ADJECTIVES IN ENGLISH COMPOUNDS*

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In this paper, I advance two claims about English adjectives, explore the predictions made by these claims, and discuss the ramifications of the analysis for current debates about how phrasal syntax interacts with the word-level phenomenon of compounding. The aspect of phrasal syntax most relevant to this material involves adjectival modifiers inside noun phrases; in the NP *red balloons*, *red* modifies the head noun *balloons*, where 'modifies' refers to an operation on the head which limits or restricts its meaning. The aspect of compound structure to be investigated here also involves adjectives; the compound formation rules of English contain (the equivalent of) a PSR N → A N, which generates compounds like *redhead* (Selkirk 1982: 16). It is not standard to say that *red* modifies the head of this highly lexicalized exocentric compound; no productive operation is being performed on the head *head*. A major difference between compounds and phrases is that an adjective may appear in a compound and not modify anything (*redhead*), while adjectives in phrases always perform a modificational function (*red balloons*); if this position could always be maintained, an interesting formal distinction between compounds and phrases would have been determined. But these two cases illustrate only the ends of a phrasal-to-compound spectrum. Compounds display varying degrees of lexicalization, and under some circumstances an adjective may modify the head inside a compound. For example, Zwicky (1986) argues that *lunar explorátion* is a compound, and it is not unreasonable to claim that *lunar* modifies *exploration*. But if adjectives can be modifiers inside compounds, is there a consistent difference between compounds and phrases in this regard? And is the difference in stress pattern between *rédhead* and *lunar explorátion*, which displays the stress pattern of a phrase, related to the greater degree of compositionality in the latter? In answering 'yes' to each of these questions, this paper identifies a heretofore unnoticed difference between compounds and phrases in English: the behavior of adjectives differs systematically in the two environments.

English compound formation involves aspects of syntax, phonology and morphology, and researchers in all of these areas have employed data from compounds to support their claims. My own work is particularly concerned with how the various structural analyses of compounds compare with the structural descriptions required by accepted theories of compound phonology, specifically compound stress. I draw here on two researchers who have two very different approaches to the problem of integrating

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theories of compound prominence and structure: Selkirk (1984) and Zwicky (1986).

These two theories share the notion that there is an unmarked or default compound stress pattern in English, which is characterized by stress on the first constituent in a two member compound like *hóuseboat*. Zwicky calls this forestress. Under certain conditions, compounds may receive afterstress, that is, stress on their second constituent, as in *state híring, motorcycle máintenance*.[1] The rules which assign afterstress precede and apply disjunctively with the default rule which assigns forestress, by the Elsewhere Condition (Kiparsky 1973, 1982).

Selkirk embeds her analysis of non-default stress within a general theory of focus prominence, with stress assignment rules sensitive to the argument structure of the items comprising the compound. Heads and arguments, as opposed to adjuncts, may optionally receive pitch accents which translate into greater prominence in the metrical grid of the compound.[2] Selkirk's framework derives a premium on the stress patterns in (1), below, where *trúck driver* receives forestress since *truck* fills a semantic argument of the head, just as it fills a semantic argument of *drive* in the phrase *drive trucks*. *Truck* receives a pitch accent because it is an argument.

(1)   Selkirk (1984)   (a) árgument head   trúck driver
                         (b) adjunct héad   lily whíte
                         (c) árgument héad   motorcycle máintenance

Lily-whíte has afterstress because *lily* is an adjunct of *white* and only the head receives a pitch accent. In *motorcycle máintenance*, both the head and the argument receive pitch accents, and this is interpreted as afterstress.

Zwicky's analysis is based not on argument structure, but on more general semantic properties and the categorial makeup of the compounds. The goal of Zwicky's paper is to refute the popular notion that afterstress is only assigned by the Nuclear Stress Rule; that is, that afterstress in a two member item is a reliable diagnostic for the phrasal status of that form. Zwicky claims with Lees (1960) that the ambiguity of an item like *legal dócument* cannot be accounted for if all compounds have forestress. He argues that *legal dócument* is a phrase when it carries the interpretation 'document which conforms to the law'. When it carries the interpretation 'document employed in the legal profession', however, *legal dócument* is a compound, stressed in accordance with the generalization in (2).

(2)   Zwicky (1986)   [A N] compounds are usually afterstressed.
                        legal dócument
                        lunar explorátion

Zwicky argues that *lunar explorátion* is unambiguously a compound and receives afterstress under the same generalization.

Selkirk's analysis enjoys a greater range of coverage than Zwicky's does, and at first it seems that no change is required to enable Selkirk's analysis to capture the facts in (2); afterstress can be derived on adjunct-head and argument-head forms in which the heads and arguments receive pitch accents, as in (1b) and (1c). *Legal dócument*, under both its interpretations, would be adjunct-head, like *lily-whíte*, while *lunar explorátion*, which is arguably of the form argument-head, could receive afterstress in the same manner as *motorcycle máintenance*. But such a solution cannot predict the consistent difference in prominence illustrated in (3), where all of the compounds are argument-head, but the ones which begin with adjectives consistently receive afterstress, in accordance with the

generalization in (2). It seems that a change in Selkirk's system is required to account for Zwicky's generalization.

(3)
	lunar explorátion	cáve exploration
	stellar observátion	stár observation
	corporate mánagement	stóre management
	nuclear prótest	árms protest

The change I am advocating is developed in Bates (1987), an analysis of compound stress which encompasses the insights of Selkirk's metrical grid-based analysis, but assigns a more limited role to focus-prominence mechanisms in favor of structure-sensitive rules which can also account for Zwicky's generalizations. I will introduce these rules shortly. First, notice that in addition to incorporating Zwicky's generalization in (2), and accounting for the facts in (3), the analysis will have to account for adjective-noun compounds like *bláckbird* and *gréenhouse*, which receive forestress and do not obey the generalization. In fact, only a subset of English adjectives appear in the first position of adjective-noun compounds like those in (2) and (3). Zwicky notes this, citing Levi (1978) and arguing that only non-predicating adjectives appear in compounds like *lunar explorátion* and *corporate mánagement*. I have found it useful to adopt such a position in my analysis of English compounds; it forms one of the two claims I will advance about the English lexicon. Each adjective is marked in its lexical entry with a value for the feature [±pred(icating)]. The standard test applies for determining which value a particular adjective is marked for. If the adjective can alternate between prenominal and postcopular position in a simple main clause, then it is [+pred]:

(4a) The red ball (bounced).
      The ball is red.
      red, A, [+pred]

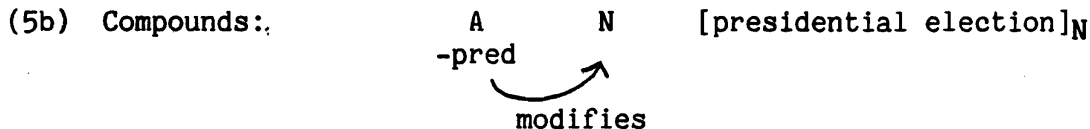If the adjective may only appear in prenominal position in a phrase, it is [-pred]:

(4b)   The presidential election (dominates the media).
       *The election is presidential.
       presidential, A, [-pred]

Of course, some adjectives have a predicating and a non-predicating use; this is Zwicky's account of the ambiguity of *legal document*; note that the sentence *The document is legal* has only one reading, that the document conforms to the law.

