



Argument Linking and Compounds in English

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Argument Linking and Compounds in English

A major goal of current linguistic research is to construct a theory of the lexicon which allows us to characterize the notion of *possible word* in a simple manner with a minimum of theoretical machinery. Such a theory would ideally predict the possibility of certain sorts of inflected or derived forms, compounds, and reduplicated words, while ruling out others. In this article, I will take the lexical structure theory of Lieber (1980) as a point of departure (see section 1) and will concentrate on the formal devices necessary to account for compound formation in English. The particular question I will address is this: what sorts of formal mechanisms are needed within the lexicon to account for the fact that the compounds in (1) are easily coined and readily interpreted, whereas those in (2) are unacceptable or uninterpretable?¹

- (1) truckbook, branch-brown, green-crazy, door-leveler, ballad-singing, over-ground, slow-dry, draw-sheet
- (2) *fresh-smell, *carefully-considering, *during-happy, *put-box, *green-dry, *appear-give

The answer that will emerge is a simple one. The lexical structure theory of Lieber (1980) provides the basic structural principles of compound formation. No special rule is needed within the lexicon to rule out impossible compounds. Rather, an independently needed principle of syntax suffices to account for the range of possible compounds. Lexical items often have lexical argument structures which must be satisfied when those items are inserted into a tree, whether it be a syntactic tree or a lexical one. Principles of this sort have been articulated within a number of current theories of syntax (Chomsky (1981), Bresnan (1980), Marantz (1981)), but have only recently become relevant to word formation as well (Williams (1980)). Such a principle, interacting with the basic principles of word formation provided by Lieber (1980), will account not only for a large range of *primary compounds*, i.e. those in which the second stem is not derived from a verb, but also for *synthetic compounds*, those in which the second stem is deverbal (*truckdriver*,

¹ The grammaticality judgments in all examples are my own. Where possible, however, I have used attested (usually nonce) forms from Marchand (1969) and elsewhere as examples of potential words; that is, these are words which will be new for most readers, but which have actually been used. In addition, in most cases I have checked my judgments with those of others and have found substantial agreement. I will point out cases where disagreement exists.

strange-sounding, hand-made).² This result is significant in that it provides a simple alternative to Roeper and Siegel's (1978) analysis of synthetic compounds, an alternative that does away with complex formal devices like lexical transformations and at the same time makes predictions that go beyond those made by Roeper and Siegel's analysis.

1. A Lexical Structure Framework

The theory of lexical structure proposed in Lieber (1980) makes available the following theoretical mechanisms for derivation and compounding. All morphemes, stems and affixes alike, have lexical entries which contain information about their category and subcategorization (i.e. what sort of lexical item, if any, they must attach to), their semantic representation, argument structures,³ diacritic specifications, and so on. Within this framework an *affix* is defined as a morpheme which subcategorizes other morphemes; the prefix *un-* and the suffix *-ness*, for example, must attach to adjectives, and the suffix *-ize* to adjectives or nouns. *Stems* are defined here in an admittedly nonstandard way as morphemes that do not subcategorize other morphemes.⁴

Morphemes are inserted into unlabeled binary-branching trees, subject to their subcategorization restrictions, and trees are then labeled by means of the following four *Feature Percolation Conventions*:

(3) *Feature Percolation Conventions* (Lieber (1980))

a. Convention I

All features of a stem morpheme, including category features, percolate to the first nonbranching node dominating that morpheme. For example:

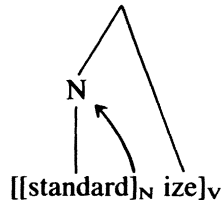
² The terms *primary* and *synthetic* for compounds are misleading in a number of ways. First, the fact that there are two terms at all suggests that these compounds are substantially different from one another. Indeed, they have been treated separately in the past both in traditional literature (Marchand (1969)) and in generative studies (Allen (1978), Roeper and Siegel (1978)). Here I will continue to use the terms even though a single analysis will suffice to delimit potential compounds in either case. Another point which might be misleading: the distinction between the two types rests upon the definition that a synthetic compound is one whose second stem is deverbal. This definition, in turn, presupposes that all synthetic compounds have the internal structure [[stem][[verb] affix]]. Although I continue to use the traditional terms throughout this article, I do not accept this structure as the only one possible for compounds containing the affixes *-er*, *-ing*, and *-ed*.

