only be in the same column as the single asterisk found on line 4. Reapplication of the same procedure gives rise to the complete grids (13a) and (13b).

In this fashion, stress prominence in a phrase is a mere reflection of depth of embedding. And the rightmost or leftmost location of the main stress is simply a function of the rightmost or leftmost location of the most deeply embedded phrase (as determined by the direction of branching).

If, as I will claim, the relation between two constituents of a phrase is always asymmetrical (in the sense that one of the two is necessarily more deeply embedded than the other), the direction of stress prominence, as in the Nuclear Stress Rule, need not be stipulated. The first constituent to receive an asterisk, whether on the left or the right, will "attract" all later asterisks.

The procedure in (10) would seem to suffer from the same deficiency as Halle and Vergnaud’s Nuclear Stress Rule (6), which called for a Stress Equalization Convention to assign the appropriate degrees of stress to a sentence such as *Jesus preached to the people of Judea*, but this is not quite so. Note that the sentence in question has two
nonintersecting constituents, the subject NP and the predicate VP (for simplicity, I now ignore all functional and intermediate X-bar projections):

(14) \([[\text{NP Jesus}] [\text{VP preached [\text{PP to [\text{NP the people [\text{PP of [\text{NP Judea}]]]]}]}}]]\].

This means that the subject NP and the VP undergo two parallel cycles before joining at the sentence level. In particular, this means that the NP Jesus will receive a line 4 asterisk—one more than preached and people, which fail to receive one on line 4 because the innermost constituent [NP Judea] receives it first, thus attracting all later asterisks (those of lines 5 and 6, as well as that of line 7, after the whole sentence is computed):\(^9\)

(15)

```
*          *          *          *          *          *          line 7
*          *          *          *          line 6
*          *          *          *          line 5
*          *          *          *          line 4
*          *          *          *          line 3
```

[[Jesus] [preached [to the people [of Judea]]]]

The general consequence of this formal procedure is then that the first constituent to receive an asterisk will be the one to ultimately receive greatest stress within a phrase.

An immediate problem would seem to be posed by those cases where the subject NP has more layers of embedding than the predicate (e.g., in a sentence such as [[\text{The author} [of many popular articles [on the effects [of senescence]]]] [died]]). Here the formal procedure would lead us to expect the most deeply embedded constituent of the subject NP to bear more stress than the verb in the VP. But this is not necessarily the case. I return to this problem below when discussing the relation between the proposed formal procedure and the effects of the focus and presupposition articulation of the sentence (its “information structure”). Also see the discussion at the end of section 7. Other problems stemming from predictions of this procedure that appear to fail (given certain assumptions about the constituent structure of English and Italian) are also deferred until section 7, after some implications of this general approach have been considered in more detail.

As noted, under the hypothesis to be explored here, no language-specific rule (such as the Nuclear Stress Rule) should be postulated to determine stress prominence at the phrase level. Rather, phrase stress should be entirely determinable (given the word stresses) from the independent principles in (10) in interaction with such purely syntactic parameters as the head-initial or head-final parameter (responsible for the direction of embedding). As observed, the general prediction of this hypothesis is that in right-branching phrases the stress prominence should fall on the main stress of the rightmost con-

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\(^9\) Halle and Vergnoud (1987:265) claim that preached has more stress than people. If this is a clear and perceptible intuition, then the procedure in (10) will need to be amended. “Supplementary principles of prosodic realization” (Prince 1983:24) are likely to superimpose themselves on the effects of the present procedure to give finer stress gradations. Concerning rhythmic principles, see Selkirk 1984, Dell 1984, among others.
stituent (thus deriving the effects of the Nuclear Stress Rule of English), whereas in leftbranching phrases the stress prominence should fall on the leftmost (to yield, in essence, the same effects produced by the Compound Stress Rule of English).

Although some suggestive typological evidence in this direction does exist (see section 8), it may be useful to consider a specific case in some detail. German stands out as particularly appropriate to the task. Its mixed branching character allows us to test the opposing predictions of the hypothesis within a single language. Furthermore, its syntactic structure and its accentual system are both rather well known.10

In the next section I begin with a brief excursus of the main features of German phrase stress, based in essence on the classical work of Kiparsky (1966). I then compare the language-specific approach taken there and in subsequent works with the null approach developed above and consider a number of more subtle predictions afforded by the latter approach on the basis of what is now known about the syntactic structure of German.

5 Phrase Stress in German

Kiparsky (1966:81) distinguishes two different classes of phrases in German according to whether they receive stress prominence on their rightmost or leftmost constituent (for suggestions along the same lines, see Jacobs 1982). His terms Nom and Satz, taken from Bierwisch’s (1963) fragment of German grammar, correspond to NP and CP, respectively.11 The rendition of other terms is more problematic since some of them do not even seem to correspond to constituents in today’s theory. So, for example, D essentially


11 (ia–l) represent (part of) the fragment of German grammar presupposed by Kiparsky.

(i) a. Satz → (I) S
b. I → \{ W \}
c. S → D VP
d. D → Nom (Nom) (Nom) (Adv)
e. VP → (Satz) Vb Aux
f. Vb → (Adv) V
g. Nom → d (Satz) N
h. Aux → (Md) Fin
i. d → determinant
j. Md → modal verbs (sollen, wollen, . . . )

In addition to the rules in (i), Kiparsky, again following Bierwisch, assumes two rules applying to root clauses, one moving an arbitrary constituent to first position (corresponding to current XP-movement to the Spec of CP), and another moving the finite verb to second position (corresponding to current head movement of V (to I) to C).
renders the notion of *Mittelfeld* in the German grammatical tradition.\textsuperscript{12} This comprises all the constituents found between the head of CP and the head of VP, namely, the subject NP and the possible adjunct and argument XPs of the VP without the verb—a sequence that is apparently not a constituent (but see footnote 16). Analogously, Kiparsky's "VP" is used for a verbal group comprising a verb plus an auxiliary (plus a complement CP if there is any), but excluding the rest of the verb's complements: another non constituent under current assumptions, which analyze auxiliaries as heads (of an auxiliary VP) taking ordinary VPs (or AgrPs containing VPs) as their complements. Assuming this partition of the German sentence and the fact that NPs, CPs, and D receive final stress prominence, whereas the sequence S ( = D + VP), corresponding to IP, and the verbal group "VP" receive initial stress prominence, Kiparsky manages to derive the intricacies of ordinary sentence stress in German with remarkable accuracy.\textsuperscript{13}

Let us briefly consider how. The case of NPs is straightforward. They receive final stress prominence (*Endbetonung*):

(16) a. [die dicke Émma]
   the fat Emma

b. [der Mann aus Río]
   the man from Rio

Concerning CPs, the stress contour of such simple root clauses as (17) is derived directly under the "constituent" analysis in (18) (Kiparsky 1966:81).

(17) a. Waldemar spielt Théâter.
    Waldemar plays theater
    'Waldemar is on the stage'.

b. Die Katze lief weg.
   the cat ran away

(18) a. [Satz[I Waldemar spielt] [S Theater]].

b. [Satz[I Die Katze lief] [S weg]].

S has only one word (*Theater, weg*, respectively), so that word will receive the primary stress of the S cycle. Although Kiparsky does not explicitly discuss the stress contour of I, it is reasonable to assume that in his system it would have left prominence. If so, the subject NP will receive the primary stress of the I cycle. When the Satz cycle, which is subject to the ordinary Nuclear Stress Rule, is reached, primary stress will be assigned to the most prominent stress to the right (*Theater and weg*, respectively), all other stresses being reduced by one at the same time. Kiparsky's ingenious procedure will

\textsuperscript{12} See Drach 1940. For recent critical comparisons of this tradition with current generative analyses of German, see Olsen 1982, Scherpenissee 1986:chap. 1, and Greendorf 1988:20, among others.

\textsuperscript{13} Phrased in other words, NPs, CPs, and Ds would be subject to the (German analogue of the) Nuclear Stress Rule, whereas IPs and the verbal group "VP" would be subject to a "Reverse Nuclear Stress Rule," identical in effects to the English Compound Rule, modulo the word-external versus word-internal domain of application.
also derive the correct result in more complex cases such as (19), under the analysis indicated in (20).

(19) Hans wird einem Kind ein Buch geben können.
     Hans will to a child a book give be able
     ‘Hans will be able to give a book to a child.’
(20) [satz[I Hans wird] [S[D einem Kind ein Buch] [VP geben können]]).

The verbal group “VP” and I are subject to the “Reverse Nuclear Stress Rule,” so that the leftmost constituent (geben and Hans, respectively) will receive the primary stress of the cycle. D is subject to the ordinary Nuclear Stress Rule, so that the rightmost constituent ein Buch will receive primary stress. When the S cycle is reached, which is again subject to the “Reverse Nuclear Stress Rule,” the most prominent stress of the leftmost constituent (that of Buch) will receive primary stress, thereby causing all other stresses of that cycle to lower. Finally, when the Satz cycle is reached, which is subject to the ordinary Nuclear Stress Rule, the most prominent stress to the right (once again that of Buch) will receive the primary stress, with the concomitant weakening of all the other stresses.

Despite its ingenuity and remarkable empirical success, Kiparsky’s analysis raises certain questions about the constituent structure it must assume. But even if all such questions could be satisfactorily answered, the fact that certain German phrases take left prominence whereas others take right prominence would still be treated as an accident. The theory could just as well accommodate the opposite arrangement of stress prominence.

A more interesting theory, it seems, would be one that derived the rightmost or leftmost prominence of a certain German phrase as a necessary consequence of general and independent principles. The null theory sketched above appears to qualify as such a theory. This is because, as predicted, the leftmost or rightmost stress prominence of a German phrase appears to correlate exactly with the direction in which the phrase’s depth of embedding develops.

Let us see how, beginning with complements and delaying for a moment the examination of adjuncts and other modifiers. Consider what value the head complement parameter takes in each phrase. NPs are head-initial. This means that their complements are found to their right:

(21) a. die [N_1 Entdeckung [NP des [N_2 Impfstoffs]]]
     the    discovery     of     the    vaccine

14 It also faces certain empirical problems. So, for example, given that subjects are included in D and that D receives greater prominence in S (= D + “VP”), the subject rather than the verb would be expected to bear primary stress in the following case, contrary to fact:

(i) Da hat das Kind mit gespielt.
     it has the child with played
     ‘With it the child has played.’
b. die [N' Landung [PP auf [NP dem [N' Mond]]]]
   the landing on the moon

Since the complement's head is more deeply embedded than the head N (in the sense that it is dominated by more projections than the head N), it will receive an asterisk on the first and second phrase cycles, the lower N' and NP, before the head N can receive one on the higher N' cycle. This, in turn, will mean that the main stress of the complement will continue to attract all later asterisks, in accordance with principle (10d), ultimately bearing the strongest prominence within the largest phrase, as desired.

Except for a handful of cases (such as (23)), PPs are also head-initial, and in fact their stress properties are analogous to those of the NPs in (21), with prominence on the main stress of the complement to the right:

(22) a. auf den Tisch
       onto the table
b. durch das Zimmer
       through the room
c. unter den Línden
       under the lime-trees

The situation is reversed with postpositional phrases, as expected. Greater prominence is now on the left:\textsuperscript{15}

(23) a. den Flúß entlang
       the river along
       'along the river'
b. den Bérg hinauf
       the mountain up
       'up the mountain'

Next, consider VPs, which in German are head-final. The rough generalization is that the primary stress falls on the XP to the immediate left of the verb, or verbal group (see von Stechow and Uhmann 1986:315, Grewendorf 1989:sec. 4.3, among others):

       that Hans a book on the table put has
       that Fritz to a child money given has
c. . . . daß Karl [ein Buch mit Múhe lesen] kann.
       that Karl a book with difficulty read can

\textsuperscript{15} This fact also follows under Van Riemsdijk's (1990) interesting analysis of post- and circumpositional PPs in German. According to this analysis, lexical Ps are always head-initial, although their maximal projection is selected by a functional head-final head ([fP [P NP] F]). Postpositions then are prepositions raising to F, and circumpospositions are cases of Ps base-generated in both P and F.
d. daß Hans [ein Buch interessant findet].
   that Hans a book interesting finds

This is in fact what the null theory predicts, since (as (25) illustrates) in a left-branching constituent whose head is V, the constituent to its immediate left is in each case the most deeply embedded constituent of the VP.

\[
\text{(25)} \quad \text{IP} \\
\quad \text{NP} \quad \text{I}' \\
\quad \text{VP} \quad \text{I} \\
\quad \text{YP} \quad \text{V'} \\
\quad \text{XP} \quad \text{V}
\]

This is true even if the configuration in (25) is not base-generated, but derived, with YP moved from a position between XP and V (see footnote 32). Note that the direct object in (26) has been moved to the left via scrambling, thus leaving the indirect object as the most deeply embedded constituent of the VP.