The second claim I wish to make is schematized in (5). Noun phrases may have the form A N, where A is [+pred] and modifies the head.

(5a) Phrases: A   N   [red ball]$_{N'}$
                      +pred
                        ⤴
                      modifies

The generality and regularity of this structure indicates its syntactic nature. In contrast, the non-regularity and item-specific semantics of [-pred] adjectives require combinations of the form in (5b) to be listed in the lexicon; that is, these are compounds:

(5b) Compounds:.   A   N   [presidential election]$_N$

          $-$pred

                    modifies

The claim, then, is the normal domain of [+pred] adjectives is syntactic, while the normal domain of [-pred] adjectives is lexical.

So far, I have not made any novel claims. The distinction between predicating and non-predicating adjectives is motivated in the works of Levi (1978), Zwicky (1986), and Coulter (1983), and the first two argue [-pred] adjectives appear in compounds. My analysis does, however, provide a new perspective on the behavior of [+pred] adjectives inside compounds.

All adjectives must be available for the compound formation rules of the language. But the canonical position for [+pred] adjectives to modify another constituent is within a phrase. The idea proposed in Bates (1988) is that [+pred] adjectives may appear in compounds as long as they behave differently inside the compounds than they do in phrases. That is, productively derived phrasal environments are reserved for [+pred] adjectives with their predictable, compositional, modificational, predicating properties, while lexical environments are by definition in conflict with entirely predictable and compositional structures, being fundamentally part of a list. A [+pred] adjective may, however, appear inside a compound if it does not actually modify anything within the compound, because non-modificational structures must be listed, due to their idiosyncratic nature. A [+pred] adjective may also appear in a compound if it adopts some [-pred] behavior. Details follow.
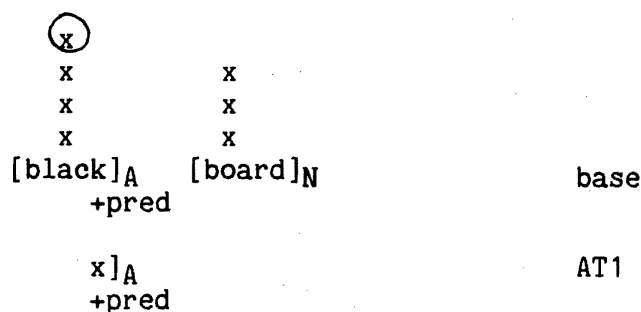
The compound stress mechanisms are sensitive to the feature [±pred]. The templates in (6) are special beat-addition rules introduced in Bates (1987).[3] They specify bracket configurations in which an extra beat is added to the compound. The extra beat is the x in each template:

(6)   Bates (1987)   Adjective Template 1 (AT1):   x]$_A$

                                                        +pred

                Adjective Template 2 (AT2):   ]$_A$ [x

                Default Template: x]$_W$ $_W$[

The extra beat translates into greatest prominence on the constituent closest to the target position of the beat, which is where "x" is positioned in the template. The templates are given here in order of (disjunctive) application.

A template aligns with a compound right to left, at the first position in which its bracket configuration is completely satisfied. The beat added by the template aligns with the closest grid column at the highest metrical level. Thus, AT1 prosodically highlights [+pred] adjectives appearing in compounds, as in the derivation in (7a), where the circled gridmark represents the one added by the template, and the template is shown directly below the rightmost position in which its bracket configuration is satisfied.

(7a)

```
          Ⓧ
          x         x
          x         x
          x         x
      [black]ₐ  [board]ɴ        base
       +pred

          x]ₐ                   AT1
         +pred
```

(7b)

```
                    Ⓧ
          x         x
          x         x
          x         x
      [grass]   [green]ₐ        base
                  +pred

                   x]ₐ          AT1
                  +pred
```
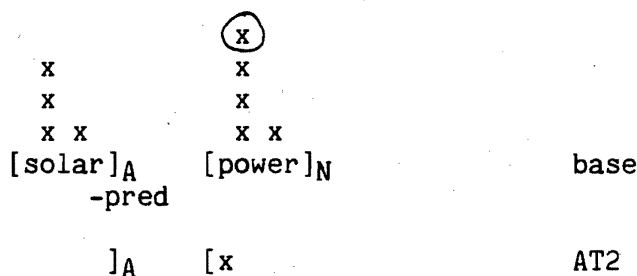
The noncircled gridmarks represent the lexical grids for the constituents of the compound which form the input to the compound formation and compound stress rules. The derivation in (7b) shows that [+pred] adjectives in head position are also given prosodic highlighting by AT1. AT1-stressed compounds, in general, are the most lexicalized of the adjective-containing compounds; this prosodic highlighting can be looked at as a signal that an adjective is exhibiting some behavior beyond what it is normally lexically specified to do.

But some adjectives are behaving quite in keeping with their lexical entries by appearing inside compounds. Adjectives which are lexically specified as [-pred] require no special stress marking, since item-particular semantics is the norm for them and they require listing anyway. Structures which contain [-pred] modification fall in the middle of the phrasal-to-compound spectrum. Although less compositional than the normal predicating modification of phrases, a structure defined by [-pred] modification is more compositional than one with a [+pred] adjective appearing in the compound, since modification of whatever type is a more tractable operation than the idiosyncratic connections formed in non-modificational structures like *redhead* and *blackboard*. This lack of a requirement for highlighting results in Adjective Template 2, a general stress template for adjective-containing compounds which applies disjunctively with AT1.

Adjective Template 2 expresses Zwicky's generalization that A N compounds normally receive afterstress, as in the derivation in (8):

(8)

```
                        Ⓧ
          x             x
          x             x
          x x           x x
      [solar]ₐ     [power]ɴ      base
       -pred

             ]ₐ    [x            AT2
```
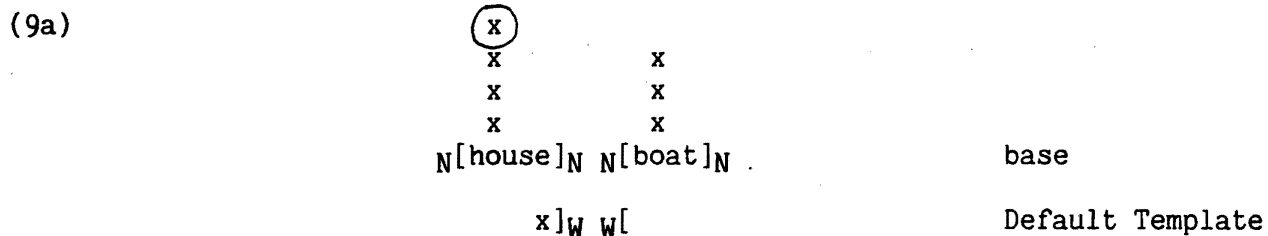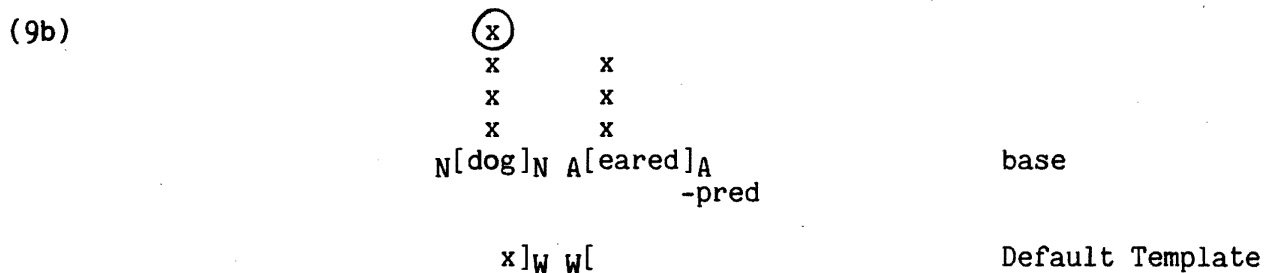
AT2 assigns its compounds the same prominence relations found in phrases; this is consistent with their relatively more compositional nature and the fact that syntactic