³ For the purposes of this article, argument structures of verbs will be represented as an array of semantic roles (Agent, Theme, Goal, etc.), together with an indication of which of these acts as the subject of the sentence (what Williams (1980) calls the *external argument*). For example, the verb *hit* will have an argument structure like this:

(i) *hit*: (Agent, Theme)
 |
 external

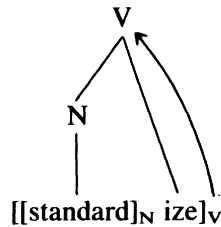
Nothing crucial hinges on the particular way I have chosen to represent argument structures.

⁴ It is assumed also that derivational and inflectional affixes have the same status in the lexicon—that is, they have the same sorts of lexical entries and obey the same lexical structure principles. See Lieber (1980) for arguments supporting this position.



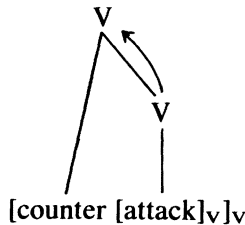
b. Convention II

All features of an affix morpheme, including category features, percolate to the first branching node dominating that morpheme. For example:



c. Convention III

If a branching node fails to obtain features by Convention II, features from the next lowest labeled node automatically percolate up to the unlabeled branching node. For example:



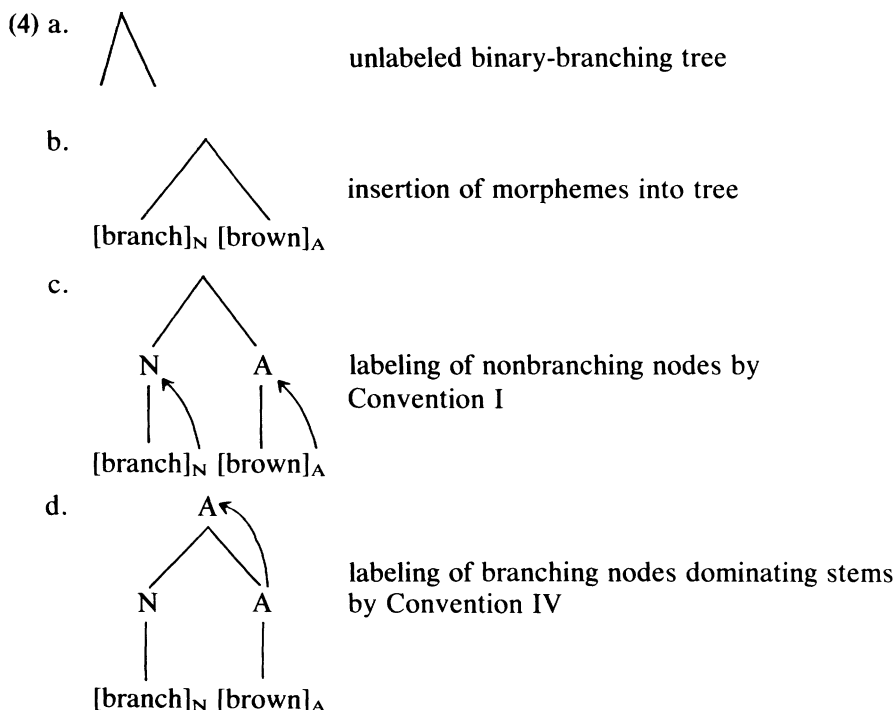
(where *counter-* lacks a category feature—cf. Lieber (1980))

d. Convention IV

If two stems are sisters (i.e. they form a compound), features from the right-hand stem percolate up to the branching node dominating the stems (see (4) for a complete derivation).