(26) daß Bruno sein Geld oft [den Kindern gab].
    that Bruno his money often to the children gave

If so, the basic stress contour of the VP is predicted with no need for a special version of the Nuclear Stress Rule.

The same predictions follow a fortiori if the verb raises to I, as is now standardly assumed:¹⁶

(27) daß Bruno sein Geld oft [den Kindern t₁] gab_t₁.

Next, consider APs (not discussed in Kiparsky 1966). They can take prepositional complements on both sides, and Case-marked NPs to their left only. See (28) and (29), with the indication of their unmarked stress pattern.

(28) a. Er ist [über seinen Freund ungehälten].
    he is at his friend angry

¹⁶ See Giusti 1986, 1990, Den Besten 1989, Webelhuth 1989, among others. Note that raising of the verb leaves a constituent essentially corresponding to Kiparsky’s D constituent, which thus looks less ad hoc, in retrospect.
b. Er ist [ungehältn über seinen Freiund].
he is angry at his friend

(29) a. Er war [dem Mann böse].
he was to the man nasty
b. *Er war [böse dem Mann].
he was nasty to the man

This is generally taken to indicate their head-final character (with the head-complement order derived via the independent rule of extraposition; see Giorgi and Longobardi 1991: chap. 3, Tappe 1990):

(30) a. Er ist [AP[A' [PP über seinen Freund] ungehalten]].
b. Er ist [AP[AP[A' t ungehalten]] [PP über seinen Freund]].

If this were the case, the null theory of phrase stress would face a serious problem, since it would predict the strongest stress to fall in (28a) and (29a) on Freund and Mann, the most deeply embedded constituents, rather than on the adjective, as is instead the case.

Interestingly, there is evidence that more is involved—in particular, that preadjectival complements in German cannot stay under A’, but must move out of it, to adjoin at least to AP, whatever their D-Structure source (also see Webelhuth 1989:chap. 6). The evidence comes from the following peculiarity of the word order internal to AP: when the complement precedes the head and there is a lexical specifier or some other prehead modifier, one finds the order complement-specifier-head rather than the order specifier-complement-head. For example:

(31) a. Er ist über seinen Freund sehr ungehalten.
he is at his friend very angry
b. *Er ist sehr über seinen Freund ungehalten.
he is very at his friend angry

(32) a. Er war dem Mann oft böse.
he was to the man often nasty
b. *Er war oft dem Mann böse.
he was often to the man nasty

The fact that the complement must precede the specifier sehr ‘very’/oft ‘often’ is evidence that it cannot stay under A’, but instead must adjoin at least to AP. As Henk van Riemsdijk (personal communication) has pointed out, there is in fact evidence that the complement must adjoin to some projection even higher than AP, since the complement must precede the negation (which is outside the AP and is in fact taken to mark the left boundary of VP; see Webelhuth 1990:55):

(33) a. . . . daß er dem Mann nicht [VP[AP böse] t] war,.
that he to the man not nasty was
b. * . . . daß er nicht [VP[AP dem Mann böse] t] war,.
that he not to the man nasty was
(The string in (33b) is—irrelevantly—possible if nicht and dem Mann form a constituent; that is, if nicht is a constituent rather than a sentential negation.)

The case of German APs is methodologically instructive. It shows how careful one must be in putting a hypothesis to test. Insufficiently analyzed structures may easily lead to incorrect conclusions concerning the hypothesis to test.

When the functional categories IP (or rather AgrPs, TP, AgrPo of Chomsky 1991) and CP are taken into account, a more complete picture of German sentence stress can be given. As (34) illustrates, German AgrO and presumably T and AgrS take their complements to the left, whereas C takes AgrPs to its right (see Grewendorf 1988, Den Besten 1989:274, among others).

(34)

\[
\begin{array}{c}
\text{CP} \\
\mid \\
\text{C'} \\
\mid \\
\text{C} \\
\mid \\
\text{AgrPs} \\
\mid \\
\text{AgrS} \\
\mid \\
\text{TP} \\
\mid \\
\text{T'} \\
\mid \\
\text{AgrPo} \\
\mid \\
\text{T} \\
\mid \\
\text{AgrO} \\
\mid \\
\text{VP} \\
\mid \\
\text{V'} \\
\mid \\
\text{V}
\end{array}
\]

In root clauses (and in embedded clauses selected by certain predicates; Bader and Penner 1990, Vikner 1990, Cinque 1989), the V raises to C, and a maximal projection
must fill the Spec of CP (in declaratives). In non-V2 subordinate clauses, instead, the finite V does not raise higher than AgrS. This gives rise to a variety of different cases, all sharing the property that the greatest prominence falls on the most deeply embedded (lexical) constituent, as predicted by the null theory (when not crucial, I conflate AgrP_S, TP, and AgrP_O into IP):  

(35) a. \[\text{[CP Waldemar} \_ [C \_ spielt} \_ [IP t} \_ [VP Theáter t} \_ k]]\].
Waldemar plays theater
‘Waldemar is on the stage.’
b. \[\text{[CP Das Buch} \_ [C \_ findet} \_ [IP er} \_ [VP t} \_ interessánt t} \_ k]]\].
the book finds he interesting
‘He finds the book interesting.’
c. \[\text{[CP[Trinken wollen]} [C \_ wird} \_ [IP sie} \_ [VP nicht VP} \_ t} \_ k]]\].
want to drink will she it not
‘She will not want to drink it.’

(36) a. \[\text{[CP Hans} \_ [C \_ hat} \_ [IP t} \_ [VP kein Búch gelesen]} t} \_ k]]\].  
Hans has no book read
‘Hans has read no book.’
b. \[\text{[CP Den} \_ [C \_ hat} \_ [Hans [t} \_ gelésen]} t} \_ k]]\].
that has Hans read
‘Hans has read that one.’

(37) a. \[\text{[IP Fritz} \_ [VP[NP viele Tórten] backen]} kann]\ldots
because Fritz many pies bake can
‘Because Fritz can bake many pies . . .’
b. \[\text{[IP Fritz} \_ [VP gütt kochen]} kann]\ldots
because Fritz well cook can
‘Because Fritz can cook well . . .’

Next consider (38a–b).

(38) a. \[\text{[CP Der Arzt} \_ [C \_ wird} \_ [AgrP[VP einen Patiénten untersuchen]]]\].
the doctor will a patient examine
‘The doctor will examine a patient.’

\footnote{17 I abstract for the moment from such cases as Ein Brief kam an ‘A letter arrived’ and Otto kommpt ‘Otto is coming’, which have primary stress on the subject (in the Spec of CP) in the unmarked case (see Kiparsky 1966:89, von Stechow and Uhmann 1984:253). An understanding of such cases requires a discussion of the focus in footnote 19 in the sentence, which I undertake in the next section. On the stress properties of separable prefixes in German, see Giegerich 1985 and the remarks in footnote 20 below.}

\footnote{18 For the apparently unexpected stress contour in (i), due to Josef Bayer (personal communication), see the discussion in section 7, where it is suggested that right-branching structure on a left branch constitutes a separate cycle, “invisible” to the main cycle.}

(i) Man hat den Mann [ohne zu zögern] hingerichtet.
one has the man without hesitating executed
‘They executed the man without hesitation.’
b. \( \text{[CP Der Arzt } \text{[C \cdot \text{ wird } } \text{[AgrP den Patienten]} \text{[VP t, untersuchen]]]} \). 

the doctor will the patient examine

'The doctor will examine the patient.'

Such contrasts as this one connected to the (in)definite character of the object (Kiparsky 1966:91f.) fall into place if one assumes that only indefinite objects can remain in VP, definite ones being necessarily scrambled to some projection of Infl (perhaps, Spec of AgrP\(D\)), as argued for on independent grounds by Brugger (1990) (also see the discussion in Moltmann 1990). 19

I close this section by briefly considering the position of a number of specifiers and other modifiers in relation to the positioning of stress. In noun phrases with prenominal genitives and adjectives the main stress goes on the head N (Kiparsky 1966):

(39) a. Peters Auto
Peter's car

b. die dicke Émma
the fat Emma

Recent work on the structure of the noun phrase indicates that its internal structure is more complex than previously assumed, with a projection for the determiner and at least two functional projections intermediate between D and the NP (see Ritter 1990 and Cinque 1990 for evidence based on Hebrew and Romance, respectively). If prenominal adjectives are located in the Spec position of these intermediate functional projections (possibly, of agreement; Cinque 1990), the head N will qualify as the most deeply embedded constituent, thus bearing primary stress according to the null theory (the case of prenominal genitives requires, instead, a refinement that will be discussed in section 7):

(40) \( \text{[DP die } \text{[FP dicke } \text{[F \cdot F [NP[N \cdot \'Emma]]]]]} \)]

19 The same conclusion is reached for Hindi by Mahajan (1991). The contrast reproduces itself with indefinite subjects (which in German can remain within VP), but apparently not with indefinite indirect objects. See (ia–b) and (iia–b), provided by Gerhard Brugger and Günther Grewendorf (personal communications), respectively:

(i) a. . . daß diesen Baum ein Förster fällte.
that this tree a forester cut

b. . . daß diesen Baum der Förster fällte.
that this tree the forester cut

(ii) a. . . daß das Buch dem Studenten gehört.
that the book to the student belongs

b. . . daß das Buch einem Studenten gehört.
that the book to a student belongs

Quantified NPs seem to go together with definite rather than indefinite objects, as Günther Grewendorf (personal communication) points out:

(iii) . . . daß der Arzt bereitwillig jeden Patienten untersuchte.
that the doctor willingly every patient examined
Similar considerations hold for adjectival and verbal specifiers:

(41) a. \[\text{AP sehr [\text{A böse}]}\]
very nasty
b. \[\text{weil [\text{IP er [oft [kochen kann]]}]}\]
because he often cook can

When a postnominal genitive or adverbial PP modifier is present, the main stress of the noun phrase is located on it:

(42) a. \text{die Ankunft von Karl}
the arrival of Karl
b. \text{der Mann aus Rio}
the man from Rio

This follows from their being more deeply embedded than the head N under current assumptions (Giorgi and Longobardi 1991, Haider 1991):

(43) a. \[\text{DP die [NP Ankunft [PP [\text{von [DP Karl]]}]]}\]
b. \[\text{DP der [NP Mann [PP [\text{aus [DP Rio]]}]]}\]

No doubt, other aspects of German phrase and sentence structure deserve attention. The cases so far reviewed, however, already constitute some evidence for the null theory of phrase stress.

Dutch appears to provide analogous evidence, at least to judge from the inventory of Dutch phrase and sentence types given by Baart (1987:83–103) with an indication of their unmarked, noncontrastive stress.