prehead modifiers are normally not prosodically prominent. The model at this point makes no formal connection between AT2 and the Nuclear Stress Rule, but these considerations suggest that AT2 is a natural rule.

The default template in (6) assigns forestress to compounds consisting of two W categories, where W is the morphological category Word (Selkirk 1982). This is illustrated in (9a):

(9a)

$$
\begin{array}{cc}
\textcircled{x} & \\
x & x \\
x & x \\
x & x \\
_N[\text{house}]_N & _N[\text{boat}]_N
\end{array} \quad \text{base}
$$

$$
x]_W \; _W[\quad\quad \text{Default Template}
$$

The default template has counterparts in both Zwicky's and Selkirk's analyses and is well motivated as a rule of English grammar. Striking confirmation of the analysis is provided when the head on an N A compound is [-pred]; the following derivation is predicted to hold:

(9b)

$$
\begin{array}{cc}
\textcircled{x} & \\
x & x \\
x & x \\
x & x \\
_N[\text{dog}]_N & _A[\text{eared}]_A \\
& \text{-pred}
\end{array} \quad \text{base}
$$

$$
x]_W \; _W[\quad\quad \text{Default Template}
$$

Neither AT1 nor AT2 could assign stress to the compound in (9b) since their structural descriptions are not met; default forestress obtains.

According to the claims in (4) and (5), adjectives in English compounds can differ in at least two ways: they can be + or - predicating, and they can either modify a constituent within the compound or not modify anything within the compound. These two parameters, coupled with the two possibilities for the placement of an adjective in a two member compound, spawn several possibilities for compound structure. Another variable lies in the fact that adjectives may either appear with nouns or other adjectives inside compounds. The different possibilities predicted by the interaction of all of these factors are enumerated in Table 1.

Each of the compound types listed in Table 1 is predicted to bear a certain stress by the rules in (6). I will now turn to a discussion of the possibilities in Table 1 and to the consequences of this analysis.

The first combination described in Table 1 is not a compound at all. The form is A N, where the adjective is [+pred] and modifies the head:
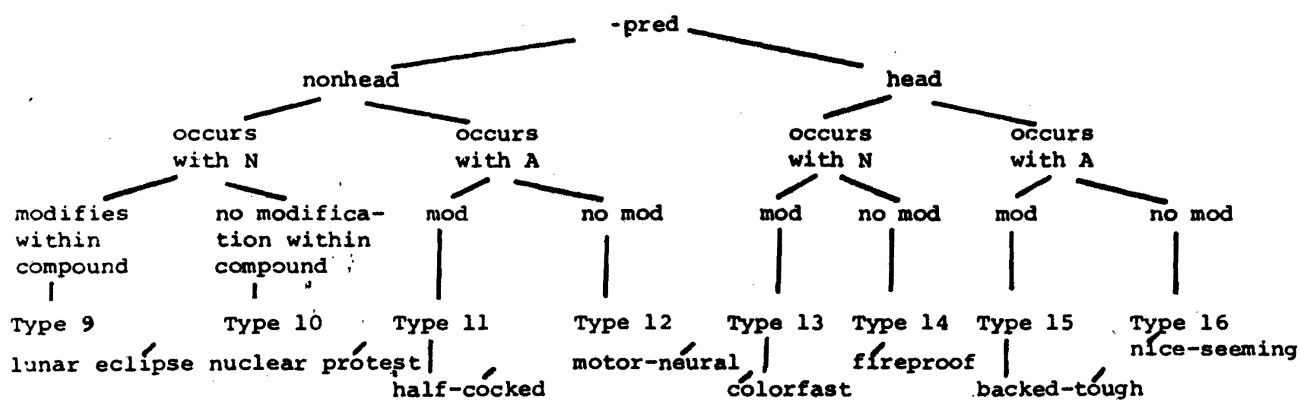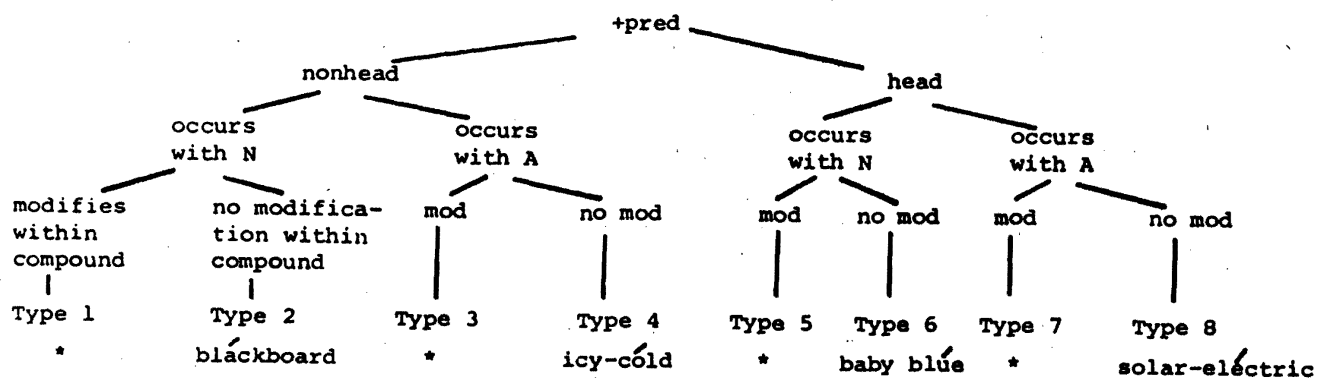
(10)   Type 1   *A   N
            +pred

```
                                    +pred
                    nonhead                          head
              occurs           occurs          occurs          occurs
              with N           with A          with N          with A
        modifies   no modifica-  mod    no mod   mod   no mod   mod    no mod
        within     tion within
        compound   compound

        Type 1     Type 2      Type 3  Type 4  Type 5  Type 6  Type 7  Type 8
          *        blackboard    *     icy-cold   *    baby blue   *    solar-electric
```

```
                                    -pred
                    nonhead                          head
              occurs           occurs          occurs          occurs
              with N           with A          with N          with A
        modifies   no modifica-  mod    no mod   mod   no mod   mod    no mod
        within     tion within
        compound   compound

        Type 9     Type 10     Type 11  Type 12  Type 13 Type 14 Type 15  Type 16
      lunar eclipse nuclear protest     motor-neural                      nice-seeming
                             half-cocked        colorfast   fireproof   backed-tough
```

TABLE 1

A TAXONOMY OF ADJECTIVE-CONTAINING COMPOUNDS

This is of course the canonical form for a noun phrase:

(11)   [the red ball]$_{NP}$

A lexical compound of this form could not exist under the analysis presented here, which claims that productive [+pred] modification is a syntactic phenomenon. In order to become a compound, the phrase would have to become lexicalized.[4] I claim that the formal concomitant of this lexicalization is the loss of the [+pred] feature on the adjective. This would yield an item of the form A N, where A is [-pred] and modifies the head. This is type 9 in Table 1 and will be discussed shortly.