These conventions have the net effect of labeling the highest branching node in a word tree with the category and features of the outermost affix if the tree contains affixes, and with the category and features of the right-hand stem if the tree contains only stems. The only exception occurs when a morpheme is lexically unspecified for category, gender, argument structure, or some other feature; in this case, the branching node dominating the unspecified morpheme receives the relevant missing feature from “the next

morpheme down'' (cf. Lieber (1980) for more examples and discussion). This particular convention will have substantial consequences below. Conventions I–III are assumed to be universal principles of word formation. Convention IV, however, is language-particular: English, German, and other Indo-European languages make use of it, but some (e.g. Vietnamese, Thai) instead label compounds on the basis of the leftmost stem. Since this article is exclusively concerned with compound formation, the derivation of an English compound is illustrated in (4):



This lexical structure framework has the attractive property of being simple. Rather than having word formation rules specified for each affix and still more rules for compounding (as in Aronoff (1976), Allen (1978)), it makes use of a few principles which govern both derivation and compounding. In addition, it allows us to say that the locus of all idiosyncratic information in the lexicon is in lexical entries; morphemes may have diacritics, or bear peculiar restrictions on their subcategorization, but the actual principles by which morphemes are combined into words are exceptionless. It is beyond the scope of this article to give further arguments in favor of the proposed framework; I refer the reader to Lieber (1980) for the relevant evidence.

In one respect, however, this framework seems to be too simple. It predicts that a stem of any lexical category⁵ can be inserted into a word tree as a sister to a stem of any other lexical category to form a compound which will have the category and other

⁵ The lexical categories are N, V, A, and P.

properties of the right-hand stem; since stems by definition have no subcategorization restrictions, all combinations should be attested. Moreover, since the framework as it stands places no restrictions on compound formation, it also predicts that all types of compounds should be equally productive. But this is clearly not the case.

The following list illustrates all the logically possible combinations of stems:⁶

- (5) N N mailman, fire truck, file cabinet
- N A sky-blue, girl-crazy, color-blind
- A N hard hat, wildfire, poorhouse
- A A icy-cold, wide-awake, deaf-mute
- P N afterbirth, underarm
- V N drawbridge, pickpocket
- P A
- V A diehard
- N V hand-make, spoon-feed, hand-wash
- A V double-coat, sweet-talk
- N P
- A P
- P V overshoot
- V V freeze-dry, drop-kick
- P P into, onto
- V P

Of these sixteen possible combinations, some are not attested at all, and some which do occur are clearly more productive than others. As has frequently been noted (Marchand (1969), Allen (1978)), N N compounds are abundant in English and readily coined. An interpretation for any new N N compound can easily be found; for example, a *desk-stamp* might be a stamp which sits on a desk or a device for stamping desks. A N, N A, and A A are also easily found and readily coined. The following seem perfectly acceptable as new compounds: *poor-store*, *green-lady*,⁷ *brown-crazy*.

⁶ A few comments on the examples in (5):

(i) I can find no attested examples of true A P or V P compounds. Although there are forms like *whiteout* which seem to consist of an A stem and a P stem, and also numerous V P combinations like *call up* and *put down*, these do not have the characteristics of normal compounds. True compounds in English adopt the category of the second stem; *whiteout* is not a preposition or even an adjective, but a noun. *Call up*, *put down*, and other verb-particle combinations are verbs. Second, these compounds have highly unpredictable meanings. Since such forms are irregular both structurally and semantically, it might be best simply to list them with individual lexical entries rather than trying to derive them by regular principles of word formation. The same would be true for other compounds which are structurally and semantically exocentric (e.g. *speakeasy*); I assume that they too would be listed rather than productively derived.

(ii) *Diehard* can be a noun as well as an adjective. I assume that the noun may be created from the adjective by some process of morphological conversion (cf. Lieber (1982)).

(iii) *Into* and *onto* are at least *prima facie* candidates for P P compounds. I will argue below, however, that prepositions constitute a closed lexical class and that we would not expect new prepositions to be formed by compounding any more than we would expect new compounds to be formed by derivation.

⁷ This is in fact an attested compound. At the college I attended, *green-ladies* were female custodial workers who wore green uniforms.