Before we turn to some hitherto ignored questions concerning the information structure of the sentence, a brief comparison may be worthwhile between the metrical grid theory and the metrical tree theory. As we have seen, the former permits the derivation of phrase stress from the word stresses and surface syntactic structure via asterisk addition to each phrase (in conformity with certain general conditions). The formalism of the latter appears unable to derive the same result without stipulation. This is because it is a purely interpretive procedure that marks the two branches of a binary structure weak (W) and strong (S) in relation to each other, and independently of the manner of

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A different interesting case is provided by German ‘‘separable (verb) prefixes,’’ one of whose characteristics is to bear greater prominence than the verb (Helbig and Buscha 1984, Bresson 1983:vol. 1, 562). Since they separate from the verb, they cannot be treated as being part of a complex lexical unity. A plausible analysis, which captures both properties, would consist in analyzing them as heads of intransitive PPs selected by the V (see Van Riemsdijk 1988):

(i) a. \text{Wann werden wir [vp [pp [\text{an}]] [v kommen]]?}
‘‘When will we arrive?’’
b. \text{Wann kommen wir [vp [pp [\text{an}]] [v t]]?}
‘‘When do we arrive?’’

In this case the ‘‘prefix’’ would be more deeply embedded than the V in the VP (especially if this moves to I even in infinitival clauses; Giusti 1986, 1990).
its application (cyclic or not). Thus, it leaves no way to link the assignment of S to the most deeply embedded constituent. Even if assignment of S were somehow to be linked to depth of embedding, the link would not be principled. That is, it seemingly would not follow as a necessary consequence of the formalism. If correct, this approach also shows that at least certain phonological phenomena may be directly syntax-driven, without recourse to prosodic-theoretic notions such as the phonological phrase or intonational phrase.

6 The Focus and Presupposition Articulation of the Sentence

The study of phrase and sentence stress is not complete without considering the "information" articulation of the sentence into F(ocus) and P(resupposition) (Chomsky 1970), a distinction that recalls that found in other traditions between "new" and "old" information (Halliday 1967/68), "rheme" and "theme" (Firbas 1964 and references cited there), or "comment" and "topic" (Chomsky 1965:221, Dahl 1974). 21

Such distinctions pertain to discourse grammar in that they determine "the relation of the utterance to . . . utterances to which it is a possible response, and to other sentences in the discourse" (Chomsky 1970:205). For example, in the context of a question like (44a), which introduces John into the discourse and shows ignorance of his actions, an appropriate answer will have John as part of the presupposition (or old information, or theme, or topic) and the VP as the focus (or new information, or rheme, or comment). Conversely, in (45b), the answer to (45a), John will be the focus and the VP the presupposition.

(44) a. What did John do?
    b. \[\text{John} \; [\text{left}].\]

(45) a. Who left?
    b. \[\text{John} \; [\text{left}].\]

The absolute prominence of the sentence falls in both cases on the phrase that constitutes the focus, the VP left in (44b), and the subject NP John in (45b). Note that in neither case is any contrastive or emphatic stress necessarily involved. For this reason the stress contour of (45b) has occasionally been taken to be an exception to Chomsky and Halle's Nuclear Stress Rule (see Schmerling 1976).

But this is not really so. One must distinguish the formal sentence grammar procedure that determines where the prominence of a phrase will be located (the Nuclear Stress Rule or the null alternative discussed above) from the discourse grammar pro-

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21 I don't mean to say that these dichotomies exactly correspond to each other (see Gundel 1977:chap. 2 for a review of the various traditions), but they all seem to try to separate the part of a sentence that provides information "assumed by the speaker not to be shared by him and the hearer" from the part "assumed to be shared" (Jackendoff 1972:230).
cedure that determines that the prominence of the phrase in focus will win out, in relative terms, over that of the presupposed phrase.

That the two procedures are indeed different, and must be distinguished, is shown by the fact that the formal procedure is at work both in the phrase constituting the focus and in the phrase constituting the presupposition, as we see from cases slightly more complex than (44) or (45) (where **** is less prominent than *** in absolute terms):

(46) a. (Any news of John?)
   [NP Our poor child] [VP is in bed with a 'flú].

b. (Who's in bed with a 'flú?)
   [NP Our poor child] [VP is in bed with a 'flú].

Both the presupposition (the NP in (46a) and the VP in (46b)) and the focus (the VP in (46a) and the NP in (46b)) have a detectable prominence, determined by the formal sentence grammar procedure, which applies blindly to each phrase.

The fact that in both cases the prominence of the phrase in focus will ultimately be higher than the prominence of the phrase constituting the presupposition is a different matter (see Jackendoff 1972:237). In this light, the sentence grammar procedure of phrase stress assignment can be conceived of as a formal means for locating the main stress of a phrase (the most deeply embedded constituent under the null theory), and for marking the relative degree of prominence of the various stresses in the phrase (in terms of the respective number of asterisks in the metrical grid). The discourse grammar procedure instead may be taken to impose the requirement that the main stress of the phrase in focus be more prominent than the main stress of the presupposition (in absolute terms).

The well-known ambiguity in focus of a sentence like (47) (Chomsky 1970)—where,

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22 As expected, when a VP is preposed, it is the rightmost constituent in Italian and the constituent left-adjacent to the V in German that receive VP-internal prominence, irrespective of whether the VP constitutes the focus or the presupposition:

\[
\begin{array}{c}
\text{P} & \text{F} \\
(i) & a. \quad [VP \text{ Venduto la màcchina}] \text{ ancora non hà.} \\
& \quad \text{sold the car yet not he has} \\
& \quad \text{‘Sold his car, he hasn’t yet.’} \\
& \quad \text{P} & \text{F} \\
& b. \quad [VP \text{ Sein Àuto verkauft}] \text{ hat er noch nicht.} \\
& \quad \text{his car sold has he not yet} \\
& \quad \text{‘Sold his car, he hasn’t yet.’} \\
& \quad \text{F} & \text{P} \\
(ii) & a. \quad [VP \text{ Venduto la màcchina}] \text{ pare che ábbia.} \\
& \quad \text{sold the car it seems that he has} \\
& \quad \text{‘Sold his car, it seems he has.’} \\
& \quad \text{F} & \text{P} \\
& b. \quad [VP \text{ Sein Àuto verkauft}] \text{ hat er schon.} \\
& \quad \text{his car sold has he already} \\
& \quad \text{‘Sold his car, he has already.’} \\
\end{array}
\]
as shown by the variety of answers in (48), any of the phrases indicated can be focus—is a direct consequence of the interplay of the two procedures. (I follow here Chomsky’s convention of capitalizing the word bearing the most prominent stress.)

(47) Was he [warned [to look out for [an ex-convict [with a red [SHIRT]]]]?  
     (48) a. No, he was warned to look out for an ex-convict with a red [TIE].  
           b. No, he was warned to look out for an ex-convict [with a CARNATION].  
           c. No, he was warned to look out for [an AUTOMOBILE salesman].  
           d. No, he was warned [to expect a visit from the FBI].  
           e. No, he was [simply told to be more CAUTIOUS].

The ambiguity arises from the fact that the most prominent stress of a phrase will be located by the formal procedure on the most deeply embedded constituent of the phrase, and the fact that the noun shirt qualifies as the most deeply embedded constituent of all of the phrases indicated in (47), each one potentially qualifying as focus.\(^{23}\) If the main stress were on red, the ambiguity would disappear, since that is the most deeply embedded constituent only of the dominating AP, not of the NP containing it, nor of any other more comprehensive phrase. Hence, main stress on red would be compatible only with the AP being in focus.

Depending on context, the most deeply embedded constituent of a focus phrase (where the formal procedure would predict the main stress to fall) may happen to be old information, thus qualifying as part of the presupposition rather than of the focus. For example:

(49) a. I’d give the money to Mary, but I don’t TRUST Mary. (Schmerling 1976: 59)  
       b. Has John read Tristram Shandy? He doesn’t READ novels.

In this case the constituent is destressed, the main stress falling on the most deeply embedded constituent left in the phrase that qualifies as focus. Such destressing is possibly a consequence of the “marginalization” of the presupposed constituent (Antinucci and Cinque 1977, Calabrese 1990), whereby it is removed from its base position and adjoined to some higher node, thus ceasing to be the most deeply embedded constituent of the phrase.

Certain elements, such as anaphoric pronouns and epithets, are inherently old information, so to speak—hence marginalized (50a), unless specially contrasted (50b).

\(^{23}\) Certain languages appear to be able to disambiguate cases like (47). In Polish, if the most deeply embedded constituent is stressed on the initial syllable rather than regularly on the penult, only that constituent may be focus. See the contrast between (ia) and (ib), noted by Dogil (1980:225f.), who points out that only in the latter case can any of the phrases indicated be focus.

(50) a. [ważność [komunikacji [SAmochodowej]]]  
       b. [ważność [komunikacji [samochoDOwej]]]  
       the importance of traveling by car
(50) a. I’d give the money to JOHN, but I don’t TRUST him/that bastard. (Schmerling 1976:71)
   b. John insulted Mary, and then SHE insulted HIM. (Lakoff 1968)

Other possibilities exist, but the few remarks just made should be sufficient to justify postulating the two different procedures for stress assignment. Failure to distinguish them has led certain authors to deny the existence of a formal means to predict the location of the most prominent stress of a phrase based on structural principles. But we have just seen that their conclusion is not warranted.

Nonetheless, their work provides important insights on the not always easy task of determining what counts as focus in a certain discourse, and in out-of-the-blue contexts. Concerning the latter, for example, from Schmerling’s (1976:41f.) discussion of the minimal pair of out-of-the-blue sentences in (51), one can surmise that determination of focus and presupposition may depend on knowledge of the world’s events.

(51) a. Truman DIED.
   b. JOHNSON died.

As Schmerling recalls, when (51a) was uttered President Truman had been written and spoken of by the news media for some time because of his ill health; so it was appropriate to consider him as part of the presupposition, whereas the news was the termination of his critical state. President Johnson, instead, died somewhat unexpectedly. He was not on people’s minds as Truman had been, so it would have been inappropriate to take him as part of the presupposition.

Given that the entire event was new, one may wonder why stress on the VP could not have served as the unmarked stress pattern in this case too in which the entire CP is in focus. After all, V is more deeply embedded than the subject N, since it is dominated by its own projections plus at least the projections of T and Agr (Pollock 1989, Belletti 1990, Chomsky 1991).

An answer may come from a comparison with those languages, like Italian, in which the subject may remain in its D-Structure position. In Italian the sentences appropriate to the above contexts are (52a) for (51a), and (52b) for (51b), not (52c), the word-by-word translation of (51b). (See Dezsö 1982:118f. for similar remarks on Russian.)

(52) a. Truman è MORTO.
   b. E’ morto JOHNSON.
   c. (*)JOHNSON è morto.

(52b), as a report for a totally new event, is expected if the subject is in the D-Structure

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object position. This is because it qualifies there as the most deeply embedded constituent of (the VP and) the entire CP.\textsuperscript{25}

The inappropriateness of (52c) in the same context would follow if a preverbal subject (in the Spec of Agr\_S) were necessarily part of the presupposition. This is in fact just what Guérón (1980) suggests on partly similar grounds. See, in particular, her distinction between predication sentences (like (51a)), in which the preverbal subject is presupposed, and presentation sentences (like (51b)), most common with verbs of appearance, in which “the subject is the (unmarked) Focus” (p. 659). (Also see Firbas 1964, Allerton and Cruttenden 1979, Culicover and Rochemont 1983:fn. 34, Faber 1987).

Given that no postverbal subject is possible in English (*Died JOHNSON), the subject must move to the Spec of Agr\_S. This, however, would give rise to a predication sentence in which the subject is presupposed and the predicate is focus—an inappropriate state of affairs in such contexts where the entire event is new. The way out apparently consists in marking the least predictable element in the event (the subject) as focus while treating the predicate as presupposed (dying is one of the possible accidents that may occur to someone), in a kind of weighing of relative predictability.\textsuperscript{26}

\textsuperscript{25} Nothing changes even if proper names, as definite NPs, cannot remain in situ, but must raise to the postverbal VP subject position of transitive and unergative verbs (Belletti 1988). (However, for evidence that proper names behave more like indefinite than definite NPs, hence can remain in situ, see Benincà 1991:fn. 5, where the relevance of such cases as All'improvviso è entrato Giorgio dalla finestra 'Suddenly entered Giorgio from the window' is noted.) This is because the V (whether finite or participial) moves out of VP, to the respective Agr position, thus leaving the subject as the most deeply embedded constituent anyway. This can be seen with sentences containing unergative verbs denoting types of ordinary happenings. (i), for example, can be uttered in out-of-the-blue contexts where the entire event is new (not just Gianni).

