A NULL THEORY OF PHRASE AND COMPOUND STRESS

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1. Introduction

Since Chomsky, Halle and Lukoff (1956), it is generally assumed that (surface) constituent structure is the fundamental determinant of phrase (and sentence) stress. A natural question that one may pose 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 (1960) 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 as 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 rather follow from their respective constituent structure, as determined by purely syntactic parameters such as the head-initial or head-final character of their phrases.
The argument will be made on the basis of rather limited evidence, essentially a comparison of Italian, English and German. At this preliminary stage, a more careful analysis of 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 (V. section 8). 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 in Halle and Vergnaud (1987).

2. The metrical grid theory
Within this theory, which develops an idea of Liberman (1975), stress is represented in a separate autosegmental plane, as 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 fig.1.

```
\[ \begin{array}{c}
  * \quad * \\
  \text{torment} \\
\end{array} \]
```

fig.1

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

Not every potentially stress-bearing unit (e.g. a syllable 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 these receive an asterisk, as illustrated in fig.2 with a word such as serendipity, whose first, third and forth syllabic nuclei only are stressed.

![Diagram of stress placement](image)

fig.2

If one of these 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 yet a higher line 2 (not indicated in fig.2).

Since at most three degrees of stress (beside 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 (cf. 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 boundary 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.
Here, I give only a brief illustration of 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 as the main stress, is obtained by means of the parameter
settings in (1), in interaction with the general principles of grid
construction (2):

(1)a Line 0 parameter settings: +HT, +BND, left, left to right
   b Line 1 parameter settings: +HT, -BND, left

(2)a Construct constituent boundary 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 (3) (where indication of the plane and the phoneme line is
omitted):

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

The grid is obtained by means of the parameter settings (1)a-b and the
rules that construct constituent boundaries (2)a-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 applying rule (2)a in accordance with the
parametric values indicated in (1)a. So bounded (binary) constituents
are constructed left to right (with the last 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 (2)b 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 applying again rule (2)a in accordance with the parametric values indicated in (1)b. 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 fn.2, and others) give rise to the stress patterns found in the other languages. I refer to Halle and Vergnaud (1987), Halle and Kenstowicz (1990) for detailed discussion.

In this approach, differences in degrees of stress are expressed in terms of the different heights of the associated asterisk columns, as seen.

Interesting evidence for this particular notation over potential alternatives (such as the use of different Arabic numerals) is provided by the phenomenon of Stress Shift, as found, for example, in the English Rhythm Rule cases (4) and (5):

(4)a Tennessee
\[ \begin{array}{c}
2 \, 0 \, 5 \\
\end{array} \]
\[ b \text{ Tennessee Williams} \]
\[ 3 \, 0 \, 2 \, 4 \, 0 \]

(5)a Japanese
\[ \begin{array}{c}
2 \, 0 \, 3 \\
\end{array} \]
\[ b \text{ Japanese beetle} \]
\[ 3 \, 0 \, 2 \, 4 \, 0 \]

Halle and Vergnaud (1987,39) note that if stress is marked with Arabic
numerals, as in (4) and (5), the rule can only be stated in an unperspicuous and unprincipled way ("Assign a highest stress number N in the lefthand constituent to the syllable with the highest stress number M on its left, simultaneously reducing the original N by one degree").

Under the metrical grid notation, instead, as observed by Prince (1983,33), the phenomenon can be expressed simply and naturally by allowing lateral movement of an asterisk on a line from one column to another (in appropriate contexts):

\[
\begin{array}{cccc}
\text{Ja pan ese beetle} \\
\text{line 0} & \ast & \ast & \ast \\
\text{line 1} & \ast & \ast & \ast \\
\text{line 2} & \ast & \ast & \ast \\
\text{line 3} & \ast & \ast & \ast \\
\text{line 4 (Nuclear Stress Rule)} & \ast & \ast
\end{array}
\]

More importantly, the major properties of the rule ((a) the fact that the position of the original main stress does not become stressless, but retains a stress weakened by one; (b) the fact that the new main stress has the same degree as the old main stress (3 in (6)); and (c) the fact that the main stress is shifted to the next highest peak to the left rather than simply to the next position to the left) now follow in a principled way. For the first two properties it is obvious how. Consider the third. It too follows if we assume that an asterisk can move to another column on a certain line L only if that column has an asterisk on the immediately lower line L-1. If so, it is clear why the asterisk shifting to the left in (6) cannot stop in column with the second stress-bearing unit, but must proceed to the first. No asterisk is present in the second column on the next lower line.

To extend Halle's (1985) image, one could say that the grid is like a magnetic abacus. Beads can move within their respective rows, but are
forced by 'attraction' to stop in correspondence with the (first) bead of the next lower row they encounter.

This condition will play a crucial role in the argument below. Having briefly sketched Halle and Vergnaud’s (1987) theory of the stress contours of single words, let us now 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 is largely unaffected, the effect of the combination merely being the assignment of greater prominence to the main stress of one constituent over that of the others. In both 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) propose to incorporate the rule in the formalism of their theory as follows (cf. their (80)):

(7) Nuclear Stress Rule

a Parameter settings on line N (N ≥ 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 (7)a.
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)):

(8)(. . . *) line 6

. ( . . . *) line 5

. . . ( . . . *) line 4

* * * * * line 3

(Jesus (preached to the (people of Judea))

The first metrical constituent built on line 3 on the basis of (7)b is that corresponding to *people of Judea*. In accordance with the principle of the cycle, (metrical) constituents which 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).  

The head of the constituent is located on line 4 by applying (7)c. Then, a metrical constituent is created on line 4, and so forth.

Halle and Vergnaud (1987,265), 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*) propose to supplement it with the following convention:

(9) **Stress Equalization Convention**

When two or more constituents are conjoined into a single higher-level constituent, the asterisk columns of the heads of the constituent 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 (8).

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:

(10)a Are the phrase stress systems as numerous and diverse as the 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)?

Suppose, for the sake of the argument, that both questions receive a negative answer. Suppose, in particular, 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, while left branching languages should show the reverse (essentially, the effects yielded by the Compound Stress Rule of English, which gives prominence to the main stress of the leftmost constituent). Languages with mixed branching should instead combine properties of the two 'pure' systems.

But 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 cannot derive the same result, so it appears (cf. below for some discussion).

What is apparently necessary and sufficient is the combination of (7)b, simplified as in (11)a, (7)c, repeated here as (11)b, the principle of the cycle, (11)c, essentially in its original formulation, and the condition that there be no gap in an asterisk column,(11)d.

(11)a Interpret boundaries of syntactic constituents as metrical boundaries

b Locate the heads of line N constituents on line N+1

c Each rule applies to a maximal string containing no internal boundaries

d An asterisk on line N must correspond to an asterisk on line N-1

Let us consider first a couple of simplified abstract cases to illustrate the working of (11); namely (12)a-b (or (12)a'-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:

10
(12)a: \[ A \ast (B \ast [C \ast ])) \] \[ b [A [B [C \ast ] \ast ] \ast ] \]

(12)a-b (a'-b') represent right and left branching structures, respectively, with constituents each nested in the next higher one. Application of (11) gives rise to the grids (13)a-b (lines below line 3 are omitted):

(13)a

\[
\begin{array}{c}
\ast \\
. \\
. \\
(\ast \\
( ( \ast \\
( ( ( ( \ast \\
\end{array}
\]

b

\[
\begin{array}{c}
\ast \\
(\ast \\
(\ast \\
\ast \\
\ast
\end{array}
\]

line 6

line 5

line 4

line 3

Consider how. The combination of (11)a and (11)c, the principle of the cycle, imposes that the first metrical constituent to be computed is the innermost (to the right in (13)a, and to the left in (13)b). (11)b 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 cannot but be in column with this position. When we pass to consider the next cycle, (11)b will again demand that the head of this constituent be located on the next line up (line 5). On line 4 there are two positions, but only one of them contains an asterisk. So, by (11)d, we have no choice. The head (on line 5) of the constituent on line 4 can only be in column with the single asterisk found on line 4. Reapplication of the same procedure gives rise to the complete grids (13)a and b.

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 shall claim, the relation between two constituents of a phrase is always asymmetrical (in the sense that necessarily one of the two is more deeply embedded than the other), no direction of stress prominence, as in the Nuclear Stress Rule, need be stipulated. The first constituent to receive an asterisk, whether on the left or the right, will 'attract' all later asterisks.

The procedure of (11) would seem to suffer from the same deficiency as Halle and Vergnaud's Nuclear Stress Rule (7), 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.

It should be noted that the sentence has two non intersecting constituents, the subject NP and the predicate VP (for simplicity, I ignore now all functional and intermediate X' projections):

(14) [(NP Jesus) [Vp preach [Pp to [NP the people [Pp of [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 because of the innermost constituent [NP Judea], which receives it first (on line 4), thus attracting all later asterisks (those of line 5 and 6, as well as that of line 7, after the whole sentence is computed).10
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: [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) will also be deferred until section 7, after some implications of this general approach have been considered in more detail.