The only way the adjective could retain its [+pred] feature would be to not modify the head, and simply be semantically juxtaposed to the N, rather than predicating of it. This is type 2 in Table 1.

Examples of type 2 compounds appear in (12):[5]

(12)   Type 2   bláck board
                         bláck bird
                         hót tub
                         hígh school
                         swéet talk
                         hígh jump

This is a very productive type of compound. A [+pred] adjective is combined with a head noun, but does not modify that head noun. I suggest that these are interpreted in a manner analogous to N N compounds. The following quotation from Selkirk (1982) expresses a standard, if informal, position on the interpretation of endocentric N N compounds; I suggest it be extended to cover type 2 compounds as well.

> In general, in endocentric compounds, of which *string apron* and *apron string* are examples, the class of elements denoted by the compound is a subset of the class of elements that would be denoted by the head on its own. The non-head constituent of the compound in some way further defines the head ... (Selkirk 1982: 22).

Modification, I suggest, differs from this kind of interpretation in that not only is a subset relation defined, but the head is actually claimed to possess the property which defines the subset. Under this analysis, *hot* in *hot tub* may define a subset of tubs without actually modifying *tub*; this allows the real-world situation in which a *hót tub* can be cold, or a *bláckboard* can be green. True modification, as in the phrase *a hot stóve*, must involve the head possessing the attribute *hot*.

The data in (12) illustrate the first situation which requires prosodic highlighting by AT1; *black, hot,* and the other adjectives of (12) are lexically specified to be predicating modifiers, but inside these compounds they are not modifying anything. This type of deviation from the lexical specification of the adjective has a formal concomitant in this theory - the non-modificational relationship in (12) allows the [+pred] adjective to retain its [+pred] feature. AT1 then predicts forestress on the compound, as shown in the derivation in (13). Ignoring word-level grids for clarity of exposition, the top gridmark represents the associated gridmark of the template:

(13)
$$x$$
$$[\text{hot}]_A \qquad {}_N[\text{tub}]$$
$$+\text{pred}$$

$$x]_A \qquad\qquad\qquad\qquad \text{AT1}$$
$$+\text{pred}$$

As the diagram in (14) shows, type 3 compounds are supposed to have a [+pred] adjective in non-head position and another adjective in head position, where the non-head modifies the head. These do not occur, as indicated by the asterisk below and in Table 1.

(14) Type 3
$$*A \qquad A$$
$$+\text{pred}$$

The existence of this type of compound is ruled out independently, because adverbs are always non-predicating, by hypothesis. Although I have no detailed motivation for the claim that adverbs are always [-pred], the working definition of a predicating adjective is one which may appear in postcopular position, and this claim about adverbs is at least consistent with this definition. Thus, whenever an adjective modifies another adjective and is thus an adverb, the first will always be [-pred].

As schematized in (15), type 4 compounds have the form A A, where the non-head does not modify the head.

(15) Type 4
$$A \qquad A$$
$$+\text{pred}$$

Type 4 compounds are illustrated in (16).

(16)
```
icy-cóld
white-hót
hot pínk
electric blúe
```

The same principles of interpretation may apply to these compounds as apply to type 2 compounds.

The afterstress on the compounds in (16) is the result of AT1, since the heads in (16) are all [+pred]. The first [+pred] adjective the template can align with, going right to left across the compound, is the head adjective. This is illustrated in (17):

(17)
$$x$$
$$[\text{icy}]_A \qquad [\text{cold}]_A$$
$$+\text{pred} \qquad\quad +\text{pred}$$

$$x]_A \qquad\qquad\qquad\qquad \text{AT1}$$
$$+\text{pred}$$

Note that afterstressed compounds are often embedded in Rhythm Rule contexts like

white–hot stóve; this should not deter us from assigning afterstress on the first compound cycle, since in phrase-final, non-Rhythm Rule contexts, afterstress is the norm for these compounds: *The stove is white–hót.*

When modification is not present, a dvandva or coordinate interpretation is possible for some compounds:

(18)   dvandvas: [blue-green]$_A$ shirt

The reading intended is one in which the shirt has the quality of being blue and the quality of being green, whether this be describing a solid color halfway between blue and green or a plaid or striped shirt. Type 4 dvandvas are restricted, however, to adjectives which share many semantic features. Notice the illformedness of a compound like *talldrúnk,* as in the following:
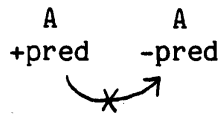
(19)   *[tall-drunk]$_A$ man

This item may not describe a man who has the quality of being tall as well as the quality of being drunk. In Bates (1988), I argue that coordinate readings in lexical structures always require the conjuncts to share many semantic features. In order to express the reading intended in (19), a phrasal structure must be employed. At the phrasal level, items can be combined which share very few semantic features:

(20) $_N$'[tall $_N$'[drunk man]]

The diagram in (21) illustrates that there is another possibility for type 4 compound structures.

(21)   Type 4   A   A
                              +pred   -pred

Type 4 compounds may appear with [-pred] adjectives in head position. The compounds in (22) illustrate this structure.[6]

(22)   róugh cast
                           níce seeming
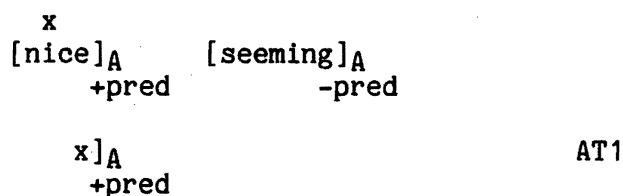   néw modeled
                           stránge sounding
                           roúgh shod

Although the subset relation does not illuminate the interpretation of these compounds, the [+pred] non-heads are claimed to do something other than modify the heads. In support of this, in the phrase *nice–seeming person,* it is the person, and not the seeming, that has something about niceness being predicated of it.[7]
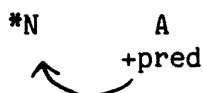
The forestress on these compounds comes from AT1, which skips over the [-pred] head and assigns a beat to the [+pred] initial constituent:

(23)   x
                         [nice]$_A$ [seeming]$_A$
                           +pred   -pred

                           x]$_A$ AT1
                          +pred

With type 5 compounds, we turn to [+pred] adjectives in head position.