(i) Ha telefonato GIANNI.
has telephoned Gianni
'Gianni has telephoned.'

(ii), however, is possible only if Gianni alone is in focus and V plus object is the presupposition:

(ii) a. Ha telefonato a me GIANNI.
has telephoned me Gianni
'Gianni has telephoned me.'

b. Ha telefonato la notizia IL NOSTRO CORRISPONDENTE.
has telephoned the news our correspondent
'Our correspondent has telephoned the news.'

\textsuperscript{26} The focus/presupposition structure of intransitive sentences with unaccusative verbs in English appears to be preserved under embedding:

(i) a. I just heard that Truman DIED.
b. I just heard that JOHNSON died.

The impossibility in Italian of the word-by-word translation of JOHNSON died in the same context is presumably related to the existence of the less marked option (52b). It is possible that such unmarked stress patterns as (iia–c), reported by Schmerling (1976:21f.), should fall under the same generalization.

(ii) a. There is a CAR coming.
b. I don't know what I'm going to do—I don't have any money and the RENT's due.
c. You left the WATER running.

Interestingly, the corresponding Italian sentences cannot have the same contour, but instead have rightmost prominence (or subject inversion).
Other well-known minimal pairs, possibly susceptible to similar treatment via computation of relative predictability, are (53a–b) and (54a–b), from Bolinger 1972.

(53) a. I have a POINT to make.
b. I have a point to EMPHASIZE.

(54) a. The end of the chapter is reserved for various PROBLEMS to solve.
b. The end of the chapter is reserved for various problems to COMPUTERIZE.

Indeed, Bolinger notes, “In phrases like . . . work to do, clothes to wear, . . . , the verb is highly predictable: . . . clothes are to wear, work is to do, . . . . Less predictable verbs are less likely to be deaccented. Where one has leçons to learn, one will probably have passages to mémorize” (1972:633–634). (For remarks along similar lines, see Berman and Szamosi 1972:312.)

In this context, the stress properties of a sentence like [[The author [of many popular articles [on the effects [of senescence]]]] [died]], mentioned in section 4 as a potential difficulty for the null theory, ceases to be problematic. The most prominent stress will fall either on the subject (in which case it will be located on its most deeply embedded constituent senescence) or on the predicate (died), depending on which of the two constitutes the focus portion of the sentence. (In this connection, also see the discussion at the end of section 7.)

Other cases undoubtedly deserve specific discussion. Many English stress patterns are still poorly understood or unanalyzed, as are a number of cross-linguistic differences. However, it seems that, whatever the results turn out to be, they should not affect the main point of this section, namely, that a formal sentence grammar procedure

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27 It is however not inconceivable that such contrasts have a structural basis. I leave the question open. (53a) is the same type of case, originally observed by Newman (1946), that led Bresnan (1971, 1972) to propose that the Nuclear Stress Rule applies at the end of each syntactic (NP and S) cycle rather than on surface structure. Quite apart from the difficulty of translating some of Bresnan’s assumptions into the present theory, her suggestion is not without empirical problems, as Lakoff (1972) and Berman and Szamosi (1972) pointed out. Bresnan (1972:332ff.) in fact acknowledges one such problem. Another is provided by the Italian facts discussed here in footnote 28. For further critical discussion of Bresnan’s proposal, see Selkirk 1984:239ff.

28 All in all, it seems that there is no real motivation for abandoning Chomsky and Halle’s (1968:15) insight that “[stress] contours are determined in some manner by the surface structure of the utterance.” Of course, what interferes is the discourse grammar procedure, sensitive to the focus and presupposition articulation of the sentence.

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28 For example, it appears that Italian differs systematically from English in generally not allowing primary stress in nonfinal position (in nonemphatic contexts). Many of Bresnan’s (1971) contrasts thus appear to be neutralized in Italian. For example:

(i) a. Ho istruzioni di PARTIRE.
    I have instructions to LEAVE
b. Ho istruzioni da LASCIARE.
    I have INSTRUCTIONS to leave
(possible: Ho da lasciare ISTRUZIONI.)

(ii) a. John chiese cosa Helen avesse SCRITTO.
    John asked what Helen had WRITTEN
b. John chiese quali libri Helen avesse SCRITTO.
    John asked what BOOKS Helen had written
of phrase stress assignment should be carefully distinguished from a discourse grammar procedure that favors the main stress of the phrase in focus over the main stress of the phrase constituting the presupposition.

7 Some Residual Questions and a Refinement

In this section I will first consider certain structures displaying a stress pattern that is at first sight problematic for the null theory. In each case we will see that alternative analyses exist in the literature, or appear to be plausible on closer scrutiny, which are indeed compatible with the null theory. One residual class of cases will also point to a particular refinement of the system proposed above. Consider, to begin with, (55a–b).

(55) a. Loro stanno seguendo la lezione attentamente.
    b. They are following the lecture attentively.

In both Italian and English the greatest prominence of the sentence is, under normal conditions, on the adverbial phrase (AdvP), the rightmost constituent. This is unexpected if the sentence structure is that shown in (56), the one assumed traditionally.

(56)

Here, the most deeply embedded constituent is the object N (even abstracting from the extra DP projection) and consequently it, of all the VP constituents, should receive the greatest prominence. Given this structure, the only way for the AdvP to bear greatest prominence would be for it to be the only constituent in focus, with *stanno seguendo*

(iii) a. Giorgio ha trovato qualcuno che vorrebbe che tu INCONTRASSI.
    Giorgio found someone he'd like you to MEET
    b. Giorgio ha trovato degli amici che vorrebbe che tu INCONTRASSI.
    Giorgio found SOME FRIENDS he'd like you to meet
la lezione/they are following the lecture constituting the presupposition (as is the case in the context of a question like How are they following the lecture?). But this is clearly not necessary. (55b) can be an answer to What are they doing?, with the entire VP as focus.

Fortunately, there is evidence that (56), the traditional syntactic analysis of such cases, is incorrect. Larson (1988:fn 11 and 49) and Stroik (1990), extending Barss and Lasnik’s (1986) analysis, provide evidence that objects asymmetrically c-command VP adverbials (at least) at S-Structure. Hence, a more accurate representation of (55a–b) would be something like (57), where the AdvP indeed qualifies as the most deeply embedded constituent of the VP.29

(57) . . . IP
    NP
      loro
      they
    I
    stanno
    are
    VP
    V
    seguendo
    following
    NP
    la lezione
    the lecture
    V
    Vp
    AdvP
    attentamente
    attentively

29 Stroik (1990) derives this particular c-command relation between objects and VP adverbials on the basis of object-adverbial asymmetries such as the following (p. 656):

(i) Negative polarity
   a. John saw no one anywhere.
   b. *John saw anyone nowhere.

(ii) Superiority
   a. Who did you see where?
   b. *Where did you see who?

(iii) Bound pronouns
   a. I saw everyone the day before he did.
   b. *I see a man who plays Santa on it every Christmas.

The double VP structure with movement of the V from head to head is Larson’s.
If so, the unmarked stress pattern of (55) with main stress on the VP adverbial is precisely what the null theory predicts.  

If the first object of the double object construction in English (the "dative") asymmetrically c-commands (is higher than) the second (see Kayne 1984, Barss and Lasnik 1986, and Larson 1988), then the fact that the second object bears greatest prominence in the VP is expected under the null theory, since it is more deeply embedded. Analogously, if direct objects asymmetrically c-command prepositional objects (Larson 1988), it is no longer surprising that prominence will fall on the latter.

Another potentially problematic case is represented by heavy NP shift. Consider the following alternations:

(58) a. Loro ricordarono l’appuntamento a Carlo.
   they reminded the appointment to Carlo
   ‘They reminded Carlo of the appointment.’
   b. Loro ricordarono a Carlo l’appuntamento (che gli avevano dato).
   they reminded to Carlo the appointment (that they had given him)
   ‘They reminded Carlo of the appointment that they had given him.’

(59) a. Gianni incontrò il figlio arrabbiato.
   Gianni met his son angry
   b. Gianni incontrò arrabbiato il figlio.
   Gianni met angry his son

(60) a. Carlo parlò a Maria di noi.
   Carlo spoke to Maria about us
   b. Carlo parlò di noi a Maria.
   Carlo spoke about us to Maria

In such cases too the greatest prominence is on the rightmost constituent, whatever that is.

This would follow once again from the null theory if we were to adopt Larson’s (1988, 1990) general approach, with its uniform rightward downward branching: "... elements appearing on the right ... are typically lower in the phrase marker than elements to their left" (1990:591)—hence, we expect, will bear greater prominence.  

30 If speaker-oriented adverbs like probably are not under VP, but under some higher functional projection (see Belletti 1990), then the null theory predicts that they will not bear greatest prominence even when rightmost in the sentence—a correct result. For example:

   (i) a. Giorgio è uscito, probabilmente.
       (vs. *Giorgio è uscito probabilmente.)
   b. Giorgio léft, probably.
       (vs. *Giorgio left probably.)

31 As Richard Kayne (personal communication) has noted, the prediction is not always fulfilled, though. For example, particles, in some contexts, cannot bear the greatest prominence of the VP (and sentence), even if they are the rightmost constituent:

   (i) John threw a book away.
such cases Larson suggests a rule of *light predicate raising*, which moves the V + XP sequence, reanalyzed as V, leftward around the object.

This particular analysis faces a problem in Romance, where finite Vs raise to Agr, across temporal and aspectual adverbs. These adverbs can separate the V from the XP, and moreover cannot intervene between the putatively reanalyzed V + XP sequence and the heavy-NP-shifted object:

(61) a. Maria non ricorda mai a Carlo gli appuntamenti di lavoro.
   ‘Maria never reminds Carlo of business appointments.’

   b. *Maria non ricorda a Carlo mai gli appuntamenti di lavoro.

(62) a. Gianni non incontra più arrabbiato il suo direttore.
   ‘Gianni no longer meets his boss angry.’

   b. *Gianni non incontra arrabbiato più il suo direttore.

All this suggests that the V raises alone across such adverbs and cannot in fact be treated as part of a complex V including the XP. If it is the case that the heavy-NP-shifted element must be the only constituent in focus (cf. Rochemont’s (1978:33) term focus NP shift), then there is no problem for the null theory even if the NP is right-adjointed to VP (hence is not the most embedded constituent). This is because, as noted, the main stress of the focus constituent is the most prominent stress.

A possible alternative, compatible with Larson’s general approach, would be to assume a *light XP shift*, which adjoins the oblique complements (or adjuncts) leftward across the NP object, much as is generally assumed for German, which would thus look more similar to English and Italian, modulo the rightward raising of the V to Agr.\(^{32}\) It

This cannot be due to their inability to bear main stress, as shown by the following cases:

(iii) a. John threw it away.
   b. What did John throw away?

Kaye (1985) provides evidence that these constructions involve a "small clause" particle phrase, where the object is in fact the subject of an intransitive particle:

(iii) John [VP threw [Part [a book] [Part [Part away]]]].

If this is so, the possibility arises of extending to these cases the focus/presupposition analysis of English intransitive clauses with verbs of appearance, discussed in footnote 26 and the corresponding text. The systematic difference with Italian noted there is, suggestively, found here too: *Un libro ha buttato [John ha buttato [un libro via]]* (unless *un libro is contrasted) versus *John ha buttato [via un libro].*

Other cases where as expected the rightmost constituent cannot bear the greatest prominence of the sentence are, as already noted, those with sentence-final speaker-oriented adverbs (*John left probably*) and other types of adjuncts. The well-known ambiguity of *John doesn’t beat his wife because he loves her*, where the adjunct can be either inside VP, within the scope of the negation, or outside it, appears to correlate systematically with two different stress patterns, consistent with the null theory.

\(^{32}\) Note that the German VP is not a perfect mirror image of English and Italian VPs. As a matter of fact, the three languages essentially show the same domain asymmetries, with direct objects higher than complement PPs, locative PPs, and adverbials.