As noted, in the hypothesis we wish to explore 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 (11) 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 constituent (thus deriving the effects of the Nuclear Stress Rule of English), while in left branching 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,\textsuperscript{11} 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 one to test within a single language the opposed predictions of the hypothesis. Furthermore, its syntactic structure and its accentual system are both rather well known.\textsuperscript{12}

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

5. Phrase stress in German

Kiparsky (1966) distinguishes two different classes of phrases in German according to whether they receive stress prominence on their rightmost or leftmost constituent (p.81).\textsuperscript{13}

His terms Nom and Satz, taken from Bierwisch's (1963) fragment of
German grammar\textsuperscript{14}, correspond to NP and CP, respectively. 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 renders the notion of Mittelfeld of the German grammatical tradition.\textsuperscript{15} 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 not a constituent, apparently (but see fn.21 below). 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: again a non constituent under current assumptions, which analyse 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, while the sequence $S \,(=D+\text{VP}),$ corresponding to IP, and the verbal group 'VP' receive initial stress prominence, Kiparsky manages to derive the intricacies of German ordinary sentence stress with remarkable accuracy.\textsuperscript{16}

Let us briefly consider how. The case of NPs is straightforward. They receive final stress prominence (Endbetonung):\textsuperscript{17}

(16)a [Die dicke Emma]  
the fat E.

b [Der Mann aus Río]  
The man from Río

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

15
(17) a. Waldemar spielt Theater
    W. plays theater

    b. Die Katze lief weg
    The cat ran away

(18) a. [Satz[I] Waldemar spielt] [gTheater]]
    b. [Satz[I] Die Katze lief] [gweg]]

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 (namely, Theater and weg, respectively), all other stresses being reduced by one at the same time. Kiparsky's ingenious procedure will 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
    H. will be able to give a book to a boy

(20) [Satz[I] Hans wird] [g[deinem Kind ein Buch] [vpgeben 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 (namely, 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 (namely, that of Buch once again) will receive the primary stress, with the concomitant weakening of all the other stresses.

In spite of its ingenuity and remarkable empirical success, Kiparsky's analysis raises, as noted, certain questions concerning 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 while 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 which derived the right 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:Entdeckung [NP des [N: Impfstoffs]]]  
The discovery of the vaccine

b Die [N:Landung [pp auf [dem 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 at 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 (lid), ultimately bearing the strongest prominence within the largest phrase, as desired.

Except for a handful of cases (cf. (23) below), PPs are also head-initial, and in fact their stress properties are analogous to those of the NP just seen, with prominence on the main stress of the complement to the right:

(22)a Auf den Tisch 'on the table'
   b Durch die Zimmer 'through the room'
   c Unter den Linden 'under the lime-trees'

The situation is reversed with postpositional phrases, as expected. Greater prominence is now on the left:

(23)a Den Fluß entlang 'along the river'
   b Den Berg hinauf '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 (cf. Stechow and Uhmann (1986, 315), Grewendorf (1989, sect. 4.3), among others).

(24)a ..dass Hans [ ein Buch auf den Tisch gestellt ] hat
   ..that H. a book on the table put has
   b ..dass Fritz [ einem Kind Geld gegeben ] hat
   ..that F. to a child money given has
   c ..dass Karl [ ein Buch mit Mühe lesen ] kann
   ..that K. a book with difficulty read can
d. dass Hans [ein Buch interessant findet]  
.. that H. a book interesting finds

This is in fact what the null theory predicts, as, 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:

\[(25)\]

\[
\begin{array}{c}
\text{NP} \\
\text{VP} \\
\text{YP} \quad \text{XP} \quad V \quad \text{INFL}
\end{array}
\]

This is true even if (25) is not a base generated configuration, but a derived one, with YP moved from a position between XP and V.

Note that in (26)a, the direct object, and in (26)b both the direct and the indirect object have been moved to the left via Scrambling, thus leaving the indirect object and the adverbial phrase, respectively, as the most deeply embedded constituent of the VP:

\[(26)a\] . dass Bruno sein Geld [ oft Kindern gab ]  
.. that B. his money often to the children gave

\[(26)b\] . dass Bruno sein Geld den Kindern [ oft gab ]  
.. that B. his money to the poor often 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 INFL, as is now standardly assumed: \( ^{21} \)

\[(27)a\] . dass Bruno sein Geld [ oft Kindern ] gab

\[(27)b\] . dass Bruno sein Geld den Armen [ oft ] gab

Next, consider APs (not discussed in Kiparsky 1966). They can take prepositional complements on both sides, and Case-marked NPs to their left only:
(28)a Er ist [ über seinen Freund ungehalten ]
   He is at his friend angry

   b Er ist [ ungehalten über seinen Freund ]
   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 – cf. Giorgi and Longobardi (1991, chapter 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, as it would predict the strongest stress to fall in (28)a-(29)a 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 is their D-structure source (also see Webelhuth (1989, chapter 6)). The evidence comes from the following peculiarity of the word order internal to the AP: when the complement precedes the head and there is a lexical specifier or some other pre-head modifier, one finds the order complement-specifier-head rather than the order specifier-complement-head. See:

20
(31a) Er ist über seinen Freund sehr ungleichen
   b *Er ist sehr über seinen Freund ungleichen

(32a) Er war dem Mann sehr böse
   b *Er war sehr dem Mann böse

The fact that the complement must precede the specifier sehr 'very' is
evidence that it cannot stay under A', but that it must adjoin at
least to AP. As Henk van Riemsdijk pointed out (p.c.), there is in
fact evidence that the complement must adjoin to some projection
higher than AP even, as the complement must precede the negation
(which is outside the AP and is in fact taken to mark the left
boundary of VP — cf. Webelhuth 1990,55):

(33a) ...dass er dem Mann nicht [VP [AP böse] t₁] war₁
   ..that he to the man not nasty was
   b *...dass er nicht [VP [AP dem Mann böse] t₁] war₁
   ..that he not to the man nasty was

((33)b is — irrelevantly — possible if nicht and dem Mann form a
constituent).

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

When the functional categories IP (or rather AGRPₜ, TP, AGRPₜ —
Chomsky 1989) and CP are taken into account, a more complete picture
of German sentence stress can be given.

German AGRPₜ, T and AGRPₜ take their complements to the left, while C
takes AGRPₜ to its right (cf. Grewendorf 1988, den Besten 1989,274,
among others):
In root clauses (and in embedded clauses selected by certain predicates – Bader and Penner 1990, Vikner 1990, Cinque 1989), the V raises to C, while a maximal projection must fill the SPEC of CP (in declaratives). In non V/2 subordinate clauses, instead, the finite V raises just to AGRP_s (cf. the references of fn.21). This gives rise to a variety of different cases, all sharing the property that apparently the greatest prominence falls on the most deeply embedded (lexical) constituent, as predicted by the null theory. See (when not crucial, we conflate AGRP_s, TP and AGRP_o into IP): 22

(34)a [CP Waldemar_i [C' spielt_k [IP ti [VP Theater t_k ] tk ]]]
  W. plays in the theater

  b [CP Das Buch_i [C' findet_k [IP er [VP interessant t_k ] tk ]]]
    The book he finds interesting

  c [CP [Trinken wollen]_i [C' wird [IP sie ihn nicht VP_i ]]]
    want to drink he will not

22
(35)a. \[\text{CP Hans}_i [\text{CP hat}_k [\text{NP niemals gelesen }] t_k]]^{23}.

H. has never read

b. \[\text{CP Den}_i [\text{CP hat}_k [\text{NP Hans (gelesen) }] t_k]]

That has H. read

(36)a. \[\text{IP Weil [VP Fritz [\text{NP viele Torten} ] backen ] kann }..\]

Because F. many pies bake can..

b. \[\text{IP Weil [VP Fritz [\text{NP gut [viel köchen]}] kann }..\]

Because F. well cook can..

Such contrasts as (37)a-b 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$_o$), as argued for on independent grounds by Brugger (1990) (Also see Moltmann's (1990) discussion):24

(37)a. \[\text{CP Der Arzt [CP wird [\text{ACP [vpeinen Patienten untersuchen]]}]]]

The doctor will visit a patient

b. \[\text{CP Der Arzt [CP wird [\text{ACP den Patienten untersuchen}]]]}

The doctor will visit the patient

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):

(38)a. Peters Auto 'P.'s car'

b. Die dicke Emma 'The fat E.'