(24)   Type 5   *N   A
                            ⌢   +pred
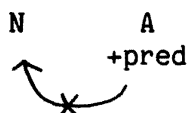
Consider the A N structure above. There is nothing to prevent an adjective in head position from modifying the non-head inside a compound; we will have examples of this. However, normal modification of N by [+pred] adjectives is the domain of N' syntax,[8] and type 5 compounds are therefore predicted to be non-occurring in the same manner that type 1 compounds are predicted to not occur. In order to appear with N inside a compound, the A head must either modify the head and lexically lose its [+pred] feature, making a type 13 compound like *colorfast*, or it may retain its [+pred] feature by not modifying anything inside the compound, which would render the compound type 6.

Type 6 compounds have the form in (25):

(25)   Type 6   N   A
                            ⌢   +pred
                             ⤬

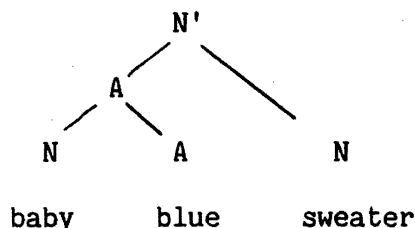AT1 assigns prominence to these forms by giving the adjective a beat:

(26)   baby blúe
                         knee déep
                         grass gréen
                         dog tíred

The difference between these compounds and *high school*, which illustrates Type 2, is the fact that when the adjective is in head position, as in *baby blúe*, the entire compound is an adjective which can modify something outside the compound. In this way, the integrity of the adjective is preserved in a way that is lost when the adjective is in non-head position. The example in (27) shows the compound *baby blúe* modifying a head noun inside an N', which is the normal way for [+pred] adjectives to modify nouns.

(27)   N'
                             A
                        N   A   N

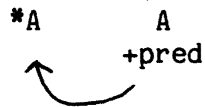   baby   blue   sweater

The prediction of this system is that the sweater, and not the baby, is blue, since the [+pred] adjective *blue* is prevented from modifying any constituent inside the compound if it is to retain its [+pred] feature. This is of course the correct interpretation of *baby blue sweater*. In the same way, I claim that in *knee deep water*, the [+pred] adjective is

not modifying *knee,* but *knee* and *deep* combine in a non-modificational relationship to form the compound [+pred] adjective *knee deep,* which in turn modifies *water* in the normal way for [+pred] adjectives to modify nouns within N' phrases.

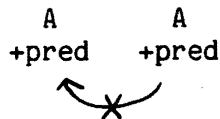Type 7 structures are schematized in (28).

(28) Type 7   *A   A
                                  +pred

A [+pred] head modifying an adjectival non-head is ruled out independently in the same way as type 3 compounds. An adjective modifying another adjective will always be [-pred], due to the adverbial nature of modification of an adjective by another adjective.

Type 8 compounds have the form in (29):

(29) Type 8   A   A
                      +pred   +pred

A [+pred] head appears with, but does not modify a [+pred] adjective. These can be illustrated with the same forms as type 4 compounds. Other examples appear in (30) below:

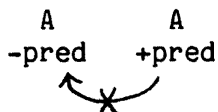(30)   dead tíred
                              blind drúnk
                              wet-cóld

Neither [+pred] adjective modifies the other. AT1 assigns a beat to the rightmost adjective, and afterstress is correctly derived.

In type 8 compounds, a [+pred] head may also appear with a [-pred] non-head which it does not modify:

(31) Type 8   A   A
                      -pred   +pred

These are illustrated in (32).

(32)   solar-eléctric
                              lunar-hormónal
                              fighting-mád

Once again, the dvandva reading is possible when no modification takes place. This is shown clearly in *solar-electric power.* AT1 is responsible for the afterstress of these forms, as it 'flags' the [+pred] adjective appearing in the compound.

This exhausts the possibilities for the occurrence of [+pred] adjectives inside compounds. The rest of the discussion focusses on types 9 through 16, and the behavior of [-pred] adjectives in compounds.

Two possible origins exist for a [-pred] adjective inside a compound; either the adjective is [-pred] by virtue of its lexical entry, as in *lunar, nuclear,* and *presidential,* or
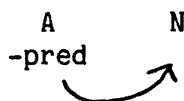
the adjective is normally [+pred] and has lost that [+pred] feature by virtue of its lexical connection with the other element of the compound. A continuum expressing the amount of lexicalization is perhaps the best way to view the position being taken here.

least lexicalized, purely syntactic: [+pred] A modifying N
   NP[an intelligent man]
somewhat lexicalized: A modifying N inside the compound
   N[lunar eclípse] N[dry íce]
most lexicalized: [±pred] A appearing with, but not modifying N
   N[hót dog]

This continuum applies only to compounds of the form A N. When the adjective is in head position, an independent factor comes into play: the percolation of the meaning of the head adjective to the entire compound differs depending on whether the adjective modifes the non-head or not. This will be discussed further in conjunction with type 13 compounds below.

As (33) shows, type 9 describes a [-pred] adjective modifying a head noun.

(33)   Type 9   A   N
                              -pred   ↗
                                 ⌣

This is the canonical position for [-pred] adjectives to effect modification. Some examples appear below:

(34)   presidential propósal
                              lunar eclípse
                              urban spráwl
                              solar pówer
                              historical linguístics
                              generative grámmar

     These compounds should be as plentiful as [-pred] adjectives themselves, since it is within compounds that the highly idiosyncratic semantic relationships required by [-pred] adjectives is normally found. Compare, in this regard, the use of *lunar* in *lunar eclipse* and in *lunar madness.*

     I have no formal analysis of the semantics of nonpredicational modification to accompany my claim that the adjectives in (34) modify their heads. The very fact that these items are often analyzed as phrases is enough to indicate that the adjective is operating in a manner similar to that of normal predicating adjectives and justifies the claim that some modification is taking place in (34). I do, however, have a few informal observations about the difference between predicating and nonpredicating modification. The subset relation common to predicating modification holds in (34); *lunar eclipses* can be viewed as a subset of the set of eclipses, just like *red balls* form a subset of the set of all balls. Within the set of eclipses, the subset distinguishes items which possess the property of "being lunar" from those which do not. But the intersection relation common to predicational modification is missing in (34); *red balls* is the intersection of the set of balls with the set of red things, but there is no set of "lunar things" which could intersect with the set of eclipses to form the set of lunar eclipses. The model presented here can derive this, because in this model, *lunar* only appears in compounds. Because it only appears in lexical structures, it always forms some special connection with its head. A

set of lunar things, defined as a set of things all bearing the same relation to the word *lunar*, is impossible to assemble, because the different heads that appear with *lunar* bear idiosyncratic relations to the adjective. Assembling a set of red things, in comparison, is a straightforward matter, since each item bears exactly the same relation to the adjective *red*; that is, they each possess the property of being red. This contrast is so clear because *lunar* and *red* are easily categorized as to their value for the feature [±predicating]. *Lunar* is [-pred] by virtue of its lexical entry, and *red* is a typical [+pred] adjective; the situation is less clear with adjectives like *legal*, which is marked in its lexical entry as having a predicating and a nonpredicating use, and by the processes which allow [+pred] adjectives to appear inside compounds. The claim is that if modification occurs inside compounds, then that modification will be [-pred] modification, where modification is defined informally as a subset relation requiring the head to possess the property designated by the adjective and [-pred] modification is defined as modification plus some idiosyncratic lexical connection.