For an interesting account of this apparent asymmetry between English and German (actually between
may be that such PP alternations as those in (60a–b) are not to be treated as cases of heavy NP shift (or light XP shift). (For discussion, see Larson 1990.)

Another question is raised by coordinate structures. As has occasionally been noted (by Kiparsky (1966:82ff.), among others), the last conjunct of a coordinate structure usually bears greatest prominence:

(63) a. \[[2\text{Kafka's Werke}] \text{und} [3\text{die moderne Novelle}]\]
    b. \[[2\text{[Kafka's works]} \text{and} [3\text{the modern short story}\,]\]
    c. \[[2\text{[le opere di Kafka]} \text{e} [3\text{la novella moderna}]]\]

This is unexpected under the null theory if coordination is symmetric, as often assumed:

(64) \[
\begin{array}{c}
\text{XP} \\
\text{XP and XP}
\end{array}
\]

However, in this case, too, there is some evidence for an asymmetric representation of coordination in which the last conjunct is more deeply embedded than the others. Ross (1967:162–167) presents both syntactic and phonological evidence that the coordinating conjunction forms a constituent with the following conjunct, so that a more appropriate representation of (63) would be (65) rather than (64).

(65) \[
\begin{array}{c}
\text{XP} \\
\text{XP and XP}
\end{array}
\]

Kayne's (1984) binary branching requirement for syntactic structures provides an additional conceptual reason to prefer (65) over (64). He has, in fact, explicitly argued (in Kayne 1983) that coordinating conjunctions should be treated as heads (in X-bar terms) of a maximal projection (for similar claims, see Munn 1987 and Larson 1990:595ff.). If so, coordinate structures are entirely compatible with, and in fact support, the null theory of phrase stress.

Admittedly, other questions that deserve attention remain open. Should the null theory withstand a wider and deeper scrutiny, then it would not be unreasonable to use it to question certain syntactic analyses that do not conform with its predictions.

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VO and OV languages), see Haider 1991. Haider's arguments to the effect that Universal Grammar permits rightward downward branching, but no leftward downward branching, provide a straightforward explanation for the fact that in VO languages it is the rightmost constituent of the VP that bears greatest stress, whereas in OV languages it is not the leftmost constituent of the VP, but the constituent to the immediate left of the V. (See section 8 below.)
There is still one class of facts that are apparently not reconcilable with the assumptions granted so far, and that point to a particular refinement of the present analysis. In section 6 we saw how the unexpectedly possible stress prominence of the predicate in a sentence like \([[[\text{The author} \ [\text{of many popular articles} \ [\text{about the effects} \ [\text{of senescence}]\]] \ [\text{died}]]\]]\) could be rendered compatible with the null theory by taking into consideration an independent dimension of the sentence: its articulation into focus and presupposition. The same account is not available, however, for the comparable situation found in NPs. Consider the following examples, pointed out by Richard Kayne and Morris Halle (personal communications), respectively:

\begin{align*}
(66) \ a. \ \text{[the [man [from [Philadelphia]]]]'s hát} \\
\quad \text{b. [der [[von sieben [jungen [Italienern]]] entdeckte] Ímpflöft]} \\
\quad \text{the by seven young Italians discovered vaccine}
\end{align*}

These phrases are not internally partitioned into a focused and a presupposed part. Rather, they are usually themselves part of the focus or the presupposition of the sentence in which they appear. Yet in spite of the specifier's complexity, the main stress falls on the head. This suggests the need to refine the procedure of grid construction utilized above (see (10)).

One way of drawing a principled distinction between heads and complements on one side and specifiers on the other would be to capitalize on how the property of recursion (namely, the property of having a certain category dominated by a category of the same type, ad infinitum) is realized within a phrase. It is well known that the complement, not the specifier, introduces recursion, so that depending on the relative position of the complement and the head a language will be right-recursive (say, Italian) or left-recursive (say, Japanese). (I abstract from the case of mixed languages, where the position of the complement with respect to the head may vary from phrase to phrase.)

That there is a real asymmetry between the recursive and the nonrecursive sides is shown by the fact that (as has often been noted) the side opposite to that of the complement has only limited, or selective, recursion, at least for the lexical phrases NP, AP, AdvP, VP, and PP (see Zwarts 1974, Emonds 1976:19, 1985:130ff., Williams 1982, and Longobardi 1991a:95–100). The asymmetry in question can be roughly characterized as follows: When on the recursive side, recursion is possible either to the recursive or to the nonrecursive side. When on the nonrecursive side, recursion is possible only to the same nonrecursive side.\(^{33}\)

The latter property is exemplified by the following cases, simplified for convenience:

\begin{align*}
(67) \ a. \ \text{He is a [\text{NP proud ("of his children") father}]}. \\
\quad \text{b. He was [\text{AP less ("than us") sympathetic}]}. \\
\quad \text{c. He walks [\text{AdvP more ("than us") rapidly}]}.\\
\end{align*}

\(^{33}\) Emonds (1985) refers to this restriction as the "Recursion Restriction," and Longobardi (1991b) refers to it as the "Consistency Principle." The notion of "recursive side" is Emonds's (1976:19).
d. He [VP specially (*for us) made the cake].

e. The boat was [PP three miles (*further than Sue's) off the coast].

As noted by Emonds and Longobardi, this restriction does not hold for (certain) functional projections, free right recursion being allowed in the specifier positions of CP, AgrP, and DP. For example:

(68) a. [CP On which day of the week [C' are they coming]]?

b. [AgrP The destruction of the documents [Agr' was deliberate]].

c. [DP the man from Philadelphia's [D' hat]]

Now, according to the null theory, a consequence of the general principles of grid construction is that location of the main stress is simply a function of depth of embedding. Qualifying this notion, suppose we take it to involve consideration of the recursive side of a phrase in such a way that the relevant notion of embedding is now limited to the continuous path uniting from the bottom all and only the nodes found on the recursive side and on the X-bar projection line of a phrase up to the node that is expanded on the nonrecursive side. A simple example, (69), will illustrate this idea.

(69)

\[\begin{align*}
&\text{X''} \\
&\quad \text{W''} \quad \text{X'} \\
&\quad \quad \text{W'} \quad \text{X} \quad \text{Y''} \\
&\quad \quad \quad \text{W} \quad \text{K''} \quad \text{Y'} \\
&\quad \quad \quad \quad \text{K'} \quad \text{Y} \quad \text{Z''} \\
&\quad \quad \quad \quad \quad \text{K} \quad \text{Z'} \\
&\quad \quad \quad \quad \quad \quad \text{Z}
\end{align*}\]

One path of embedding is that which unites Z to X'' (Z, Z', Z'', Y', Y'', X', X''). It is a well-formed path of embedding since all the nodes that it connects are either on the X-bar axis (Z, Z', Z'', Y', Y'', X', X'') or expanded on the recursive side (assuming recursion to be fixed to the right). Another is the path of embedding uniting K to W''. By contrast, the path of embedding uniting K to X'' is ill formed, since it contains at least one branch, (W'', X''), that is neither on the X-bar axis nor on the recursive side.

Furthermore, let the main path of embedding be that path which has the root of the constituent as one of its extremities (in (69), the path connecting Z to X'').

Qualifying the notion of embedding in this way, we obtain, as a consequence, that recursion of the specifier of CP, AgrP, and DP be considered a separate (minor) path
of embedding. If so, it is not unreasonable to take the principles of grid construction to operate on this path on a separate cycle.

Assume, further, that when a minor path of embedding joins the main path (i.e., when the minor cycle joins the main cycle), only the end result of the former is visible in the form of a single asterisk. This implies that no matter how complex the specifier of CP, AgrP, and DP, it will never win over a complement, or, in the absence of one, over the head. Consider the simplified structures (70a–b), which underlie (71a) and (71b), respectively.

(70) a. \[\text{XP} \quad \text{YP} \quad \text{X'} \quad \text{ZP} \quad \text{X} \quad \text{ZP}\]
    \[\ast \quad \ast \quad \ast \quad \ast \quad \ast \quad \ast\]

(71) a. the man from Philadelphia’s letter to the dean
    b. the man from Philadelphia’s letter

In (70a), where the complement is present, the complement will prevail over the head (and the specifier), since its head will be the first to receive an asterisk (it being the most deeply embedded constituent on the main path of embedding). When no complement is present, as in (70b), the head of the phrase will qualify as the most deeply embedded constituent. This is because the internal structure of YP is visible at the level of the main cycle only in its end result, in the form of a single asterisk. Since the head receives an additional asterisk at the X’ level, it will also attract the asterisk of the XP level. This refinement thus appears to have the correct empirical consequences for the stress contour of the apparently problematic cases (66a–b).\(^{34}\)

It may also shed some light on the observation made in section 6 (following considerable tradition) that a sentence with a preverbal subject cannot count as a single

\(^{34}\) It also appears to make the correct prediction for the stress contour of conjuncts under the X-bar analysis of coordination discussed above. According to that analysis, the conjunction is the head of an X-bar projection taking (as a first approximation) the two conjuncts as its specifier and head, respectively ([XP [and XP]]). In head-initial languages, this will imply, then, that however complex the first conjunct is, the main stress will fall on the second, since the former is on the nonrecursive side. This indeed appears to be true:

(i) [[il primo | dei due autori | del libro | [di poesie]]] e [Mário]
    the first of the two authors of the book of poems and Mario

This refinement of the null theory has both some points in common (in enhancing the role of complements) and some points of divergence (in allowing heads to win over specifiers) with Duanmu’s (1990:chap. 4) notion of “nonhead stress” (“whereby in a head-nonhead relation, the stress is assigned to the nonhead”; p. 174). In the present system, the cases cited by Duanmu where a specifier appears to have more prominence than the head could perhaps be interpreted as compounds, as suggested by Selkirk (see Duanmu 1991).
focus constituent (as opposed to one with a postverbal subject in an unaccusative structure). Either the subject is focus and the predicate is presupposition or vice versa. In this framework, what prevents the entire sentence from counting as a single focus is the fact that it is made up of two distinct paths of embedding. An unaccusative structure with an inverted subject in situ is different, being in fact made up of a single path of embedding.

8 Some Typological Evidence for the Null Theory

As we have seen, according to the null theory, a phrase's main stress is located on its most deeply embedded constituent. This is ordinarily the innermost complement of the phrase head; hence, the location of the main stress is expected to covary with the location of the innermost complement, as determined by the head-complement parameter. Thus, in a VP, main stress should be to the right of V in VO languages and to its left in OV languages.

Caution is needed, however, since this is one of a number of simplifications. For example, in section 5 we noted that the D-Structure innermost complement of a head can be moved higher up in the tree so that another constituent ends up as the most deeply embedded constituent, consequently receiving the main stress.

The responsible way to proceed in checking the correctness of the correlation would be to reach a perfect understanding of the S-Structure constituency of the language, and then consider its stress patterns—a hardly feasible task. Nevertheless, it is possible to find in the literature some (at least) suggestive evidence going in the direction of what the null theory predicts.

Maling (1971) observes that a version of the Compound Rule (which gives prominence to the leftmost element of a constituent) "applies to all categories and nodes (except prepositional phrase)" in Old English (p. 382) and that this appears to be connected to the verb-final nature of the language (p. 382, fn. 1).

McCawley (1977:273) notes that the Nuclear Stress Rules of English and Japanese are "mirror images" of each other ("the rule that the first accent in a constituent predominates is the Japanese analogue to the English 'nuclear stress rule' (Chomsky and Halle 1968), according to which the last accent in a constituent predominates"). The correlation with the head-final character of Japanese phrases (Kuno 1973) and the head-initial character of English phrases seems hardly accidental.

In a more comparative vein, Donegan and Stampe (1983:337), contrasting typologically the Munda family of languages with the Mon-Khmer family, make the important observation that phrase stress correlates with constituent order, so that in the Munda languages, whose phrases are head-final ("operator-first," in their terminology), the phrase stress is phrase-initial (e.g., ['O V]), whereas in the Mon-Khmer languages, whose phrases are head-initial, the phrase stress is phrase-final ([V 'O]).