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 (cf. 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 which will be discussed in section 7 below):

(39) \[ \[ \text{PP Die } \text{[PP dicke F* [NP \[N, Emma ]]]} \] \]

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

(40)a Die Ankunft von Karl 'the arrival of John'

b Der Mann aus Río 'the man from Rio'

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

(41)a \[ \text{[DP Die } \text{[NP \[N, Ankunft ] [PP \[P, von \text{[DP Karl ]}]]]} \]

b \[ \text{[DP Der } \text{[NP \[N, Mann ] [PP \[P, aus \text{[DP Río]}]]]} \]

Similar considerations hold for adjectival and verbal specifiers \([\text{AP sehr [A, böse ]] 'very nasty'; [weil [\text{IP er [VP Gut [V, kochen ]] kann}] 'because he well cook can'].25\n
No doubt, other aspects of German phrase and sentence structure would deserve attention. The cases so far reviewed, however, 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, non contrastive,
stress.
In the next section, we turn to some of the questions hitherto ignored concerning the information structure of the sentence. Before that, a brief comparison may be worthwhile between the metrical grid theory which, as seen, 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), and the metrical tree theory. The formalism of the latter appears unable to derive the same result. This is because it is a purely interpretive procedure which marks the two branches of a binary structure weak (W) and strong (S) in relation to each other, and independently of the manner of 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 to be somehow linked to depth of embedding, the link would not be principled. That is, it would not follow as a necessary consequence of the formalism, it seems.
This approach, if correct, also shows that at least certain phonological phenomena may be directly syntax driven, without recourse to prosodic theoretic notions such as phonological phrase or intonational phrase. Nespor and Vogel (1989, 1990)

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 Focus and Presupposition (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 1969).26

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 (42)a, which introduces John in 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 'rhemat', or 'comment'):

(42)a What did John do?
   b [ John ] [ left ]
   P
   F

Conversely, in (43)b, the answer to (43)a, John will be the focus and the VP the 'presupposition':

(43)a Who left?
   b [ John ] [ left ]
   F
   P

The absolute prominence of the sentence falls in both cases on the phrase which constitutes the focus, the VP left in (42), and the subject NP John in (43)b. Note that in either case no contrastive or emphatic stress is necessarily involved. For this reason the stress contour of (43)b has occasionally been taken to be an exception to Chomsky and Halle's Nuclear Stress Rule (cf. Schmerling 1976). But this is not really so. One must distinguish the sentence grammar formal procedure which determines where the prominence of a phrase will be located (the Nuclear Stress Rule or the null alternative discussed above) from the discourse grammar procedure which 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 have to be distinguished, is shown by the fact that the formal procedure is at work both in the phrase constituting the focus and in that constituting the presupposition, as we see from cases slightly more complex than (42) or (43):

(44) (Any news of John?)
    Well, [NP the poor fellow] [VP is in bed with a 'flu']
(45) (Who's giving him a hard time?)
    [NP The candidate that he failed] [VP is apparently giving him a hard time]

Both the presupposition (the NP in (44) and the VP in (45)), and the focus (the VP in (44) and the NP in (45)) 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. 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 (46) (Chomsky 1970), where, as shown by the variety of answers in (47), any of the phrases indicated can be focus, is a direct consequence of the interplay of the two procedures:

(46) Was he [warned [to look out for [an ex-convict [with a red [SHIRT]]]]]?

(47)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 [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 (46), each one potentially qualifying as focus.29

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. So, 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. See:

(48)a I'd give the money to Mary, but I don't TRUST Mary (Schmerling 1976,59)

b Has John read Tristam 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 which qualifies as focus. Such destressing is possibly a consequence of the 'marginalization' of the presupposed constituent (Antinucci and Cinque 1977, Calabrese 1990), whereby this 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' ((49)a), unless specially contrasted ((49)b):

(49)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 the postulation of 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.

Their work, nonetheless, 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) interesting discussion of the minimal pair of out-of-the-blue sentences in (50), one can surmise that determination of focus and presupposition may depend on knowledge of the world's events:

(50)a Truman DIED

   b JOHNSON died

As Schmerling recalls, when (50)a was uttered Truman had been on the news media for some time because of his critical health conditions; so it was appropriate to consider him as part of the presupposition, while the news was the termination of his critical state. Johnson, instead, died somewhat unexpectedly. He was not on people's mind 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 (50)a 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, in the CP of (50)a, as it is dominated by its own projections plus at least the projections of T and AGR (Pollock 1989, Chomsky 1989, Belletti 1990).

An answer may come from a comparison with those languages, like Italian, in which the subject may remain in situ in its D-structure position. In Italian the sentences appropriate to the above contexts are (51) for (50)a, and (52)b for (50)b, not (52)a, the word-by-word translation of (50)b. Also cf. Dezso (1982,118f) for Russian.

(51) Truman e' MORTO

(52)a (*)JOHNSON e' morto

   b E' morto JOHNSON
(52)b, as a report for a totally new event, is expected if the subject is in the D-structure object position. This is because it qualifies there as the most deeply embedded constituent of (the VP and ) the entire CP.31

The inappropriateness of (52)a in the same context would follow if a preverbal subject (in the SPEC of AGR) were necessarily part of the presupposition. This is in fact just what Guéron (1980) suggests on partly similar grounds. See, in particular, her distinction between predication sentences (like (50)a), in which the preverbal subject is presupposed, and presentation sentences (like (50)b), 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,fn34), Faber (1987).

Given that no postverbal subject is possible in English (*Died JOHNSON), the subject must move to the SPEC of AGR. 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 consists apparently 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.32

Other well-known minimal pairs, possibly susceptible of similar treatment via computation of relative predictability are (53)a-b or (54)a-b, from Bolinger (1972):

(53)a I have a POINT to make

   b I have a point to EMPHASIZE

31
The end of the chapter is reserved for various PROBLEMS to solve

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 de-accented. Where one has lessons to learn, one will probably have passages to memorize" (1972,633–634). For remarks along similar lines, see Berman and Szamosi (1972,312). 33

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 either fall 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 one of the two constitutes the focus position of the sentence. In this connection, also see the discussion at the end of section 7.

Other cases would deserve specific discussion. Many English stress patterns are still poorly understood or unanalysed, as are a number of crosslinguistic differences. 34 It seems, however, that, whatever the ultimate results will be, they should not affect the main point of this section, namely that a sentence grammar formal procedure of phrase stress assignment should be carefully distinguished from a discourse grammar procedure which privileges the main stress of the phrase in focus over the main stress of the phrase constituting the presupposition.

32
7. Some residual questions and a refinement

In this section I will firstly consider certain structures displaying a stress pattern that is at first sight problematic for the null theory. In each case, we shall see that alternative analyses exist in the literature, or appear to be plausible at a 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, (55)a–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) \[
\begin{array}{c}
\text{IP} \\
\text{NP} \text{ I'} \text{ VP} \\
\text{pro} \text{ they} \text{ stanno are} \text{ V'} \text{ AdvP} \\
\text{seguido} \text{ le lezione attentamente} \\
\text{following} \text{ the lecture attentively}
\end{array}
\]

For, here, the object N is the most deeply embedded constituent (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 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 not necessary, clearly.

(55)b can be an answer to what are they doing?, with the entire VP as
focus.

Fortunately, there is evidence that the traditional syntactic analysis
of such cases is incorrect.

Larson (1988, fns. 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 (55)a-b would be something like (57), where
the AdvP indeed qualifies as the most deeply embedded constituent of
the VP.35

(57)

\[
\begin{array}{c}
NP \\
pro they \\
stanno are \\
seguendo la lezione following the lecture \\
X' XP \\
V' VP \\
AdvP attentamente attentively
\end{array}
\]

If so, the unmarked stress pattern of (55) with main stress on the VP
adverbial is precisely what the null theory predicts.36

Comparable evidence exists, as noted, that the first object of the
double object construction in English (the 'dative') asymmetrically c-
commands the second (cf. Barss and Lasnik (1986), and Kayne (1984) and
Larson (1988)). So, the fact that the second object bears greatest
prominence in the VP is expected under the null theory.37

Another potentially problematic case is represented by Heavy NP Shift.
Consider the following alternations:
(58)a Loro ricordarono l'appuntamento a Carlo
(lit.) They reminded the appointment to C.

b Loro ricordarono a Carlo l'appuntamento (che gli avevano dato)
(lit.) They reminded to C. the appointment (that they had given
him)

(59)a Gianni incontro' il figlio arrabbiato
G. met his son angry

b Gianni incontro' arrabbiato il figlio
G. met angry his son

(60)a Carlo parlo' a Maria di noi
C. spoke to M. about us

b Carlo parlo' di noi a Maria
C. spoke about us to M.

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"
- Larson 1990, 591); hence, we expect, will bear greater prominence.38

For such cases, Larson suggests a rule of 'Light Predicate Raising',
which moves the V + XP sequence, reanalysed as V, around the object.

This particular analysis faces a problem in Romance, where finite Vs
raise to AGR, across temporal and aspectual adverbs. These adverbs,
unexpectedly, can separate the V from the XP, and moreover cannot
intervene between the putatively reanalysed V + XP sequence and the
heavy NP shifted object, again contrary to what one would expect:

(61)a Maria non ricorda mai a Carlo gli appuntamenti di lavoro
(lit.) M. does not remind ever to C. business appointments

b *?Maria non ricorda a Carlo mai gli appuntamenti di lavoro
(62)a Gianni non incontra più arrabbiato il suo direttore
G. does not meet any longer angry his boss
b *Gianni non incontra arrabbiato più il suo direttore

All this suggests that the V rises 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 adjoined 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.39

It may be that such PP alternations as (60)a-b are not to be treated as cases of Heavy NP Shift (or Light XP Shift). Cf. Larson (1990), for discussion.