The compounds in (34) are Levi's (1978) complex nominals, and she presents several arguments that they are dominated by a lexical, rather than phrasal category; I will not review those arguments here. Compounds like *lunar exploration, presidential proposal,* and *stellar observation* (cf. (3) above) also illustrate type 9. The fact that these have additional thematic relationships being assigned inside them is independent of the determination of the + or - pred status of the adjectival constituents and whether modification is taking place inside the compound. However, any statement of thematic roles is beyond the scope of this presentation; Bates (1988) contains some discussion of this issue.

The compounds in (34) receive stress via AT2, since there is no [+pred] adjective for AT1 to assign a beat to. The derivation in (35) is illustrative.

(35)

$$[\text{lunar}]_A \quad \overset{x}{}_N[\text{eclipse}]$$
$$-\text{pred}$$

$$]_A \quad [x \qquad\qquad\qquad \text{AT2}$$

The data in (34) all contain adjectives which are marked as non-predicating in their lexical entries. The data in (36) illustrate that type 9 compounds can also be created when an originally [+pred] modifies the head and the modificational relationship becomes highly lexicalized, making these items candidates for compoundhood, and distinguishing their modificational relationship from the normal predicating relationship which is found in phrasal collocations. The proposed analysis of these forms is that the [+pred] adjective assumes a [-pred] usage in order to modify a constituent inside the compound. This [-pred] usage can be attained by adding some extra piece of idiosyncratic meaning to the modificational relationship. This is of course what is normally referred to as lexicalization. Examine the following forms, keeping in mind the claim that there is modification as well as some degree of lexicalization in these forms:

(36)
                          dry íce
                          blue cóllar
                          high kíng
                          (my) old lády
                          (the) Blue Ángels
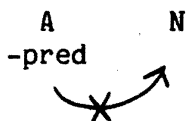   wild ánimal (in [wild animal] park)

The question at this point is, what evidence do we have that there actually is modification in these structures, and not, for example, a purely lexicalized, non-modificational relationship between the adjective and the noun, as in type 2 compounds? Recall that the distinction between modification and the usual subset relation created by compounding is that in the modificational structure, the head must possess the property defining the subset, while in plain endocentric compounds (e.g., *apron string*), the head need not possess the property which defines the subset (e.g., *blackboard*). The claim is, then, that the heads in (36) possess, to a certain extent, the property normally associated with the adjective on its left, and that these compounds differ from type 2 compounds in exactly this way. An illustrative contrast can be seen in *drýrot*, a type 2 compound, versus *dry íce*, or type 9. In *drýrot*, or *drýdock*, the heads *rot* and *dock* are not really dry in any obvious way; the subset relation between *rot* and *dry rot* is defined in a very idiosyncratic way. But in *dry íce*, I suggest, *dry* is to *ice* as *lunar* is to *eclipse* in *lunar eclipse*; non predicational modification obtains. Possession of the property *dry* can define a subset of kinds of ice, but *dry ice* does not belong to a subset of dry things. The latter would be true if this were predicational modification. *Dry* modifies *ice*, but loses its lexical [+pred] feature by assuming the meaning which prevents all ice that happens to be dry from being solidified carbon dioxide. *Old lády* is another example of a [+pred] adjective taking on extra meaning inside the compound; *old* really does modify *lady* in *old lady*; *lady* possesses the property *old* which defines the subset relevant to the interpretation of the compound, but the *old* inside *old lady* does not refer solely to age, but to status within a relationship.

In contrast, in the type 2 compounds *drýdock* and *drýrot*, the heads do not possess the property *dry* even in a nonpredicational sense. This is not to say that the choice of the first member of a normal endocentric Type 2 compound is totally idiosyncratic (cf. Levi (1978) on why this is not the case); the observation is simply that the meanings of type 9 compounds are more compositional that those of type 2 compounds, in that in type 9 compounds a salient modificational relationship exists between the adjective and the head. Type 2 compounds, in contrast, are no more compositional in semantics than normal endocentric N N compounds like *ápron string*. Of course, even within a particular type, lexicalization should be viewed on a continuum. On the one hand, the compound *wild ánimal* is quite compositional even though the normally [+pred] *wild* is non-predicating here: *The animal is wild* does not paraphrase *the wild animal*. A St. Bernard dog could be a *wild animal* in the predicating sense (*the dog is wild*) and still never be a candidate for a *wild animal park*. On the other hand, *red herring* would be included in the type 9 compounds, and it has extremely idiosyncratic semantics. I would include *red herring* in (36) because all of the compounds in (36) receive afterstress by AT2 (cf. the derivation in (35)) and *red herring* has afterstress. At this point the argument is in danger of being circular – I argue that the compound stress mechanisms are sensitive to the distinctions enumerated in Table 1, but I characterize *red herring* as Type 9 since it has afterstress. Actually, the danger of circularity is not great; the central claim of this paper is that we do not find normal modification by [+pred] adjectives inside lexical structures. *Red herring* is surely not a counterexample to this claim. The model does force me to say that modification exists inside *red hérring*, even though that modificational structure is overshadowed by the great degree of lexicalization in this form. Perhaps *red herring* is not a compound at all, but a real syntactic idiom. I would not like to call all of the items in (36) idioms, however, since they are compositional to a certain extent.

The treatment of type 9 compounds is central to any discussion of the interaction between syntax and morphology; more research is required to fully explore the predictions of this system. Some further remarks on type 9 compounds are included at the end of this paper.

Type 10 compounds have a [-pred] adjective in construction with a head noun which it does not modify.

(37)   Type 10   A   N
                           -pred
                              ⤣⤤ ✗

Since this is the canonical position in which [-pred] adjectives modify their heads, and the semantics of [-pred] modification is so item-particular, examples of type 10 may be difficult to distinguish from type 9 compounds. But in the compounds in (38), it seems reasonable to claim that the adjective does not modify the head noun, that the head noun does not possess the property designated by the adjective.

(38)   nuclear prótest
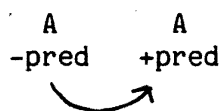   historical línguist
                                generative grammárian
                                nuclear enginéer

It is a familiar observation that in no sense is the protest itself nuclear in the normal reading of *nuclear prótest*. Similarly, *historical* appears in type 9 *historical linguistics*, where it modifies the head, and also in *historical linguist*, in which it does not modify the head. These compounds have of course been the center of much discussion, since items like *historical linguist* seem to violate principles of level ordering, and are cited in Sproat (1985) as counterexamples to a lexical phonology model like that proposed in Kiparsky (1982). The system presented here predicts that such compounds should be possible simply because the constituents are available for compounding at level 2, *historical* and *linguist* being products of level 1 processes. The claim is that *historical linguist* is interpreted in the same way as a type 2 compound. This is simply to say that *linguist* does not possess the property of being historical, while *historical* still defines the subset of historical linguists within the set defined by the head *linguists*. The same distinction should be made with regard to *electrical engineering*, a type 9 compound, versus *electrical engineer*, of type 10. Further research is needed to determine how many putative bracketing paradoxes might be explained independently with reference to the framework employed in this paper.