Similar general observations are also found in the more traditional typological lit-
erature, in particular in Dezső's work on the typology of theme-rheme structure and sentence stress (see Dezső 1974, 1977, 1982). Basing his work on data from Uralic, Altaic, and some Indo-European languages, Dezső suggests that in SOV languages "the usual place of sentence stress and hence of rheme is the position immediately preceding the verb," whereas in SVO languages "the usual place of sentence stress is after the verb either in an immediately postverbal position or after an unstressed element" (1977:7). (Also see Dezső 1982:149f.) Although in his theoretical framework sentence stress is determined by theme-rheme structure (and only indirectly by word order), in practice Dezső relates accentuation typology to word order directly—a revealing insight.

Dezső's results are confirmed and further extended in Kim's (1988) study, where Dezső's word order–stress correlation is found to obtain in other language families. The SOV languages examined there in which the unmarked focus (and sentence stress) falls in the position immediately preceding the V are Telugu, Laccadive Malayalam, and Tamil of the Dravidian family, Dogri, Bengali, Gujarati, and Hindi-Urdu of the Indo-European family,\(^{35}\) Sherpa of the Sino-Tibetan family, Mongolian and Turkish of the Altaic family, and Japanese and Korean. For work along the same lines, devoted to mixed languages (Hungarian, German, etc.), also see Harlig and Bardovi-Harlig 1988. Another mixed language, apparently, is Afghan Persian, as discussed by Bing (1980).

9 On the Stress Pattern of Compounds

Since the dependence of compound stress on the internal constituency of the compound is (if anything) even more striking than that of phrases, it is tempting to try to extend the null hypothesis of phrase stress to compounds as well. Ideally, one should be able to derive the stress pattern of compounds from the stresses of the component words, the internal constituent structure of the compound, and the metrical grid theory, without recourse to any language-specific rule. As with the stress of phrases, any cross-linguistic difference should reflect the different structural relations into which the component words enter within the compound, possibly subject to parametric choices (see footnote 39). In what follows, I will show that this appears to be possible for the three languages we have been examining, under a finer-grained analysis of the constituent structure of compounds. Should the analysis prove correct more generally, then no language-specific Compound Stress Rule would be needed anymore—undoubtedly a desirable result.

In English two-word compounds, the classical Compound Stress Rule "assigns primary stress to the first of the two peaks, reducing all other stress levels by one" (Chomsky and Halle 1968:92):\(^{36}\)

\[
\begin{align*}
(72) \ a. \ & [[\text{kitchen}] \ [\text{towel}]] \\
& \text{[4 3]} \\
\ b. \ & [[\text{towel}] \ [\text{rack}]] \\
& \text{[4 3]} \\
\ c. \ & [[\text{teachers}] \ [\text{union}]] \\
& \text{[4 3]}
\end{align*}
\]

\(^{35}\) For a different picture of Bengali phrase stress, however, see Hayes and Lahiri 1991:sec. 3.

\(^{36}\) I assume here, as above, that 3 represents the highest degree of word stress.
More interesting is the case in which one of the two component words is itself a binary compound:

(73) a. [[[kitchen] [towel]] [rack]]
    b. [[kitchen] [[towel] [rack]]]

Here, depending on the direction of branching (left branching in (73a) and right branching in (73b)), the stress contour changes.\(^{37}\)

In the first case the most prominent stress falls on *kitchen*, the leftmost subcomponent of the leftmost element of the compound. In the second case it falls on *towel*, the leftmost subcomponent of the rightmost element of the compound.

The stress pattern of (73a) requires no particular modification of the classical rule handling two-word compounds. It follows from a cyclic application of the rule. In the innermost constituent, prominence is assigned to the leftmost peak *kitchen*, and in the outer constituent it is assigned to *kitchen* as well, since this word is also the leftmost peak of the outer cycle.

Matters are not as simple with the stress pattern of (73b). Right-branching compounds such as this one require a special qualification in Chomsky and Halle’s (1968: 93) system, and have called for some special statement in all treatments of compound stress since then. In Liberman and Prince 1977, the *iff* clause of their Compound Stress Rule (8b), repeated here as (74), is motivated by just such cases.

(74) In a configuration \([c \ A \ B \ c]\), if \(C\) is a lexical category, \(B\) is strong *iff* it branches.

In Halle 1985 and Halle and Vergnaud 1987, Liberman and Prince’s *iff* clause is rephrased as a condition on the retraction of stress (my italics):

(75) In a constituent \(C\) composed of two or more words, retract the right boundary of \(C\) to a position immediately before the head of \(C\), provided that \(C\) is dominated by a lexical category and *that the head of \(C\) is located in the last word of \(C\).*

Although both (74) and (75) derive the correct stress pattern of (root) compounds, one cannot help wondering why the rule should contain those very conditions and not others. No principled reason appears to exclude that the condition for (74) be “*iff* A branches,” or that of (75) “*(provided) that the head of \(C\) is located in the penultimate word of \(C\).*”

It seems that the correct theory of compound stress should derive as necessary the fact that the most prominent stress falls on \(A\) in the left-branching structure (76a), and on \(B\) in the right-branching structure (76b).

\(^{37}\) The difference in the direction of branching, which implies in one case that *kitchen* and *towel* form a unit and in the other that *towel* and *rack* form a unit, correlates with a predictable semantic difference: ‘rack for kitchen towels’ vs. ‘towel rack in the kitchen’ (see Chomsky and Halle 1968:93).

In this and similar cases, syntactic (subword) structure mediates the correlation between stress patterns and semantic interpretations. I will come back to this question later.
The null theory of phrase stress appears to have precisely these consequences under an analysis of the internal structure of compounds that in part modifies the standard analysis along lines that can be independently motivated.

For compounds, the standard analysis recognizes the existence of a head (the rightmost constituent in English; Allen 1978, Williams 1981) and of a modifier, but takes the two constituents to be of equal bar level, $X^0$ (the same level, in fact, as the compound itself).\(^{38}\)

\[(77) \ [N_{NP} \ \text{towel}] \ [N \ \text{rack}]\]

Suppose, however, that Universal Grammar uniformly forbids such symmetric relations in the lexicon (in word-syntax), as it does in the syntax proper, by requiring that the relation between a head (the governor) and its complements or modifiers (the governees) be asymmetric, with the head an $X^0$ category and its complements or modifiers XP categories (Stowell 1981, Muysken 1982, Chomsky 1986, Baker 1988). This amounts to saying that the head status of a constituent is singled out structurally rather than being assigned by rule (as with the Right-Hand Head Rule of Williams 1981).\(^{39}\)

In this light, a more accurate representation of a compound such as towel rack would be as shown in (78).

\[(78) \ [N_{NP} \ \text{towel}] \ [N \ \text{rack}]\]

This modification, prompted by conceptual considerations, also has an empirical payoff. As often noted in the literature, the modifier constituent of a compound can be phrasal (with certain restrictions).\(^{40}\)

\[(79) \ a. \ a \ [[\text{ground to air}] \ [\text{missile}] ] \\
 b. \ a \ [[\text{green vegetable(s)}] \ [\text{shelf}] ]\]

---

\(^{38}\) See, for example, Toman 1982, Selkirk 1982, 1984, Di Sciullo and Williams 1987. This is true of Chomsky and Halle's (1968) analysis as well, except for the fact that they also appear to admit cases like $[N_{NP} \ N]$; for instance, $[N_{NP} \ \text{American history}] \ [N_{NP} \ \text{teacher}]$, $[N_{NP} \ \text{blackboard}] \ [N_{NP} \ \text{eraser}]$ (p. 21f.).

\(^{39}\) This is not to say that Williams's insight (for compounds) is superfluous. One must in any event specify whether the structurally represented head is the rightmost or leftmost constituent of the compound, a matter of parametric choice, given that English and the Germanic languages in general locate it to the right whereas the Romance languages locate it to the left. For some discussion, see Giorgi and Longobardi 1991:chap. 3 and Di Sciullo 1991.

\(^{40}\) I have already mentioned Chomsky and Halle's (1968:22, fn. 9) $[N_{NP} \ \text{American history}] \ [N_{NP} \ \text{teacher}]$. Also see Fabb 1984:136, 145, 190, Sproat 1985:199ff., Roeppe 1988:205ff., Hoeksema 1988:124ff., Lieber 1988 (from which some of the examples in (79) are drawn), Visch 1990:app. 1, and Liberman and Sproat 1992:162ff.
c. an [[ate too much] [headache]]

d. an [[over the fence] [gossip]]

e. [[everyday] [life]]

f. an [[I turn the wheel of the universe] [air]]

All such cases would be excluded if a word formation rule like (80) were assumed (as

\[ X^0 \rightarrow [X^0 X^0 X^0] \]

But if we have to admit a structure like \([X^0 [X^0 X^0]]\) for at least some compounds, then
uniformity considerations would suggest extending it to the simple case of *towel rack*
also well. (Also see Hoeksema 1988 for arguments that the modifier of a compound is a
maximal projection.)

Although I will soon introduce two further important refinements of the structure
of compounds, this analysis, interacting with the null theory of stress assignment, already
proves able to derive the stress patterns of the basic left- and right-branching compounds
(76a) and (76b) as a necessary consequence. Let us consider how. In (81), equal to (73b)
with labels added in conformity with the previous discussion (and ignoring intermediate
bar levels), the most deeply embedded constituent is *towel*, not *kitchen*—hence its more
prominent stress. The corresponding metrical grid is given in (82).

\[ X^0 \rightarrow [X^0 X^0 X^0] \]

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of compounds, this analysis, interacting with the null theory of stress assignment, already
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bar levels), the most deeply embedded constituent is *towel*, not *kitchen*—hence its more
prominent stress. The corresponding metrical grid is given in (82).

\[ (81) \]

\[ \begin{array}{c}
\text{N} \\
\downarrow \\
\text{NP} \\
\downarrow \\
\text{N} \\
\downarrow \\
\text{kitchen} \\
\end{array} \quad \begin{array}{c}
\text{N} \\
\downarrow \\
\text{NP} \\
\downarrow \\
\text{N} \\
\downarrow \\
\text{towel} \\
\end{array} \quad \begin{array}{c}
\text{N} \\
\downarrow \\
\text{rack} \\
\end{array} \]

On the basis of the ill-formedness of cases like (i–b),

(i) a. *[the Bible] lover]

b. *[an [[every animal] eater]]

it is sometimes claimed that modifiers of compounds may be of category N’ (X’, more generally), but never
maximal projections (Fabb 1984; but see his p. 143, and Sproat 1985:202ff.). Within the DP hypothesis, (i–b)
no longer warrant this conclusion. If "this suggests that a referential noun phrase may not occupy this in-
compound position" (Fabb 1984:143) (also see Lieber 1988:206, Giorgi and Longobardi 1991:sec. 3.4), it could
simply be that only the D projection is missing, owing to its role in the referential status of a noun phrase
(Stowell 1989, Longobardi 1991b), not the maximal projection NP, D’s complement.
Now consider (73a), with labels added as in (83).

Here the most embedded constituent is *kitchen*; hence, it is this element that attracts more asterisks, as shown in the corresponding metrical grid (84).

As it stands, the above analysis of compound structure raises one conceptual problem and, related to it, a more serious empirical problem, in connection with more complex cases such as (85), in which the most prominent stress is on the leftmost subcomponent of the rightmost constituent (*towel*), as in the more basic case (81). This structure, and the procedure followed so far, would seem to predict an incorrect stress contour, since the most embedded constituent appears to be the N *hotel*, not the N *towel*.