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

(63)a [[ Kafka's Werke ] und [ die moderne Novelle ]]

b [[ Kafka's works ] and [ the modern short story ]]

c [[ Le opere di Kafka ] e [ la novella moderna ]]

This is unexpected under the null theory if coordination is symmetric, as often assumed:
(64) \[
\begin{array}{c}
\text{XP} \\
\text{XP} \\
\text{XP}
\end{array}
\]

In this case too, there is, however, 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) above would be (65) rather than (64) (also see Gazdar 1981, 158):

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

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. 40

If so, coordinate structures are entirely compatible with, and in fact support, the null theory of phrase stress.

Admittedly, other questions remain open that would deserve attention. Should the null theory resist at 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.

There is still one class of facts that are apparently not reconcilable with the assumptions granted so far, and which point to a particular refinement of the present analysis. In the previous section we saw how the unexpectedly possible stress prominence of the predicate in a sentence like "[the author of many popular articles about the"
effects [of senescence])]]] [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, respectively:

\[(66)a \ [\text{The [man [from [Philadelphia]]]]'s hat} \]
\[b \ [\text{[von sieben [jungen [Italienern]]] entdeckte] Impstoff] \]

The latter are not internally partitioned into a focussed 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.

It could be suggested that given the more articulated structure of the noun phrase, comprising at least two functional projections between DP and NP, and the fact that genitives rise to the SPEC of DP, the head would end up being more deeply embedded. But this appears dubious for the cases at hand, and more generally. For one thing, the most prominent stress falls on the head no matter how complex the specifier is:

\[(67) \ [\text{the [man [from [the apartment [ next to [ your sister's [former husband]]]]]]]'s hat} \]

Secondly, and more significantly, in such cases as (66)a-b and (67) the articulated structure of the DP is replicated in the SPEC of the matrix DP, so that the genitive DP will contain in any case one layer more of embedding when it meets with the matrix D':

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38
All of this suggests the need to refine the procedure of grid construction utilized above (see (11)).

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).41

That there is a real asymmetry between the recursive and the non-recursive sides is shown by the fact that 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, as often noted (Cf. 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 both to the recursive or to the non-recursive side. When on the non-recursive side, recursion is possible only to the same non-
recursive side.\textsuperscript{42} The latter property is exemplified by the following cases, simplified for convenience:

(68)a He is a [\textsuperscript{Npp}proud (*of his children) father]

\hspace{1cm} b He was [\textsuperscript{A\textsubscript{p}}less (*than us) sympathetic]
\hspace{1cm} c He walks [\textsuperscript{A\textsubscript{adv}}more (*than us) rapidly]
\hspace{1cm} d He [\textsuperscript{vpspecially (*for us) made the cake}]
\hspace{1cm} e The boat was [\textsuperscript{p}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.\textsuperscript{Cf.},

(69)a On which day of the weak are they coming?

\hspace{1cm} b The destruction of the documents was deliberate
\hspace{1cm} c The man from Philadelphia's 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. This would limit the relevant notion of embedding to the continuous path uniting from the bottom all and only the nodes found on the recursive side and on the X' projection line of a phrase up to the node which is expanded on the non-recursive side. A simple example will illustrate this idea:

(70)
One path of embedding is that which unites \( Z \) to \( X'' \) (\( Z, Z', Z'', Y', Y'', X', X'' \)). It is a well-formed path since all the nodes which it connects are either on the \( X' \) axis (\( Z, Z', Z'', Y', Y'', X', X'' \)), or expanded on the recursive side (now assuming it to be fixed to the right). Another is the path uniting \( K \) to \( W'' \). In this context, the path uniting \( K \) to \( X'' \) is instead an ill-formed path of embedding as it contains at least one branch (\( W'', X'' \)), which is neither on the \( X' \) axis nor on the recursive side.

It is also possible to define the main path of embedding as that path which has the root of the constituent as one of its extremities (in (70), the path connecting \( Z \) to \( X'' \)).

Qualifying the notion of embedding this way, we obtain, as a consequence, that the somewhat exceptional free recursion of the specifier of \( CP, AGRP \) and \( DP \) be considered a separate path of embedding.

If so, it is not unreasonable to take the principles of grid construction to operate on it on a separate cycle. Assume, further, that when a 'peripheral' 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 terms of a single asterisk (much as happens in compound structure, as discussed in sect.9 below).

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, the head. Consider the simplified structures (71a–b):

\[ (71) \]

\[ \begin{array}{c}
\text{a} \\
Y^P \quad \text{XP} \\
\ast \quad \text{X'} \\
\ast \quad \text{Z'} \\
\ast \quad \text{Z''} \\
\end{array} \quad \text{b} \]

\[ \begin{array}{c}
Y^P \quad \text{XP} \\
\ast \quad \text{X'} \\
\ast \quad \text{Z'} \\
\ast \quad \text{Z''} \\
\end{array} \]

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In (71)a, where the complement is present, the complement will prevail over the head (and the specifier) as 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 (71)b, the head of the phrase will qualify as the most deeply embedded constituent. Receiving an asterisk at the X' level, it will also attract the asterisk of the XP level, the internal structure of YP being 'invisible', as it were, at the level of the main cycle.

This refinement appears thus to have the correct empirical consequences for the stress contour of the apparently problematic cases (65)a-b above.44

This may also shed some light on the observation made in sect.5 above (after much tradition) that a sentence with a preverbal subject cannot count as a single focus constituent (as opposed to one with a postverbal subject in an unaccusative structure). Either the subject is focus and the predicate presupposition or vice versa.

In this frame, 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. The case of an unaccusative structure with an inverted subject in situ is instead different, as it is in fact made up of a single path of embedding

8. Some typological evidence for the null theory

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

As observed, one must be cautious, as this is one of a number of simplifications. In sect. 5, we noted, for example, 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.

This notwithstanding, 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"). Also see McCawley (1968). 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, to the effect that in the Munda languages, whose
phrases are head-final ("operator-first", in their terminology), the
phrase accent 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 literature, in particular in László Dezső's work on the
typology of theme-rheme structure and sentence stress. Cf. Dezső
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 actual 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,\textsuperscript{45} 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 case of mixed language, apparently, is that of Afghan Persian as discussed in Bing (1980).

9. On the Stress Pattern of Compounds

Since the dependence of compound stress on the internal constituency of the compound is even more striking (if anything) than that of phrases, it is tempting to try and 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 crosslinguistic difference should reflect the different structural relations in which the component words enter within the compound, possibly subject to parametric choices (cf. fn. 49 below).

In what follows, I will try to show that this appears to be possible for our three languages 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)).

(1) a [[ kitchen ] [ towel ]]
   b [[ towel ] [ rack ]]
   c [[ teachers ] [ union ]]

More interesting is the case in which one of the two component words is itself a binary compound. See (73)a and b:

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

Here, depending on the direction of branching (leftbranching in (73)a and rightbranching in (73)b), the stress contour changes. 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 (73)a 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 once again assigned to it, as kitchen also is the leftmost peak of the outer cycle.

Matters are not as simple with the stress pattern of (73)b. Right-branching compounds like (73)b require in Chomsky and Halle's
(1968,93) system a special qualification, and have called for some special statement in all treatments of compound stress thereafter. 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 (our underlining):

(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 leftbranching structure (76)a, and on \( B \) in the rightbranching structure (76)b:

(76)a
\[
\begin{array}{c}
A \quad D \quad E \\
A \quad B \quad C
\end{array}
\]

(76)b
\[
\begin{array}{c}
E \quad D \quad C \\
A \quad B
\end{array}
\]
The null theory of phrase stress appears to have precisely these consequences under an analysis of the internal structure of compounds which modifies in part the standard analysis along lines which can be independently motivated.