Other sorts of compounds sometimes occur, but are not so freely coined. For example, by analogy to existing V N compounds like *drawbridge* and *pickpocket*, we might conceivably invent compounds like *drop-curtain* and *draw-sheet*, but other compounds equally derivable by the lexical structure system seem impossible, e.g. **put-box*, **appear-dog*. Similarly, a new V A compound like *appear-productive* seems possible, as in *Fred's appear-productive attitude didn't fool anyone*, but not **hit-good* and **chop-dead*. New N V and A V compounds are not inconceivable: *mallet-crack* and *knife-slice* are not unlikely verb coinages, nor are *fast-dance* and *slow-dry*. However, for many English speakers the verbs **salami-slice* and **green-dry* are much worse. Some new P V compounds might also be coined (e.g. *to oncome*), but others must be ruled out (e.g. **to during-run*, **to above-hit*).

As the lexical structure theory sketched above now stands, we have no way of explaining these observations; in other words, this framework overgenerates with respect to compounds. We might try to reduce overgeneration by directly altering our principles of lexical structure, for example, by adding to the lexicon rules specifically designed to produce some compounds (e.g. N N, N A) and not others (V P, N P). We could conceivably add to the lexicon a series of filters which let through N N, A N, N A, and V N compounds but which rule out N P, A P, and V P compounds. Such a solution, however, is very costly. First, it forces us to add a new formal mechanism to the lexicon; filters are not otherwise necessary within the present framework. More importantly, it would not explain why N N, N A, A N, etc., compounds are possible, but not N P, A P, and V P; the filter solution merely restates this observation, thus claiming implicitly that the pattern of facts in (5) is accidental. Finally, any set of filters we might devise to rule out N P, A P compounds, etc., would still be unable to explain why some compounding patterns are clearly more productive than others.

Obviously, a more desirable way of eliminating overgeneration of compounds and of predicting only possible or occurring compounds would not involve unnecessarily complicating the lexical structure component. A more attractive idea to pursue would be that there is some independent constraint upon the lexicon or the grammar as a whole which interacts with principles of lexical structure to produce the array of facts described above. In the pages that follow, I propose such a solution.

2. A Proposal

A number of current theories of syntax (e.g. Bresnan (1980), Chomsky (1981), Marantz (1981)) allow the phrase structure component of the grammar to overgenerate sentences like (6a–c):

- (6) a. **Sue hit.*
- b. **The elephant disappeared the frog.*
- c. **Ted put the box.*

Such sentences are ruled out by an independent principle requiring that lexical items which have argument structures, whether represented as semantic roles (Agent, Theme), grammatical relations (subject, object), or structural positions ([NP,S], [NP,VP]), must be able to satisfy those argument structures in any tree into which they are inserted (e.g. *hit* must have a Theme, *put* a Theme and a Locative). The exact statement of this principle varies somewhat within current syntactic frameworks, as do the inventory of categories which have lexical argument structures and the way in which these argument structures are represented. Such minor differences are of no consequence here. What is important, however, is that some principle of argument linking is already needed within most current syntactic theories.

Suppose that we allow the lexical structure component to overgenerate in the same way that we allow the base component of our syntax to overgenerate. There is good reason to believe that we can then use a principle of argument linking to correctly delimit the set of possible compounds in English. Here I will first sketch one possible statement of an argument-linking principle, and then draw out its consequences for the analysis of compounds. It must be stressed again that nothing hinges on the particular way in which I state the constraint; the same analysis of compounds is likely to follow from any reasonable statement of argument linking within a syntactic theory.

First, I will need to define three terms:

- (7) a. *Internal argument*: In the sense of Williams (1980), all obligatory (i.e. lexically specified) arguments with the exception of the subject are internal. For example, *give* and *elect* have two internal arguments; *put* has both an NP and a Locative as internal arguments; and a preposition like *during* has one internal argument.
- b. *Semantic argument*: Semantic arguments are phrases which are not obligatory or lexically specified. They include Locatives, Instrumentals, Manner phrases, Benefactives, Agentives, etc.
- c. *Free*: A stem is free if it is left unlinked by an argument-taking lexical item.