At an intuitive level, just as we would like to say that the topmost N counts as a line 3 (word) asterisk when the first syntactic cycle is reached, like any other noncompound word (*the hotel kitchen towel rack’s size*), so we would like to say that the N *hotel kitchen* in (85), irrespective of the internal derivation of its stress, begins with a line 3 asterisk, so that (85) reduces in effect to the more basic (81). Even if correct, this
intuition runs into a technical problem if the structure of hotel kitchen towel rack is the one indicated in (85). The reason is that irrespective of the internal derivation of its stress, towel rack would also count as a single line 3 asterisk when it combines with hotel kitchen, since it too is dominated by N. We would thus obtain the wrong result once again: the most prominent stress should go on the modifier hotel kitchen (ultimately on hotel), since this is the more deeply embedded constituent of the two (being dominated by the extra node NP).

However, the discussion so far has failed to note an important categorial difference between the two constituents hotel kitchen and towel rack. This difference suggests a way to begin to solve the conceptual problem and derive the correct empirical generalizations. The key lies in the notion "head." Suppose that the notion "head" is one and the same in the lexicon and in the syntax, any apparent difference between the two being a function of the different level of representation in which it is employed (in the spirit of Borer's (forthcoming) notion of Parallel Morphology).

Within X-bar theory, a head is such only in relation to a maximal phrase that it projects. For example, the N [hotel kitchen towel rack] is a syntactic head only if it projects to an NP (ultimately a DP), as in [a [cheap [hotel kitchen towel rack]]]. This means that if rack is the head of the compounds (81) and (83) (both compounds designate kinds of racks, locate any inflectional ending on rack, etc.), it will have to project to a maximal phrase, which in turn implies that the topmost N is maximal in lexical terms with respect to the N immediately dominating rack. Since the topmost N is an X0 in syntactic terms, we can agree to express its maximality by marking lower-level nodes on the lexical side with successive negative integers (−1, −2, . . . ). This gives (86) as a more accurate lexical representation of (85).41

41 This recalls similar proposals made in the literature (see Selkirk 1982, among others), but differs from them in that N−1 and N−2 are not taken here as subword entities (e.g., "stem" and "root"). N−2 and N−1 constitute, with N0, the projection line of the compound head (N−2), which dominates a full-fledged word.
(86)

Besides expressing in a more perspicuous way the notion "head of a compound," this analysis appears to have the correct empirical consequences, in interaction with the hypothesis that hotel kitchen starts with one (line 3) asterisk at the topmost cycle. Towel will receive the most prominent stress, since it will collect one asterisk more than the higher modifier hotel kitchen—that is, one at the N' level, one at the NP level, and one at the N^{-1} level (= 3). Hotel kitchen will receive only two, at the circled N' and NP levels, so that when the common N^0 cycle is reached, the final asterisk will be attracted in correspondence with the column over towel:

(87)  . * . line 7
( . * . ) line 6
( * ( * . ) ) line 5
(( * ) (( * ) . )) line 4
((( * . ) ) ((( * ) ) * ) ) line 3
[[[[hotel kitchen]]] [[[towel]]] [rack]]

As indicated in (87), the fact that syntactic heads (Ns projecting an NP) count as single words, starting with one (line 3) asterisk, implies that the cyclic derivation that has

Alternatively, one could utilize the usual X-bar schema [X^{N-1} N^0]] and establish the convention that in compound structures N'' counts as N^0 in the next higher (compound or syntactic) cycle. Evidence will be presented later in this section that a more literal extension of X-bar theory to compounds is in order, hence that X-bar theory should perhaps be generalized across levels (word structure, compound structure, syntactic structure, . . .).
derived the stress contour of *hotel kitchen* is "invisible" in (87) (except for its end result in the form of a line 3 asterisk). This implies that there will be a "round" of stress assignment for each branching (compound) N—in (86), one at the N dominating *hotel kitchen*, responsible for the relative prominence of *hotel* over *kitchen*, and one at the matrix N, responsible for the relative prominence of *towel* over *hotel kitchen* (and *rack*).

The previous account of the stress pattern of left-branching compounds ([[kitchen] [towel] [rack]]) must accordingly be slightly altered, but the outcome is unaffected by this refinement. Although [kitchen towel], as a syntactic head projecting an NP, will merely count as one (line 3) asterisk located over the first syllabic nucleus of *kitchen* in the first round of stress assignment, it will nonetheless be more deeply embedded than the head *rack*, thus ultimately receiving the most prominent stress. See the structure (88), and the corresponding metrical grid (89).\[42\]

(88)

```
( N^0
   /NP
   / N'
   / N
   / kitchen towel            / rack
   / N^-1
   / N^-2
   / line 6
   / line 5
   / line 4
   / line 3
   / [[[kitchen towel]]] [rack]]
```

Despite its apparent success, this analysis of the internal structure of compounds requires a further refinement for both conceptual and empirical reasons. The refinement involves a more literal extension of X-bar theory, which exactly parallels the one familiar in syntax. Under this interpretation, one must recognize a complement dominated by the first projection dominating the head and a specifier dominated by the maximal projection (modulo, in English, the different value of the head-complement parameter at the syntactic and the compound levels):

\[42\] One can imagine various interpretive algorithms that, from the metrical grids constructed at each round (cycle), compute the relative prominence of the constituents of the entire compound (see the discussion in Liberman and Prince 1977). Since the best form of the algorithm is not important to the current argument, I will not attempt to determine it here.
(90)

\[
\begin{array}{c}
\text{N}^0 \\
\text{specifier} \\
\text{N}^{-1} \\
\text{complement} \\
\text{N}^{-2}
\end{array}
\]

This has desirable empirical consequences.

So far we have focused on N N compounds in which prominence falls on the nonhead, a very widespread (perhaps, the majority) pattern, but certainly not the only one. As documented in the literature, there are many cases where the most prominent stress falls on the head.\(^{43}\) Here are some representative cases (also see (79a–f)):

(91) \(\text{N N}\)

a. kitchen tábale
b. town háll
c. woman dóctor
d. police investigación

The generalization that emerges from the works cited in footnote 43 (in fact, made explicit in Selkirk 1984:244ff.) is that in N N compounds, as well as in other types, stress falls on the nonhead if this is an argument of the head; otherwise, it falls on the head. This is particularly clear in N A compounds, as shown by the contrasts between (92a) and (92b).

(92) a. fróst bitten b. lily white
diséase prone waist high
blóod thirsty dirt chéap
gérm resistant crystal clér

As Selkirk puts it,

What differentiates the (a) and the (b) cases, aside from the prominence patterns, is the semantic relation holding between the head and its sister. In [the (a) cases], the head has an argument to its left: bitten by fróst, prone to disease, thirsty for blood, resistant to germs. In [the (b) cases], the head's sister has either the character of an adjunct modifier (e.g., as white as a lily, as high as (the) waist, as cheap as dirt) or a locative force. . . . (1984:245)

The same generalization is apparently at work in such well-known prominence contrasts in N N compounds as the following:\(^{44}\)


\(^{44}\) Another possibility would be to claim that the (b) cases are not compounds but phrases, hence patterning in the expected way. This claim is occasionally made (see Bloomfield 1933:228, Bates 1985, among others),
(93) a. apprentice welder  
    tőy factory  
    wine drinker  
    b. apprentice wédler  
    toy factory  
    party drinker

If the nonhead is interpreted as a complement of the head as in (93a) (‘one who welds apprentices’, ‘a factory producing toys’, etc.), stress prominence falls on it. If it is interpreted as a modifier/specifier as in (93b) (‘a welder who is an apprentice’, ‘a factory that is a toy’, etc.), stress prominence falls on the head. This conclusion is reinforced when we examine Zwicky’s (1986) careful classification of stress prominences in compounds. According to Zwicky’s material, whenever the nonhead bears a possessive (government commission), locative (kitchen table, town hall), temporal (summer holiday), attributive (woman doctor), or material (wood chest) relation to the head—that is, whenever the nonhead bears a specifier relation to the head—the nonhead never bears main stress.

To take another example, this time from A A compounds, consider the contrasts between (94a) and (94b) (from Selkirk 1984:245ff., Bates 1988:176ff.).

(94) a. sick looking  
    nice seeming  
    strânge sounding  
    b. ever lásting  
    hard hitting  
    long suffering

If the first adjective is interpreted as a complement of the following deverbal adjective as in (94a) (‘he looks sick’, ‘he seems nice’, ‘it sounds strange’, etc.), it bears main stress. If its interpretation is instead that of a modifier, as in (94b) (‘it lasts forever’, ‘he hits hard’, ‘he suffered for a long time’, etc.), stress falls on the head, the deverbal adjective.

Of course, as Selkirk (1984:246) notes, work must be done to render the notion “complement” relevant to compounds more precise. For example, it must be that the left-hand N in such cases as stéel warehouse ‘a warehouse for steel’, tówel rack ‘a rack for towels’, whéat flour ‘flour (made) from wheat’, coal-tar product ‘product (made) from coal tar’ counts as a complement (bearing a goal, or source, θ-role) of the right-hand N. What is relatively surer is that “when the left-hand element clearly has adjunct status (as a modifier, for example), the head is prominent and the adjunct may not be” (Selkirk 1984:247).45

but it runs counter to the evidence that they indeed behave like compounds—for example, in taking prefixes (an ex apprentice welder vs. *an ex nice person). (See Levi 1978, Zwicky 1986, and especially Bates 1988: chap. 3 for in-depth discussion.) In any event, it does not seem possible to treat all collocations with “after-stress” as phrases. As Zwicky (1986) points out, following Lees (1960), a sequence like legal document is ambiguous between the two readings ‘a document that conforms to the law’ and ‘a document employed within the context of the legal profession’, where the first is a phrasal compositional reading and the second a compound reading. But prominence is on document in both cases.

45 The stress pattern of certain compounds appears to be indeterminate “within and among speakers” (Bates 1988:177). Variation seems to exist in such cases as slave built, hand washed, pan fried, hand made. Perhaps this is due to the possibility of analyzing the left-hand member as either a complement (‘built by slaves’, ‘washed by hand’, etc.) or an adjunct (‘built with the help of slaves’, ‘washed with hands’, etc.). See Zwicky 1986:55 for another case possibly interpretable in this manner.
Despite certain idealizations and open questions, Selkirk's insight is illuminating. It captures what appears to be the fundamental generalization governing stress prominence within compounds (although there may also be lexical idiosyncrasies).

Suppose, then (in fact, departing from Selkirk's further conclusion that "the location of prominence [in compounds] cannot be explained in purely structural terms" (1984: 245)), that we assign a structural correlate to the semantic complement/adjunct distinction (just as we do in syntax). In other words, suppose we assume that compounds are no different from phrases in the relevant respect, with complements generated as sisters of the head, and specifiers as daughters of the maximal projection, as in (95).

\begin{center}
(95)
\end{center}

\begin{center}
\begin{tikzpicture}
  \node (X0) at (0,0) {$X^0$};
  \node (Xm1) at (2,-2) {$X^{-1}$};
  \node (Xm2) at (4,-4) {$X^{-2}$};
  \node (YP) at (-2,-2) {$YP$};
  \node (ZP) at (2,-2) {$ZP$};

  \draw (X0) -- (Xm1);
  \draw (Xm1) -- (XP);
  \draw (Xm1) -- (ZP);
\end{tikzpicture}
\end{center}

(specifier) (complement)

An $X^0$ is, in lexical terms, a maximal projection with respect to $X^{-1}$ and $X^{-2}$. Therefore, YP and ZP should more properly be $Y^0$ and $Z^0$, although we have seen that genuine phrasal categories can exceptionally be internal to compounds (see (79)). A compound such as kitchen towel rack would thus receive the representation in (96).

\begin{center}
(96)
\end{center}

\begin{center}
\begin{tikzpicture}
  \node (N0) at (0,0) {$N^0$};
  \node (Nm1) at (2,-2) {$N^{-1}$};
  \node (Nm2) at (4,-4) {$N^{-2}$};
  \node (N0) at (-2,-2) {$N^0$};
  \node (Nm1) at (0,-4) {$N^{-1}$};
  \node (Nm2) at (2,-4) {$N^{-2}$};

  \draw (N0) -- (Nm1);
  \draw (Nm1) -- (N0);
  \draw (Nm1) -- (Nm2);
  \draw (Nm2) -- (N0);
\end{tikzpicture}
\end{center}
kitchen towel rack

\[46\] There are reasons to reject an approach that institutes a direct link between the semantics of the compound and its stress pattern without having structure mediate between the two. For one thing, such an approach makes it arbitrary that complements rather than heads or specifiers should receive stress prominence. Nothing in principle would seem to exclude the opposite state of affairs from a semantic point of view. In the structural approach, instead, where the particular semantics of a compound is given a structural translation (as in the syntax), with complements more deeply embedded than heads and specifiers, the particular stress patterns that we find are forced by the null theory of stress assignment (the same theory that also works for syntactic phrases).
The analysis appears to derive as a necessary consequence a generalization about compound structure noted by Selkirk (1982:36ff.) and still in need of a principled explanation. In her words, "All [nonsubject] arguments of the head of a compound must be satisfied within the compound immediately dominating the head." A compound like *tree eater* is ambiguous between a locative interpretation ('eater in a tree') and a theme interpretation ('eater of the tree'). But a compound like *tree pasta eater* is no longer ambiguous, *tree* having only the locative interpretation; and a compound like *pasta tree eater*, with the complement higher than the locative adjunct, is impossible. This follows from imposing an X-bar structure on the compound, since this forces internal arguments to be under X' (X^{-1}) and nonarguments to be in the specifier position under X" (X^0). Since *pasta* cannot receive a locative interpretation, it must occupy the complement position, closer to the head.\(^47\)

The single structure (95), with the recursive possibility for YP (or Y^0) and ZP (or Z^0) each to be itself a compound, appears to subsume all the different possibilities discussed in the literature while bringing out the perfect identity of compounds and phrases in the pattern of stress prominence.