The standard analysis recognizes for compounds 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):\(^{48}\)

\[(77) \ [_{\text{n}} \ [_{\text{n}} \ \text{towel}] \ [_{\text{n}} \ \text{rack}]]\]

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 assigned by rule (as with the Right-hand Head Rule of Williams (1981)).\(^{49}\)

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

\[(78) \ [_{\text{n}} \ [_{\text{np}} \ \text{towel}] \ [_{\text{n}} \ \text{rack}]]\]

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):\(^{50}\)
All such cases would be excluded if a word formation rule like (80) were assumed (as in Williams (1981), Toman (1982), Selkirk (1982)):

(80) \( X^0 \rightarrow [X^0 X^0 X^0] \)

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

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

```
(81)
NP   N
  |
N    NP   N
  |
N      N

kitchen  towel  rack
```

49
Consider now (75a), with labels added:

(83)

```
(  *               )       *               *   )       *       *       *       *   )
  (                  )       (                  )       )       )       )       )
  (                  )       (                  )       )       )       )       )
  [                   ]       [                   ]       rack     )
  [                   )       [                   )       )       )       )       )
```

kitchen towel rack

Here, the most embedded constituent is kitchen. Hence it is this element which attracts more asterisks. Cf. the corresponding metrical grid (84):

(84)

```
(  *               )       *               *   )       *       *       *       *   )
  (                  )       (                  )       )       )       )       )
  (                  )       (                  )       )       )       )       )
  [                   ]       [                   ]       rack     )
  [                   )       [                   )       )       )       )       )
```

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) below, in which the most prominent stress is on the leftmost subcomponent of the rightmost constituent (towel), as in the more basic case (81):

(85)

```
(  N               )       N               *               *               *       *   )
  (                  )       (                  )       )       )       )       )
  (                  )       (                  )       )       )       )       )
  [                   )       [                   )       )       )       )       )
```

hotel kitchen towel rack

This structure, and the procedure followed so far, would seem to predict an incorrect stress contour, as the most embedded constituent

50
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 non compound word (the hotel kitchen towel rack's size), 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 at the point where it combines with towel rack, so that (85) reduces in effect to the more basic (81) above.

Even if right, this intuition runs into a technical problem if the structure of (85) is the one indicated. The reason is that also towel rack would count as a single line 3 asterisk when it combines with hotel kitchen, since it too is dominated by N in (85). We would thus get the wrong result once again, since the most prominent stress should now go on the modifier hotel kitchen (ultimately on hotel), as this is the more deeply embedded constituent of the two (being dominated by the extra node NP).

The discussion so far has, however, 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 is 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.51.

Within X'-theory, a head is such only in relation to a maximal phrase which it projects. For example, the N [hotel kitchen towel rack] is a syntactic head only if it projects to a NP (ultimately a DP) as in [a

51
[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 (lexiconwise) with respect to the *N* immediately dominating *rack*. Since the topmost *N* is an *X*\(^0\) syntaxwise, we can agree to express its maximality by noting lower level nodes on the lexical side with progressive negative integers (-1, -2, ...). This gives (86) as a more accurate lexical representation of (85) above:

besides expressing in a more perspicuous way the notion 'head of a compound', this analysis gives the correct empirical results, in interaction with the hypothesis that *hotel kitchen* starts with one (line 3) asterisk at the topmost *N* cycle. *Towel* will receive the most prominent stress as it will collect one asterisk more than the higher modifier *hotel kitchen*, i.e. one at the *N*\(^r\) level, one at the *NP* level, and one at the *N*\(^-1\) level (=3). *Toy kitchen* will instead receive two only, at the circled *N*\(^r\) and *NP* levels, so that when the common *X*\(^0\) cycle is reached the final asterisk will be attracted in correspondence with the column over *towel*.
As indicated in \((87)\), the fact that syntactic heads (NPs projecting a NP) count as single words, starting with one (line 3) asterisk, implies that the cyclic derivation which has derived the stress contour of \textit{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 \textit{hotel kitchen}, responsible for the relative prominence of \textit{hotel} over \textit{kitchen}, and one at the matrix N, responsible for the relative prominence of \textit{towel} over \textit{hotel kitchen} (and \textit{rack}).

The previous account of the stress pattern of left branching compounds \(((\text{[kitchen] [towel]} [\text{rack}])\)) must be slightly altered accordingly, but the outcome is unaffected by this refinement. Although \textit{kitchen towel}, as a syntactic head projecting a NP will merely count as one (line 3) asterisk located over the first syllabic nucleus of \textit{kitchen} in the first round of stress assignment, it will nonetheless be more deeply embedded than the head \textit{rack}, thus ultimately receiving the most prominent stress. See the structure \((88)\), and the corresponding metrical grid \((89)\):\(^{53}\)

\((88)\)

\[
\begin{array}{c}
\text{NP} \\
\text{N} \\
\text{N'} \\
\text{N}^0 \\
\text{N}^{-1} \\
\text{kitchen} \\
\text{towel} \\
\text{rack} \\
\text{N}^{-2}
\end{array}
\]
(89)

There in fact appears to be evidence for a further refinement of the structure of compounds; one involving a more literal extension of X'-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 two levels):

(90)

\[ \begin{array}{c}
\text{N} \\
\text{(spec.)} \\
\text{(compl.)} \\
\text{N}^{-1}
\end{array} \quad \begin{array}{c}
\text{N}^{-2}
\end{array} \]

So far, we have focussed on N N compounds in which prominence falls on the non-head, 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.\(^{54}\) Here are some representative cases (also see the examples in (79) above):

(91) N N

a kitchen table
b town hall
c woman doctor
d police investigation

The generalization which emerges from the three works cited in the last footnote (in fact, made explicit in Selkirk 1984) is that in N N compounds, as well as in other types of compounds, stress falls on the non-head if this is an argument of the head. Otherwise, it falls on
the head (cf. Selkirk 1984, 244ff).

This is particularly clear in N A compounds as shown by the following contrasts:

\[(92) a \text{ frost bitten} \quad \text{vs} \quad b \text{ lily white} \]
\[\quad \text{desease prone} \quad \text{waist high} \]
\[\quad \text{blood thirsty} \quad \text{dirt cheap} \]
\[\quad \text{germ resistant} \quad \text{crystal clear} \]

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 frost, 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 lily, as high as (the) waist, as cheap as dirt) or a locative force [...]" (Selkirk 1984, 245).

The same generalization is apparently at work in such well-known prominence contrasts in N N compounds as:

\[(93) a \text{ apprentice welder} \quad b \text{ apprentice welder} \]
\[\quad \text{toy factory} \quad \text{toy factory} \]
\[\quad \text{wine drinker} \quad \text{party drinker} \]

If the non-head is interpreted as a complement of the head as in (93)a ('one who welds apprentices', 'a factory producing toys',...), stress prominence falls on it. If it is interpreted as an adjunct/specifier ('a welder who is an apprentice', 'a factory which is a toy',...), stress prominence falls on the head. This conclusion is reinforced by an examination of the careful classification of stress prominences in compounds in Zwicky (1986). According to Zwicky's material, whenever
the non-head bears a possessive (government commission), locative (kitchen table, town hall), temporal (summer holiday), attributive (woman doctor), material (wood chest) relation to the head, i.e. a specifier relation to it, the non-head never bears main stress. To take another example, this time from AA compounds, consider the contrast between (94)a and b (from Selkirk 1984,245ff; Bates 1988, 176ff):

(94)a sick looking nice seeming strange sounding
b good looking hard hitting long suffering

If the first adjective is interpreted as a complement of the following deverbal adjective ('he looks sick', 'he seems nice', 'it sounds strange', etc.), it bears main stress. If its interpretation is instead that of an adjunct, as in the b cases ('he looks well', '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 lefthand N in such cases as steel warehouse 'a warehouse for steel', towel rack 'a rack for towels', wheat flour 'flour (made) from wheat', coaltar product 'product (made) from coaltar' counts as a complement (bearing a goal, or source, theta-role) of the righthand N. What is relatively surer is that "when the lefthand element clearly has adjunct status (as a modifier, for example), the head is prominent and the adjunct may not be" (Selkirk, op.cit., p.247).

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 idiosyncracies).

Suppose, then, (in fact, departing from Selkirk's further conclusion that "the location of prominence [in compounds] cannot be explained in purely structural terms" (p.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):

(95) \[ \text{XP} \rightarrow Z \rightarrow X^{-1} \rightarrow X^{-2} \]

(spec.) (compl.)

The analysis appears to derive as a necessary consequence a generalization about compound structure noted in Selkirk (1982,36ff) and still in need of a principled explanation. In her words "all [non subject] 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 more 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' structure to the compound as this forces internal arguments to be under X' (X^{-1}) and non arguments to be in the specifier position under X" (X). Since pasta cannot receive a locative interpretation, it must occupy the complement position, closer to the head.58
The single structure (95), with the recursive possibility for ZP and YP to contain a head which is 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 sect.7, according to which only elements embedded on the recursive path 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, due to their being on a non recursive branch.

We see that compounds are no exception to this generalization. In compounds too complement wins over the head (and the specifier) (cf.(96)), and, in the absence of a complement, the head wins (over the specifier), in this case giving righthand prominence (cf.(97)).