Type 11 specifies a [-pred] adjective modifying a following adjective, which may be [+pred], as indicated in (39):

(39)   Type 11   A   A
                           -pred   +pred
                              ⤣⤤⤴

This is the canonical configuration for one adjective to modify another inside A':

(40)   A'
                           ⟋   ⟍
                          A   A

                       bright   yellow
                        dark   blue
                     extremely   interesting

Adverbial modifiers are always [-pred], so an originally [+pred] adjective is under no

pressure to form an idiosyncratic connection with the head in order to appear inside the compound. This explains the scarcity of true compounds with converted [+pred] adjectives of type 11. Lexical adverbs will always be [-pred], so the compounds in (41) count as type 11 compounds. These particular items seem lexicalized enough to be called compounds.

(41)   half-cócked
                             ever-lásting
                             half-báked
                             ever-vígilant

I will not treat lexical adverbs in detail in this paper.

The head in a type 11 compound need not be [+pred], however. The compounds in (42) have [-pred] heads and modifiers which were originally [+pred].

(42)   tight-físted
                             good lóoking
                             broken-héarted
                             red-hánded
                             fast-móving

Notice that even though the [-pred] feature is automatically present on the first adjective, because of its adverbial function, these compounds still tend to take on meanings over and above the normal modificational force found in phrases. Compare *red-hánded*, which means 'guilty' in addition to saying something about the color of the hand (in a figurative sense), with the N' [a red hand], which of course carries no extra meaning.

Type 11 compounds receive stress from AT2: AT1 may not apply, since both adjectives are [-pred].

(43)   x
                    [tight]$_A$ [fisted]$_A$
                        -pred   -pred

                      ]$_A$ [x   AT2

Type 12 compounds are schematized in (44).

(44) Type 12   A   A
                         -pred
                            ⤸⤴
                             X

When no modificational relationship exists between the [-pred] non-head and the adjective head, there is no sense in which the first is adverbial, so adjectives which have been converted from [+pred] should not necessarily be prevalent in type 12 compounds.

The data below illustrate lexical [-pred] adjectives in first position inside type 12 compounds.

(45)   solar-eléctric
                           urban-polítical
                           motor-néural
                           stellar-lúnar

The heads in (45) include predicating and non-predicating adjectives (*political* vs. *neural*). Note that the dvandva reading is made possible by the non-modificational structure: *solar-electric power*. Type 12 compounds need not be coordinate in structure, however; compounds like the ones below fit the criteria for type 12 without having a dvandva reading:

(46)   [hopping]$_A$ mád
                           [fighting]$_A$ mád

These also illustrate type 8.

The compounds in (45) and (46) receive afterstress from AT1 when the head is [+pred] (*urban-polítical*), and from AT2 when the head is [-pred]: *motor néural.*

Type 13 describes an N A compound in which the [-pred] adjective modifies the noun:

(47) Type 13   N   A
                                    -pred

So far, we have not had any examples of modification to the left inside a compound. Since adjectives modify a following constituent in English syntax, perhaps there is a general restriction which prohibits a head from modifying a non-head inside a compound. This would automatically exclude types 5, 7, 13 and 15 from being predicted to be possible compounds. However, recall that types 5 and 7 can be independently accounted for in the system presented here. I suggest that type 13 compounds are found in structures like the following; if this suggestion is followed, then no general prohibition exists against modification to the left inside compounds:

(48)   cólor fast
                           bráin dead
                           nóse open (existing compound meaning 'angry' or
                               'aroused')
                           fóot sore
                           múscle bound
                           héart broken

When the originally [+pred] head modifies the non-head, the compound as a whole does not inherit the semantics of the head in the same way it does when the head modifies nothing inside the compound. This is due to the high degree of lexicalization concomitant with [+pred] adjectives appearing in a modificational lexical structure. In this regard, compare a type 6 compound like *dog tíred,* in which the head does not modify the first constituent, with type 13 *cólorfast.* When each is used in a noun phrase, the meaning of the head *tired* is retained to a greater extent than that of *fast*:

(49) Type 6.   a dog-tired student
      Type 13   a color-fast sweater

This can be seen in the fact that the student is tired, but the sweater is not fast. The percolation of the meaning of the head of a compound intact to the meaning of the mother compound is one sign of the lesser degree of lexicalization in type 6 compounds as opposed to type 13 compounds and other compounds in which normally predicating adjectives modify constituents within lexical structures.

This system suggests that the semantic connection between the adjective and the noun in (48) is strong and idiosyncratic enough to trigger the removal of the [+pred] feature on the adjective. This certainly seems to be true of *fast, open* and *bound* in their respective compounds in (48), and it also explains why type 13 compounds are not particularly productive. The following compounds sound strange because the [+pred] adjectives do not easily assume enough extra meaning to allow them to modify within the compound:

(50)   *a [window-open] house
                        *a [street-dirty] city
                        *a [dress-white] bride

Once the lexicalization triggers the loss of the original [+pred] feature on the adjective, the compounds in (48) do not meet the structural description of AT1 or AT2. The default template must apply, assigning forestress to these forms:

(51)   x
                        [color]$_N$ $_A$[fast]
                                    -pred

                          x]$_W$ $_W$[Default Template

I have found no lexical [-pred] adjectives in head position of type 13 compounds. Although I have no formal account of this fact, it could be due to the fact that despite the existence of compounds like those in (48), modification to the left is a marked option inside compounds, and only normally predicating adjectives may appear in such marked structures.

Type 14 compounds have an N A structure in which the [-pred] head does not modify the noun:

(52) Type 14   N   A
                                 -pred
                          ⌒⌣
                             X

Stress in these forms is predicted to fall on the noun, because AT1 requires a [+pred] feature and AT2 looks for a compound-initial adjective. The default template must apply. These compounds are quite common:

(53)   ,   séa-faring
dóg-eared
fróstbitten
diséase-prone
fíre-proof

The heads in (51) are lexically [-pred]. Although there is no pressure for lexicalization in a compound with no modificational structure, lexicalization is of course allowed. This yields the following, which have heads that are normally [+pred], but become [-pred] due to the lexical connections inside the compound:

(54)   blóod thirsty
sláp happy
gírl crazy
séasick

These compounds contrast with type 8 *baby blúe*, which has afterstress because the [+pred] feature has been retained on the head adjective. Moreover, the compound *baby blúe* inherits the semantics of its head *blue* in the same way that type 6 *dog tíred* inherits the meaning of *tired*. *Bloodthirsty* and the other compounds in (54), in contrast, do not inherit the meanings of their heads intact, placing them higher on the continuum of lexicalization than the more compositional forms of type 8. The head in *blóodthirsty* has lost its [+pred] feature due to this lexicalization, and forestress by the default template is consistent with the fact that *bloodthirsty* has highly non-compositional semantics. Even *seasick*, although it does refer to a subset of types of discomforts which might be called sicknesses, lacks the meaning 'diseased' which normally accompanies the normal predicating use of the adjective *sick*.[9]

Type 15 compounds have the following form.