For the purposes of this article, verbs and prepositions will be considered to be argument-taking lexical items, that is, morphemes whose lexical entries contain argument structures. Nouns and adjectives will, in general, be non-argument-taking.⁸

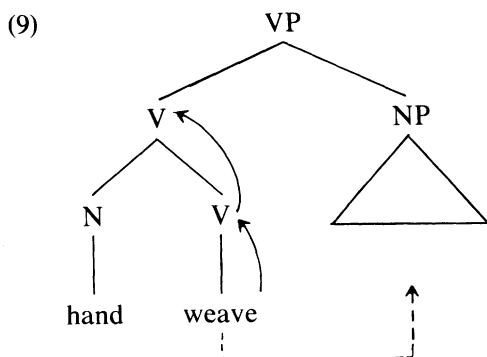
Given these preliminaries, the Argument-linking Principle might reasonably be stated as follows:

⁸ A few adjectives do seem to require some sort of specific argument structure. The adjective *worth*, for example, must have a noun argument (*worth a dime*), and *fond* must have a PP (*He is fond of gin*). Such adjectives will have argument structures listed in their lexical entries just as the normal verb or preposition would, and presumably any argument-linking constraint needed in the grammar would apply to them as well.

(8) *Argument-linking Principle*

- a. In the configuration $[\]_{\{V\}} [\]_{\alpha}^9$ or $[\]_{\alpha} [\]_{\{V\}}$, where α ranges over all categories, $\{ \begin{smallmatrix} V \\ P \end{smallmatrix} \}$ must be able to link all internal arguments.¹⁰
- b. If a stem $[\]_{\alpha}$ is free in a compound which also contains an argument-taking stem, α must be interpretable as a semantic argument of the argument-taking stem, i.e. as a Locative, Manner, Agentive, Instrumental, or Benefactive argument.

In compounds, the Argument-linking Principle must be interpreted in conjunction with the principles of lexical structure. Given the Feature Percolation Conventions in (3), the second or right-hand stem in the compound provides the lexical category and feature specification of the compound as a whole. Included in the properties which the compound as a whole adopts from the second stem is the argument structure of that stem, if it has one. A compound like *hand-weave* adopts its argument structure from the verb stem *weave*. The verb stem *weave*, by virtue of having passed its argument structure on to the compound *hand-weave*, then normally satisfies its argument structure “outside” the compound, i.e. in a sentence into which the verb *hand-weave* has been inserted:¹¹



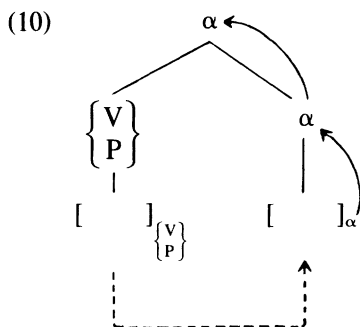
The noun *hand* is free in such a compound and is interpreted as a semantic argument (in this case, most readily as an instrumental phrase).

⁹ Note that because of this configuration α cannot be an affix (affixes are represented by two left brackets $[_ _ [_ _] _ _]$). This implies that a verb in the configuration $[[hit]_V \text{ er}]$ will *not* have to satisfy its argument structure, which in fact is the case (cf. *John is a good hitter*).

¹⁰ This statement of the Argument-linking Principle suggests an asymmetry between internal arguments and external arguments: only internal arguments must be satisfied; the external argument or subject somehow has a different status, and it is never linked in a compound. This asymmetry in fact follows from a number of current syntactic theories (e.g. Chomsky (1981), Marantz (1981)) which argue that only internal arguments are the arguments of the verb (or preposition) and that the external argument or subject is actually an argument of the predicate (consisting of a verb and its incorporated arguments). Such theories thus provide some explanation for what would otherwise be an arbitrary fact about compounding.