This grounds Selkirk's generalization in purely structural terms, thus avoiding the problem noted above of a semantically based stress assignment:

(96)

\[
\begin{array}{c}
N \\
\{ \text{kitchen} \} \\
\varnothing \\
\text{TOWEL} \\
N^{-2} \\
\text{rack} \\
\end{array}
\]

(97)

\[
\begin{array}{c}
N \\
\text{kitchen} \\
\varnothing \\
N^{-1} \\
N^{-2} 59 \\
\text{rack} \\
\end{array}
\]
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 boldface. 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):\(^{60}\)

\[(98)\]a

\[\begin{array}{c}
\varnothing \\
N \\
N^{-1} \\
N^{-2} \\
LAW \\
\text{degree requirement}
\end{array}\]

\[(98)\]b

\[\begin{array}{c}
\varnothing \\
N \\
N^{-1} \\
N^{-2} \\
LAW \\
\text{degree requirement changes} \\
\text{TEACHERS union president election}
\end{array}\]

In (98)a and b 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, and the like. Instructive is the contrast between (98) and (99):

\[(99)\]

\[\begin{array}{c}
\varnothing \\
N \\
N^{-1} \\
N^{-2} \\
law \\
\text{degree} \\
\text{LANGUAGE} \\
\text{requirement}
\end{array}\]

Here, law degree is not a complement of language, itself complement of requirement. So, it is no more 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 which qualifies as the
most embedded element of the compound and gets stress prominence.\footnote{61}

(100)a

kitchen TOWEL rack deposit

(101)a

\emptyset \text{kitchen} \emptyset \text{RACK} deposit

(102)a

\emptyset \emptyset \text{labor} union FINANCE committee president
A potential problem is provided by such A N compounds as (103) below, in which stress falls on the head even if the adjective apparently introduces a complement of the head:

(103) lunar exploration (exploration of the moon)
    stellar observation (observation of the stars)
    presidential election (election of the president)

If the adjective, as a consequence of that, were generated in the complement position of the compound, then it should receive stress prominence, but it doesn't.

Such cases as (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.). But the two cases differ. In (103), for the adjective to stand in a proper complement relation to the N it would have to receive the theta-role theme from the N. We know, however, from the syntax of NPs, that adjectives cannot receive a theta-role by being generated in complement position, though they can in SPEC (cf. 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 appears indeed 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 theta-role assignment.

In sum, if such adjectives are generated in the specifier rather than in the complement position, then expectedly stress prominence will go to the head. A(P)s would thus differ from N(P)s precisely in not being able to absorb a theta-role via government in complement position. It is interesting to note, then, that substituting a N(P) for the A(P) in (103), stress prominence changes systematically, in the expected way. (Bates 1988,80f):

(104) cave exploration
    star observation
    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. V. (105):

(105) student rebellion
    government funding
    consumer spending
    enemy movements
    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. It is however dubious that the non head Ns in (105) are genuine (external) arguments of the head. A genuine external argument cannot in general appear in the specifier position of compounds: *girl swimming, *kid eating - Selkirk (1982,34). Furthermore, as Bates (1988,111ff) notes, the head still retains the capability of assigning the external theta-role (a
student rebellion by Cambridge undergraduates). So, as he indeed suggests, the non head 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.

In the present analysis, the stress contour of phrases and compounds is determined in one and the same way, and merely depends on constituent structure, above or below the word, according to the case. So, whenever two sequences of two (or more) words differ in stress contour, we are led to assign to them two different constituent structures, implausible as it may seem in certain cases as with such well-known pairs as apple cake (with stress on apple) and apple pie (with stress on pie). The present theory, in this case, must analyse the first with apple in complement position and the second with apple in specifier position:

(106)a

\[
\begin{array}{c}
\emptyset \\
\text{apple} \\
\text{cake}
\end{array}
\]

b

\[
\begin{array}{c}
\text{apple} \\
\emptyset \\
pie
\end{array}
\]

Possibly, even such contrasts as Madison Avenue vs. Madison Street differ structurally (pace Liberman 1978, 165), though one should not exclude the possibility that there exist lexical idiosyncracies. Although we have assumed throughout that phrases can enter into compounds (both as specifiers and complements), our analysis does not crucially rest on this assumption, which is in any event controversial. While Sproat (1985), Waliska de Hackbeil (1986) argue for its correctness, others have questioned it (cf., among others, Selkirk (1982), Bates (1988)). A critical examination of this question is beyond the scope of this paper. We merely note here that the
correct compound stress patterns may follow from the metrical grid theory even if phrases are excluded from compounds. Ignoring specifiers, which, as noted, are computed on a different cycle, complements still count as more embedded than heads even if they are Ns rather than NPs. If the process of asterisk addition uniformly starts from $N^{-2}$ for constituents found on the recursive path (complements and heads), complements will win, collecting an asterisk at $N^{-1}$ and $N^0$, before the common cycle is reached. $^65$

\[ \text{kitchen} \quad N^0 \quad N^{-1} \quad N^{-2} \quad \text{towel} \quad \text{rack} \]

Many questions concerning English compounds have not been addressed here, nor has the important question concerning parametrization, which deserves a separate treatment. Others have been addressed only briefly. I nevertheless hope that the present analysis was phrased clearly enough to suggest possible ways to solve the remaining issues.
Footnotes

* For comments and suggestions to an earlier version of this article I am indebted to Werner Abraham, Josef Bayer, Paola Beninca', Gerhard Brugger, Andrea Calabrese, Anna Maria Di Sciullo, Guenther Grewendorf, Morris Halle, Richard Kayne, Michael Kenstowicz, Joan Mascaro, Marina Nespore, Petr Sgall.

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 sect. 9 below.

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); etc.

3. This condition on asterisk movement 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

\[
\begin{array}{cccc}
3 & 2 & 4 & 2 \\
2 & 3 & 4 & 2 \\
2 & 4 & 3 & 1
\end{array}
\]

retracts in antique chair (< antique chair) but not in 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 in Halle and Vergnaud (1987,235,270) according
to which the rule fails to apply in words where the potential landing
site lacks stress (serene summers vs. fifteen summers < fifteen
summers). For there is no way for the topmost asterisk of the second
syllable of serene to move over the first syllable without violating
the requirement that there be an asterisk on the immediately lower
line.

4. A potential problem for this condition is provided by such cases as
(i) below (Halle and Vergnaud (1987,39)):

```
    1 3
    3 2 4 0
```

(i)a New York b New York City

which would seem to have the following derivation:

```
(ii)
    *    line 4
    * <-- line 3
    *    line 2
    *    *    line 1
    *    *    *    line 0
```

New York City

I assume that addition of an asterisk to the first column (on line 2)

is to be avoided. Otherwise, nothing would stop one from adding an

asterisk in lines 1 and 2 of the second column in (i) thus deriving

```
    2 3 2 4 0
```

the incorrect Japanese beetle. Equally to be avoided is movement of

blocks of columns. If the asterisks of line 2 and 3 were allowed to

move leftward (as a block) in (i), the incorrect Japanese beetle in

```
    3 1 4
```

(6) would be derived, as well as the wrong contour New York City for

(ib). Cf. Prince's (1983,42) level-locality of 'Move *', whereby only

one asterisk at a time is affected. In either case we would have an

enrichment of the power of the theory.

What I will tentatively assume is that the base contour of (i)a is

```
    2 3
```

rather New York, with 2 ultimately going to 1 by a (late) reduction
peculiar to this type of collocation, but not others and that stress shift applies to the base contour (thus giving the correct result within a restrictive theory of asterisk movement). The correct order results if the Rhythm Rule belongs to the cyclic stratum of the word-sequence phonology and the reduction rule to the noncyclic stratum.

5. 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. Cf. Cruttenden and Faber (1991).

6. 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) suggest a Grid Simplification Convention (cf. their p.266). On this question, also see Chomsky and Halle (1968,23).

7. Question (10)b in fact is not particular to Halle and Vergnaud's theory, but to any theory comprising (some version of) the Nuclear Stress Rule.

8. One may note, incidentally, that some of the parametric options which seem appropriate at the word stress level may in fact 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 can be dispensed with, along with the +HT parameter.

9. (11)a differs from Halle and Vergnaud's (7)c 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 on pages 8 and 9.

10. Halle and Vergnaud (1987,265) claim that *preached* has more stress than *people*. If this is a clear and perceptible intuition, then the procedure in (11) will need to be amended. The corresponding facts of Italian seem to me not to be particularly sharp. Perhaps, "supplementary principles of prosodic realization" (Prince 1983,24) superimpose themselves on the effects of the present procedure. On rhythmic principles also see Selkirk (1984), Dell (1984).

11. See section 8 below.

13. A similar approach is taken in Jacobs (1982).

14. (i) a-l represent (part of) the fragment of German grammar presupposed by Kiparsky:

(i) a Satz \( \rightarrow \) (I) S  
   b I \( \rightarrow \) [Imp]  
   c S \( \rightarrow \) D VP  
   d D \( \rightarrow \) Nom (Nom) (Nom) (Adv)  
   e VP \( \rightarrow \) (Satz) Vb Aux  
   f Vb \( \rightarrow \) (Adv) V  
   g Nom \( \rightarrow \) d (Satz) N  
   h Aux \( \rightarrow \) (Md) Fin  
   i d \( \rightarrow \) determinant  
   l Md \( \rightarrow \) modal verbs (sollen, wollen,..)

In addition to (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).


16. Phrased in other words, NPs, CPs and Ds would be subject to the (German analogue of the) Nuclear Stress Rule, while 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 vs. word-internal domain of application.

17. To remain neutral now between the numerical convention utilized by Kiparsky and the same used in Halle and Vergnaud (1987) and below, I use either a single, acute ('), accent for primary stress, or the convention of setting the constituent with primary stress in boldface.