(55) Type 15   A   A
                                 -pred

These are not well attested. However, this result may be derivable. According to the suggestion at the end of the type 13 discussion, lexical [-pred] adjectives resist modifying to the left because they lack the ability to appear in this marked construction. Type 15 compounds with lexical [-pred] non-heads are ruled out because non-predicating adjectives cannot themselves take modifiers, even in phrasal collocations: *a reportedly nuclear engineer*, *some often lunar eclipses*.

Originally [+pred] adjectives in head position inside type 15 compounds would be under no pressure to undergo extensive lexicalization, since they would be [-pred] by virtue of being adverbial. But without lexicalization, the proper configuration for adverbial modification of an adjective is within adjective phrases. The following, from a Ford Motor Company advertisement, seem to have a coined, lexicalized quality, and might be synonymous with the adjective phrases *toughly built* and *toughly backed.*
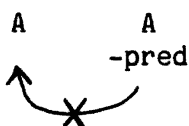
(56)   [built tough] American cars
[backed tough] warranty

These are candidates for type 15 compounds, but I believe that further research will

reveal a general prohibition against the configuration in (55), due to the combination of factors mentioned above.

Concluding the discussion of Table 1, type 16 compounds have the form designated below.

(57) Type 16   A   A
                                -pred

Type 16 compounds have already been illustrated. When the non-head is [+pred], the compound has the same structure as a type 4 compound like *nice-seeming*. When the non-head is non-predicating, type 12 compounds illustrate (57): *motor-néural*. The following dvandvas illustrate type 12 and type 16:

(58)   stellar-lúnar
                        presidential-gubenatórial
                        legal-lógical

Many of the [-pred] adjectives which have illustrated other types are constrained by an independent factor which Walinska de Hackbeil (1986) terms redundancy. These include the head adjectives in compounds like *long-legged, bare-headed,* and refers to the fact that such adjectives are not used alone because it is pragmatically odd to speak of a *legged man* or a *headed woman.* This independent consideration explains why this last illustration of type 16 is not very productive and can only have non-redundant non-predicating constituents like *lunar* and *presidential,* the following compounds being ill-formed as redundant adjectives in isolation:

(59)   *legged-headed
                        *faring-seeming
                        *proof-resistant
                        *boggling-prone

Having illustrated the possibilities predicted by the claims in (4) and (5), I turn now to a brief discussion of one of the consequences of this analysis for current debates in morphological theory. The model assumed in this work and in Bates (1988) incorporates the Principle of Syntax-Free Morphology.[10] The idea that there is a fundamental distinction between lexical and syntactic processes is under attack in the works of Walinska de Hackbeil (1986), Sproat (1985) and others. The present analysis is based on the claim that [+pred] adjectives behave differently in compounds than they do in phrases; to the extent that it is successful in accounting for the complex facts involving compounds, support is found for the Principle of Syntax-Free Morphology. True phrasal combinations should not appear embedded inside compounds if this position is to be maintained.

Type 9 compounds are at the center of any debate regarding the phrasal/lexical behavior of English adjectives, and I return now to type 9 compounds which contain lexically specified [+pred] adjectives which have developed [-pred] uses inside lexical structures like those in (36). As explained in footnote 4, this analysis does not require productive derivation of [-pred] adjectives from lexically specified predicating adjectives. However, Bates (1988) suggests that speakers do have the ability to productively assign idiosyncratic meanings to lexical [+pred] adjectives which appear, for whatever reason, inside a novel compound. That discussion involves contrived items like

[[brown dog] catcher] ('catcher of brown dogs'), which Sproat (1985) claims is an example of a phrasal projection *brown dog* appearing inside a compound, supporting his position that there is no formal separation between lexical and syntactic processes. Such a separation is supported, however, by the observation that if *brown dog catcher* is interpretable in this way, it is my strong impression that *brown dog* must be given some [-pred] force, resulting in a reading which presumes something special about the brown dogs that are being caught, some quality that they share over and above the color of their fur. The particular extra quality assumed could vary from hearer to hearer, or simply remain unspecified; the essential point is that some lexical connection is assumed to exist. In the same manner, the attested compound [[old house] lover] designates a person who appreciates a particular style of architecture, not one who loves any hovel which predates a particular period; the second would be the expected reading, if the lexical [+pred] adjective *old* had not developed a [-pred] use inside the lexical structure. These are preliminary comments on the results of the analysis presented here; further research will clarify these issues.

NOTES

[1] Dialect and idiolect differences may exist between the author and the reader with regard to the existence of particular compounds and the stress associated with them. Most of the data in this paper are cited in published sources, all dealing with American English (cf. Roeper and Siegel (1978), Selkirk (1982, 1984), Zwicky (1986)).

[2] For background on the use of grids in metrical phonology, see Liberman and Prince (1977), Prince (1983), and Selkirk (1984).

[3] For a discussion of the use of templates in generative phonology, see McCarthy and Prince (1986).

[4] Although this discussion is cast in derivational terms, it is not necessary that the model include actual derivations from [+pred] to [-pred]. This could be reformulated in terms of a checking mechanism which values compounds more to the extent that they conform to the configurations enumerated in this paper.

[5] The classification of the compounds in (12) as belonging to type 2 implies the characterization of *black, hot, high* and *sweet* as [+pred] adjectives. In this paper, I will not argue for a particular assignment of [±pred] for a given adjective, because the relevant test is simple to construct (cf. (4)). The reader should bear in mind that some adjectives are lexically specified for a predicating and a nonpredicating use. See also footnote 6.

[6] The [-pred] classification for the heads in (22) deserves some comment. These are all deverbal adjectives, and homophonous forms in *-ing* can appear after progressive *be*: *is seeming, is sounding*, and the others can appear in passives: *is cast, was modelled*, but the test [+pred] status involves postcopular position only. Adjectival passives are difficult to characterize in this regard, since many have developed predicating uses: *The torn book, The book is torn*; the second has a copular as well as a passive reading. This issue is related to the lexicalization of deverbal forms in general; the more lexicalized a form becomes, the more likely it is to develop a [+pred] use. This topic, however, is beyond the scope of this paper.

[7] In the same manner, in *strange-sounding person, strange* is not modifying *sounding* and can therefore percolate its meaning intact to the mother compound. This analysis, however, does not extend to items like *stránge-sounding* when it is used in a phrase like *strange-sounding violin*. If *strange* is an adverbial modifier in this last case, the model predicts afterstress, as in the type 11 *fast-móving, quick-thínking* (cf. (42)). This use of *stránge-sounding* no doubt receives forestress because *strange* is focussed and *sounding* is a redundant adjective (Walinska de Hackbeil (1986), cf. (59)), although the model at this point does not directly account for this form.

[8] I have been assuming a standard syntactic analysis of noun phrases which positions adjectives within the first phrasal projection of N; the claims in this paper would hold if adjectives were found to be located outside the minimal phrase, a position defended in Coulter (1983).

[9] Selkirk (1984) analyses some of the compounds in (54) as being argument-head. Indeed, there are other compounds which seem fairly productively derived which would need to be type 14 in order to be stressed correctly: *wáter-repellent, fóod-safe (pottery)*. I would claim that the argument structure in these forms is a separate issue from their modificational structure, as argued for *lunar exploration*.

[10] This felicitous name, for a principle which has had many different versions and names in the literature, is the one employed in ongoing work by G. Pullum and A. Zwicky.

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