Recall the particular refinement of the principles of grid construction for phrases motivated at the end of section 7, according to which only elements embedded on the X-bar and the complement axis are visible in their entirety for the principles of grid construction. The net effect of such a refinement was that a complement wins over the head and the specifier and, in the absence of a complement, the head wins over the specifier, with specifiers counting only as a single asterisk, because they are on a non-recursive branch.

Compounds are no exception to this generalization. In compounds, too, a *complement* wins over the head and the specifier (see (97a)), and, in the absence of a complement, the *head* wins over the specifier, in this case giving right-hand prominence (see (97b)).\(^48\) This grounds Selkirk's generalization in purely structural terms, thus avoiding the problems noted above of a semantically based stress assignment.

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The structural approach also appears to constitute a plausible acquisition model. Semantic considerations via Universal Grammar single out particular structural representations, which in turn, again via Universal Grammar, determine stress properties.

A second difficulty for a purely semantically based approach is represented by cross-linguistic differences. In this approach, presumably one would not expect parametric choices in the respective order of arguments and heads to affect the stress pattern of the compound, but they do. Compare English *toy factory* and its Italian equivalent *fabbrica giocattolo* (lit. 'factory toy') with the reverse stress pattern.

\(^47\) Selkirk (1982:37) also notes that "two [nonsubject] arguments cannot appear in a compound." Therefore, one cannot have *baby toy handing, table boot putting* to render 'the handing of toys to babies', 'the putting of boots on the table'. This may follow again from an X-bar structure like the one proposed by Larson, with a single specifier and a single complement, if it is assumed that an abstract head providing for the third argument is absent from compounds.

\(^48\) For a compound like *kitchen table*, this analysis predicts that if the interpretation 'a table for kitchens' is possible over and above the "locative" interpretation 'a table that is in the kitchen', then *kitchen* should be given prominence, since it comes to occupy the complement position. For the speakers I have consulted, the prediction appears to be confirmed: *In the bathroom, we have a KITCHEN table.*
More complex cases are instantiations of the same single structure, with its recursivity potentials realized in different ways. This can be seen by inspecting a few cases, some of which are already well known from the literature. (As above, the constituent receiving the most prominent stress is set in capital letters. The dotted lines are meant to make conspicuous the fact that what is at stake in each case is a recursive expansion of either the complement or the specifier of the same basic structure.)

First consider (98a) and (98b).

— Compound structure and compound stress in German are essentially the same as in English, as expected, given the same head-final choice for the relevant parameter (Giorgi and Longobardi 1991:chap. 3). See the following cases, drawn from Giegerich 1981, 1983, and from Grewendorf, Hamm, and Sternefeld 1987:sec. 3.4. (Also see Giegerich 1985, Doleschal 1988, and references cited there. For similar facts in Dutch, see Langeweg 1987.)
Certain apparent counterexamples (HAUPTbahnhoft 'central railway station', HALLENschwimmbad 'indoor swimming pool', or DREIfarbstift 'three-color pencil' vs. DreigROSCHEnoper 'three-penny opera') are explained away if Bahnhof, Schwimmbad, etc., are single rather than compound words, and if Dreigroschenoper differs structurally from Dreifarbstift essentially in the same way that [N[NP[AP black] board] eraser] differs from [N[NP[N blackboard]] eraser] (see Giegerich 1983). Josef Bayer (personal communication) points out that for him WELTspartag is also possible alongside WeltSPARtag, though WELTnichtrauchertag is not. Perhaps Saprag, though not Nichtrauchertag, can be optionally analyzed as a single word.

Given the head-initial order of Italian (more generally, Romance) compounds, we should expect a perfect mirror image. The expectation appears to be essentially correct insofar as it can be checked, given the severe limitations (in productivity, and perhaps type) on nominal compounding in Italian (for which see Zuffi 1981:17f. and fn. 20, where it is pointed out that N N compounds in Italian are generally coordinating rather than subordinating, and Giorgi and Longobardi 1991:sec. 3.5, especially fn. 25). Thus, we find cases like (iia)/(iiiia) contrasting with English (iib)/(iiiib).

But it is not clear whether compounds with the structure (iv), corresponding to structure (v) in Germanic, exist. No examples of that sort are found in Zuffi 1981.

Where (iv) would seem to be semantically appropriate, there are two main stresses, one on each modifier, separated by a pause: [[tavola CALDA], PIZZERIA] 'lit. hot table, pizzeria'.
Here each N appears to stand in a complement relation to the N to its right ('degree in law', 'requirement for (a degree in law)', 'changes of . . .')—hence the prominence on law, the most deeply embedded element of the compound in each case.

Similar remarks hold for cases such as teachers union president election. The contrast between (98) and (99) is instructive.
Here, *law degree* is not a complement of *language*, itself complement of *requirement*. Hence, it is no longer part of the recursive path of embedding, as it was in (98b). It can only be related to the head *requirement* in a more indirect way, as a specifier of *language requirement*. Consequently, it will be *language* that qualifies as the most embedded element of the compound and is given prominence.\(^{50}\)

(100)–(102) show additional variations of the same basic structure.\(^{51}\)

\(^{50}\) This recalls Selkirk’s (1984) discussion (modulo the noted difference in approach):

In a compound configuration like \([A[C-D]|_{A}[E-F]]_{B}\) it is impossible for A and B to stand in an argument-head relation to each other. (See Selkirk 1982:ch. 2, where it is shown that a word with an open argument position—e.g. *requirement*—must have that argument satisfied by a sister constituent (if it is to be satisfied at all)—e.g. *language*. Since branching constituents like *language requirement* do not, on that theory, have open argument positions, it follows that the sister to a branching constituent will never be an argument with respect to it). (p. 250)

\(^{51}\) Note that in (102a–b) the most prominent stress falls on the middle constituent, although the two cases instantiate two different structures and interpretations: (102a) ‘the president of the labor union’s finance committee’, (102b) ‘the finance committee’s president of the labor union’.
Rather than in their contour, the two possibly differ in the location of (virtual) pauses, with a bigger pause between committee and president in (102a) and between union and finance in (102b), much as in the ambiguous American history teacher (see Chomsky and Halle 1968:22, fn. 9). For a minimal pair in German similar to (102a) and (102b), see Giegerich 1983:7 and fn. 7, where the following two structures are assigned to Spielwarenaußenhandelsgesellschaft, with correspondingly different interpretations:

(i) a. \([A B] [[C D] E]\]
b. \([[[A B] [C D]] E]\)
b.

(102) a.
A potential problem is provided by such A N compounds as those in (103), in which stress falls on the head even if the adjective apparently introduces a complement of the head.

(103) a. lunar exploration 'exploration of the moon'
    b. stellar observation 'observation of the stars'
    c. presidential election 'election of the president'

If the adjective, as a consequence, were generated in the complement position of the compound, then it should receive stress prominence; but it does not.

Cases like (103) differ from the cases discussed above, in which an adjective stood in a complement relation to a deverbal adjective and indeed received stress prominence within the compound (sick looking, etc.). In (103), for the adjective to stand in a proper complement relation to the N, it would have to receive the θ-role theme from the N. However, we know from the syntax of NPs that adjectives cannot receive a θ-role by being generated in complement position, though they can in specifier position (see Kayne 1984:63). If an analogous property holds for compound structure, then such adjectives will only be generable in the specifier position of the compound and will possibly bear a general relation to the head similar to the R-relation holding between a genitive and the N in NPs. This indeed appears plausible, given such cases as nuclear protest, where the relation between nuclear and protest is more similar to an R-relation than to one of θ-role assignment.

In sum, if such adjectives are generated in the specifier rather than in the complement position, then as expected stress prominence will go to the head.\textsuperscript{52} A(P)s would thus

\textsuperscript{52} Cases like blackbird, bluefish, bluebook are only apparent exceptions to the generalization in the text if they are lexically reanalyzed as single Ns, as Liberman and Sproat (1992:148ff.) suggest. Perhaps the
differ from N(P)s precisely in not being able to absorb a θ-role via government in complement position. It is interesting to note, then, that substituting an N(P) for the A(P) in (103) makes stress prominence change systematically, in the expected way (Bates 1988:80ff.):

(104) a. cave exploration
    b. star observation
    c. officer election

In N N compounds, there is a class of cases in which the head receives stress prominence in the apparent presence of an argument:

(105) a. student rebellion
    b. government funding
    c. consumer spending
    d. enemy movements
    e. state hiring

At first sight the argument would seem to be an "external" one (in Williams's (1981) sense)—hence, if anything, generated in specifier rather than in complement position of the compound. However, it is dubious that the nonhead Ns in (105) are genuine (external) arguments of the head. A genuine external argument cannot in general appear in the specifier position of compounds: for example, *girl swimming, *kid eating (Selkirk 1982:34). Furthermore, as Bates (1988:111ff.) notes, the head still retains the ability to assign the external θ-role (a student rebellion by Cambridge undergraduates). Hence, as she indeed suggests, the nonhead is interpreted more as a modifier ('typical of students') than as an argument. In either case, at any rate, stress prominence is expected on the head.53

Many questions concerning English compounds have not been addressed here, nor has the important question concerning parameterization, which deserves a separate treatment. Other questions have been addressed only briefly. I nevertheless hope that the present analysis will suggest possible ways to solve the remaining issues.

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forestress of such cases as apple cake (vs. apple pie) and Madison Street (vs. Madison Avenue) should be analogously treated. Zimmer (1971:C19), Schmerling (1971), Allen (1978:103ff.), and Liberman and Sproat (1992:157) note that many cases of the former type in fact show individual differences. Some people say apple pie, crème sauce, chôcolate cake, potâto salad, and péanut butter; others say apple pie, cream suace, chocolate câke, potato sâlad, and peanut bûtter. This would be expected if lexicalization is at issue.

The other street names, in English, behave like Avenue, not Street. In German, apparently, all but Markt have stress on the first N (Lüdwigweg, Bérgasse, Kärl Platz, etc., vs. Hoher Märkt), but interestingly, if the first element of the compound is an adjective, stress may go on the head (Danziger Strâße). In Dutch there is apparently great variability both among street names and in the uses of a single street name in different cities (I thank Gerhard Brugger and Jeanette Schaeffer for this information).

53 The asymmetric theory of coordination discussed in section 7 predicts that stress should fall on the second of the two members of a stressed element of a compound. This prediction is correct: salt and pepper shaker (see Bates 1988:213ff. for an interesting discussion of coordination within compounds).
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