18. 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 cases, contrary to fact:

(i) 'Da hat das Kind mit gespielt
With it the child has played

19. Further evidence in favor of the null theory may come from considering the general properties of the acquisition of German as a second language by English speakers. As noted in Schmerling (1976,84), if the stress contour of English and German phrases were determined by language-specific rules like the Nuclear Stress Rule, then one would expect that English speakers might have difficulties in learning the German version of the rule. Some speakers at least would commit errors such as that of stressing the verb rather than the object (weil ich Hans sah.. 'because I saw H.') But this seems never to happen (cf.p.117,fn6). "[O]nce the English speaker masters the correct order, the correct stress comes automatically"(p.84).

This is just what the null theory of phrase stress (which contemplates no language-specific rules) leads us to expect.

20. It also follows under 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 ([pp [ppP NP] F ]). Postpositions then are prepositions raising to F, while circumpositions are cases of base generated Ps in both P and F. For certain speakers, prepositions can apparently carry the most prominent stress when their object is pronominal (Komm mal zu mir 'Come to me' - Fuchs 1976,310), but not when they are stranded (cf. (i) of fn.18 above).


22. We abstract for the moment from such cases as Ein Brief kam an ('a letter arrived'), Otto kommt ('O. is coming'), which have primary stress on the subject (in the SPEC of CP) in the unmarked case (cf. Kiparsky 1966,89, Stechow and Uhmann 1984,253). A comprehension of such cases requires a discussion of the focus and presupposition articulation of the sentence, which we undertake in the next section. On the stress properties of separable prefixes in German see fn. 25 below.

23. For the apparently unexpected stress contour in (i), due to Josef Bayer (p.c.), I refer to the discussion in sect.7 below, 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 Mannj [ohne zu zögern] hingerichtet
One has the man without hesitating to death sentenced
24. The same conclusion is reached for Hindi in Mahajan (1991). The contrast reproduces itself with indefinite subjects, (which in German can remain within VP), but apparently not with indefinite indirect objects. See (i)a-b provided by G.Brugger (p.c.) and G.Grewendorf (p.c.), 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 G.Grewendorf (p.c.) pointed out:

(iii) ..dass der Arzt bereitwillig jeden Patienten untersuchte
     ..that the doctor willingly every patient examined

25. A separate 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, p. 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, consists in analysing them as heads of intransitive PPs selected by the V (Riemsdijk's 1988):

(i)a Wann werden wir [vp [pp [p an]] [y kommen]] ?
   When will we arrive?

b Wann kommen wir [vp [pp [p 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 INFL even in infinitival clauses -
As shown by (ii), the intransitive \((P)P\) moves (possibly in PF) to INFL when this contains lexical zu and the incorporated infinitival:

(ii) Er wünschte bald anzukommen
He wished to arrive soon

26. I don't mean to say that these dichotomies exactly correspond to each other (cf. Gundel 1977, chapter 2 for a review of the various traditions), but they all seem to try to separate in a sentence that part which 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).

27. Expectedly, when a VP is preposed, it is its rightmost constituent in Italian and the constituent adjacent to the V in German which receive VP–internal prominence, irrespective of whether the VP constitutes the focus or the presupposition (where "\(\sim\)" is less prominent than "\(\sim\)" in absolute terms:

(i) a \([\text{VP venduto la macchina }]\) ancora non ha 'Sold the car, he hasn't'

\[
\begin{array}{l}
\text{P} \\
\text{F}
\end{array}
\]

b \([\text{VP Sein Auto verkauft }]\) hat er noch nicht 'idem'

\[
\begin{array}{l}
\text{P} \\
\text{F}
\end{array}
\]

(ii) a \([\text{VP venduto la macchina }]\) pare che abbia 'Sold his car, he has'

\[
\begin{array}{l}
\text{P} \\
\text{F}
\end{array}
\]

b \([\text{VP Sein Auto verkauft }]\) hat er schon 'idem'

\[
\begin{array}{l}
\text{F} \\
\text{P}
\end{array}
\]

28. Cf. Jackendoff (1972): "If a phrase P is chosen as the focus of a sentence S, the highest stress in S will be on the syllable of P that is assigned highest stress by the regular stress rules".

9
29. Certain languages appear to be able to disambiguate cases like (46). 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 (i)a and b, from Dogil (1980,225f), who points out that only in the latter case can any of the phrases be focus:

(i)a [waznosc [komunikacji [SAmochodowej]]]  
the importance of travelling by car

b [waznosc [komunikacji [samochoDOwej]]]


31. Note that nothing changes even if proper names, as definite NPs, cannot remain in situ, but must rise to the postverbal VP subject position of transitive and unergative verbs (Belletti 1988) (see, however, the relative wellformedness of Ad un certo punto entro! Gianni dalla finestra 'At a certain point entered G. from the window', and Beninca' (1990) for evidence that proper names behave more like indefinite than definite NPs, hence can remain in situ). This is because the V (whether finite or participial) moves out of VP, to the respective AGR position (Chomsky 1989, Belletti 1990), thus leaving the subject as the most deeply embedded constituent any way. 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 'G. called'

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

(ii)a Ha telefonato a me GIANNI

   b Ha telefonato la notizia IL NOSTRO CORRISPONDENTE

This is because the inverted subject, which is chomsky-adjointed to VP, in this case, is no more the most deeply embedded constituent. So it can receive primary stress only if it is the only element in focus (or is contrasted).

32. The focus/presupposition structure of intransitive sentences with unaccusative verbs in English appears to be preserved under embedding. See (i):

(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 (52)b. It is possible that such unmarked stress patterns as (ii), reported in 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 rather have rightmost prominence (or inversion).

33. It is however not inconceivable that such contrasts have a structural basis. I leave the question open. (53)a is of the same type of cases , originally observed by Newman (1946), which 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 in the present theory, her suggestion is not without empirical problems, as Lakoff (1972) and Berman and Szamosi (1972) pointed out. Bresnan (1972,332f) in fact acknowledges one such problem. Another problem is provided by the Italian facts discussed in the next footnote. For further critical discussion of Bresnan's proposal, see Schmerling (1976,88), Selkirk (1984,239ff).

All in all, it seems that there is no real motivation to abandon 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.

34. It appears, for example, that Italian differs systematically from English in generally not allowing primary stress in non final position (in non emphatic contexts). Many of Bresnan's contrasts appear thus to be neutralized in Italian. Cf. e.g.:

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

(ii)a John chiese che cosa Helen avesse SCRITTO
    J. asked what H. had WRITTEN
   b John chiese quali libri Helen avesse SCRITTO
    J. asked WHAT BOOKS H. had written

(iii)a George ha trovato qualcuno che vorrebbe che tu INCONTRASSI
    G. found someone he'd like you to MEET
   b George ha trovato degli amici che vorrebbe che tu INCONTRASSI
    G. found SOME FRIENDS he'd like you to meet

35. 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)a Negative polarity
    John saw noone anywhere vs. *John saw anyone nowhere
b Superiority
    Who did you see where? vs. *Where did you see who?
c Bound pronouns
    I saw everyone the day before he did vs. *I see a man who plays on it every Xmas

etc.

A similar result would follow if the object moved necessarily to a higher position for Case reasons, followed by movement of the V, as in Sportiche (1990).

36. If speaker-oriented adverbs like probably, etc. are not under VP, but under some higher functional projection (cf. Belletti 1990), then the null theory predicts that they will not bear greatest prominence, even when rightmost in the sentence. A correct result. V.:

(i)a Giorgio e uscito probabilmente (vs. *G. e' uscito probabilmente)
   b Giorgio left,probably (vs. *Giorgio left probably)

37. Larson (1988) argues that direct objects asymmetrically c-command prepositional objects, with the consequence that the latter will be more deeply embedded than the former (hence, we add, will bear greatest prominence). In this case, the same result would also seem to follow under the more traditional \[ VP [y' V NP ] [PP [NP ]] \] structure, since prepositional objects are embedded under two nodes, P' and PP, while the direct object is only embedded under one, V'.
38. As R. Kayne noted (p.c.), 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

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

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

Kayne (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 [PartP [ a book] [PartP [PartP 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 fn. 32, 34 and relative text. The systematic difference with Italian noted there is, suggestively, found here too: *John ha buttato un libro via (unless un libro is contrasted) vs. John ha buttato via un libro.

Other cases where the rightmost constituent cannot bear the greatest prominence of the sentence are, as already noted, 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 either be within the scope of the negation inside VP, or outside it, appears to correlate systematically with two different stress patterns, consistent with the null theory.
38. 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 -cf., for German, Lenerz 1977). This is due to the fact that specifiers are on the left in the three languages. The only genuine asymmetry appears to be represented by the location of datives. These are higher than accusative objects in German, but lower in Italian and English (at least in the prepositional variant). A possibility is that German datives, which are bare NPs, are more like the first object of the English double object construction than of the English and Italian prepositional dative object. Though, it remains mysterious why datives in German cannot bind an anaphor found in the accusative object (Haider 1987):

(i)  *Er hat den Gästen einander vorgestellt
    He has the guests each other introduced


41. We ignore now the case of mixed languages where the position of the complement w.r.t. the head is not the same for each phrase.

42. Emonds (1985) refers to this restriction as the "Recursion Restriction", Longobardi (1991b) as the "Consistency Principle". (Zwart 1976, Emonds 1976, Willard, 1982). The notion of "recursive side" is Emonds's (1976,19) (A consequence of [this] surface restriction is that either all freely recursive phrase nodes [...] appear to the left of a given head of a phrase in surface structure, or else all appear to the right of the head. Thus it makes sense to speak of the "recursive side of (the head of) a
phrase" as that side of a head which exhibits the freely recursive nodes [...].

43. 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, chapter 4) notion of "non-head stress" ("whereby in a head-nonhead relation, the stress is assigned to the non-head", 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 (cf. Duanmu 1991).

44. The refinement just introduced appears to make the correct prediction for the stress contour of conjuncts under the X' analysis of coordination discussed above. According to that analysis, the conjunction is the head of an X' 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, as the former is on the non-recursive side. This appears indeed to be true:

(i) [[il primo [dei due autori [del libro [di poesie]]]] e [Mario]]

The first of the two authors of the book of poems and M.

45. For a different picture of Bengali phrase stress, see, however, Hayes and Lahiri (1991, sect. 3).

46. I assume here, as above, that 3 represents the highest degree of word stress.

47. The different 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" (Cf. Chomsky
and Halle (1968,93).

In this, and similar cases, syntactic (subword) structure mediates the
correlation between stress patterns and semantic interpretations. We
come back to this question later.

48. See for example Toman (1982), Silkirk (1982,1984), Di Sciullo and
Williams (1987), among others. This is true of Chomsky and Halle's
(1968) analysis as well, except for the fact that they also appear to
admit cases like \[ N \ [ NP ] N \], e.g. \[ N \ [ NP American history] teacher] \[ N \ [ NP black board ] eraser \] (p.21f).

49. This is not to say that William's insight (for compounds) is
superfluous. One needs in any event to 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

50. I have already mentioned Chomsky and Halle's (1968,22,fn9)
\[ N [ NP American history] teacher]. Also see Fabb (1984,136,145,190),
Sproat (1985,199ff), Roeper (1988,205f), Hoeksema (1988,124ff), Lieber
(1988), from which some of the examples in (79) are drawn, and Visch
(1990, Appendix 1).

On the basis of the illformedness of cases like (i)a-b below, 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)a-b do not warrant this conclusion any longer. 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, chapt. 3, sect. 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 1990), not the maximal projection NP, D's complement:

(i)a *A [(the Bible) lover]  b *An [(every animal) eater]

51. In the spirit of Borer's (forthcoming) notion of Parallel morphology.

52. This recalls similar proposals made in the literature (cf. Selkirk (1982), among others), but differs from them in that N⁻¹ and N⁻² are not taken here as sub-word 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. Alternatively, one could utilize the usual X' schema [N'' [N' N⁰ ]] and convene that in compound structure N'' counts as N⁰ in the next higher (compound or syntactic) cycle. For evidence that a more literal extension of X' theory to compounds is in order, hence that X' theory should perhaps be generalized across levels (word structure, compound structure, syntactic structure,..), see below.

53. One can imagine various interpretive algorithms which, from the metrical grids constructed at each round (cycle) compute the relative prominence of the constituents of the entire compound. Cf. the
discussion in Liberman and Prince (1977). Since not much is at stake here, I will leave open here the determination of the best such algorithm.


55. Another possibility would consist in claiming that the b cases are not compounds but phrases, hence patterning in the expected way. This claim is occasionally made (cf. Bloomfield 1933,228), Bates (1984), among others), but it runs counter 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,chapter 3) for in-depth discussion. In any event, it does not seem possible to treat all collocations with 'afterstress' as phrases. As Zwicky (1986) points out, following Lees (1960), a sequence like legal document is ambiguous between the two readings: "a document which 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. Prominence is on document in both cases.

56. 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 mae, etc. Perhaps, this is due to the possibility of analysing the lefthand 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.). Cf.Zwicky (1986,55) for another case possibly interpretable in this manner.
57. There are reasons to reject an approach which 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 which also works for syntactic phrases).

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. Cf. Engl. toy factory and its Italian equivalent fabbrica giocattolo (lit. factory toy) with the reverse stress pattern.

58. Selkirk (1982,37) also notes that "two [non subject] arguments cannot appear in a compound". So, one cannot have *baby toy handing, *table boot putting to render 'the handing of toys to babies', or 'the
putting of boots on the table'. This may follow again from a larsonian X' structure with a single specifier and a single complement, if one assumes that an abstract head providing for the third argument is absent from compounds.

59. This analysis makes an interesting prediction in the case of kitchen rack. If the interpretation 'a rack for kitchens', comparable to 'a rack for towels', is possible over and above the 'locative' interpretation 'a rack which is in the kitchen', then kitchen should get prominence, as it comes to occupy the complement position. The prediction appears to be confirmed. See: In the bathroom, we have a KITCHEN rack.

60. Compound structure and compound stress in German is apparently the same as in English, expectedly, given the same head-final choice for the relevant parameter (Giorgi and Longobardi (1991, chapter 3)). See the following cases drawn from Giegerich (1981, 1983), and Grewendorf, Hamm and Sterenefeld (1987, sect. 3.4) (also see Doleschal (1988) and references cited there). For similar facts in Dutch, cf. Langeweg (1987):

(i)

(ii)

(iii)

(iv)
Certain apparent counterexamples (HAUPTbahnhof 'Central railway station', HALLENschwimmbad 'covered swimming pool', or DreiGROSCHENoper 'three pennies opera' vs. DREIfarbstift 'three color pencil'), 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 \[ N \rightarrow [N_P [AP\text{black}] \text{board}] \text{eraser}] \] differs from \[ N \rightarrow [N_P [N_{\text{blackboard}}]] \text{eraser}] \] (cf. Giegerich (1983)). J.Bayer points out (p.c.) that for him WELTspartag is also possible along WeltSPARTag, though WELTnichttrauchertag is not. Perhaps, spartag, though not nichttrauchertag can be optionally analysed 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 right inasmuch as it possible to check it, given the severe limitations (in productivity, and perhaps type) on nominal compounding in Italian (for which see Zuffi 1981,17f and fn20, where it is pointed out that N-N compounds in Italian are generally coordinating rather than subordinating, and Giorgi and Longobardi 1991, chapter 3, sect.5, especially fn25). Thus, we have cases like

(ii)-(iii)a contrasting with English (ii)-(iii)b:

(ii)a

\[
\begin{array}{c}
\text{settore} \\
N^{-1} \\
N^{-2}
\end{array}
\]

\[
\begin{array}{c}
\text{VENDITE}
\end{array}
\]

(ii)b

\[
\begin{array}{c}
\text{SALES}
\end{array}
\]

\[
\begin{array}{c}
\text{department}
\end{array}
\]

22
(iii) \[ N \rightarrow N^{-1} \rightarrow N \]
\[ \text{capo settore VENDITE} \]

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

(iv) \[ N \rightarrow N^{-1} \rightarrow N^{-1} \]
\[ \text{SALES department head} \]

(v) \[ N \rightarrow N^{-1} \rightarrow N^{-1} \]
\[ \text{kitchen towel rack} \]
\[ \text{Landes-haupt-versammlung} \]

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'.

61. This recalls Selkirk (1984, 250) discussion (modulo the noted difference in approach): "In a compound configuration like \[ [A [CD]_A [B]_B \text{EF}]_B \] 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)."

62. Note that in (102)a and b, the most prominent stress goes on the middle constituent, although the two cases instantiate two different structures, and interpretations: (102)a = the president of the labor union's finance committee; (102)b = 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 (102)a and between union and finance in (102)b, much as in the ambiguous American history teacher (cf. Chomsky and Halle 1968,22,fn9). For a minimal pair in German similar to (102)a and (102)b, 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]

63. Zimmer (1971,C19), Schmerling (1971), Allen (1978,103ff) note that many such cases have in fact variable prominence:

(i) apple pie apple pie

cream sauce cream sauce

chocolate cake chocolate cake

64. The other street names in English behave like Avenue, not Street. In German, apparently, all but Markt have stress on the first N (Ludwigweg, Berggasse, Karl Platz, .. vs. Hoher Markt), but interestingly, if the first element of the compound is an adjective, stress may go on the head (Danziger Strasse). 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 Jeannette Schaeffer for their information).

65. Whether syntactic or just compound phrases are admitted, the asymmetric theory of coordination discussed in sect.7 makes the prediction that stress should fall on the second of the two members of
a stressed element of a compound. A correct prediction: *salt and pepper shaker* (see Bates (1988, 213ff) for an interesting discussion of coordination within compounds).
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