¹¹ See section 3.3 for a discussion of cases in which verbs in compounds of this sort seem to satisfy their argument structures within the compound.

In contrast, the first stem in a compound does not pass any of its features on to the compound as a whole. Therefore, if it is an argument-taking stem, it can only satisfy its arguments within the compound. That is, the second stem in the compound must be appropriate to satisfy the argument structure of the first:



As shown schematically in (10), a verb or preposition in the first stem position must be able to incorporate α as its internal argument, if it has one. An appropriate example would be the compound *drawbridge*, where *bridge* satisfies the internal argument of *draw*.¹²

The lexical structure framework sketched in section 1, together with the Argument-linking Principle, will go a long way toward explaining the patterns of compounding found in English, both predicting the sorts of new compounds that might be coined and ruling out others that do not occur. In the next two sections, I will provide a detailed survey of compounding facts in English, elaborating on the skeleton of the analysis presented so far. Section 3 concentrates on primary compounds and section 4 on the synthetic compounds most recently analyzed by Roeper and Siegel (1978).

3. Primary Compounds

As mentioned earlier, primary compounds are those in which the second stem is not derived from a verb (*doghouse*, *pickpocket*, *quick-dry*, *freeze-dry*), and synthetic compounds are those which contain a deverbal second stem (*truckdriver*, *housekeeping*, *handwritten*). Although this distinction is merely terminological, since it will emerge that all compounds obey the same principles, I will discuss the two cases separately. For our purposes, primary compounds can be divided into four groups on the basis of whether or not each of the two constituent stems is argument-taking or non-argument-taking. Section 3.1 covers compounds in which neither stem is argument-taking, section 3.2

¹² Note that the second stem not only must be of a syntactic category appropriate to fill the argument structure of the verb, but also must be semantically appropriate. A compound *drop-air* is peculiar not because *air* cannot serve as an argument for *drop* but because *air* violates selectional restrictions on *drop* in the same way that it does in the VP *drop the air*. That is, not every compound which is syntactically permissible will be a plausible new compound.

compounds in which only the first stem is argument-taking, section 3.3 compounds in which only the second stem is argument-taking, and section 3.4 compounds in which both stems are argument-taking.

3.1. *Both Stems Non-argument-taking*

Compounds formed of two non-argument-taking stems are probably the most productive sort in English. (11) illustrates a number of these compounds, some of which exist and are frequently used and others of which are, as far as I know, new words:

- (11) N N compounds: mailman, fire truck, file cabinet
truck-book, baby-finger, squash-bowl
- A N compounds: hard hat, wildfire, poorhouse
hard-rock, wild-child, poor-store
- N A compounds: sky-blue, girl-crazy, color-blind
branch-brown, wife-blind, gun-crazy
- A A compounds: icy-cold, wide-awake, deaf-mute
wet-cold, happy-blind, green-crazy

Nearly any combination of N N, A N, N A, or A A stems constitutes a potential compound. Interpretations are readily found for such new compounds as *squash-bowl*, *wife-blind*, and *green-crazy*. In fact, such compounds are often open to multiple interpretations: in appropriate contexts, *squash-bowl* could be a bowl for squash, a bowl of squash, a bowl made out of squash, a racquet-sport tournament, etc. See Allen (1978) for a discussion of the principles by which these compounds are interpreted.

Given the proposal in section 2, it is not hard to see why compounds of this sort are so abundant and so productive: since neither of the constituent stems of these compounds has an argument structure, the constraint in (8) is inapplicable. A compound will never be ruled out on the grounds that one of its stems cannot satisfy its argument structure. Moreover, since the Argument-linking Principle is inapplicable, one stem's interpretation will never be limited by virtue of its having to be an internal or semantic argument to the other stem. The Argument-linking Principle thus provides an explanation both for the productivity of this class of compounds and for the freedom we have in interpreting them.¹³

3.2. *First Stem Argument-taking*

This group includes such existing compounds as those in (12):

- (12) P N compounds: afterbirth, underarm, underbelly
- V N compounds: drawbridge, pickpocket, pushcart
- P A compounds:
- V A compounds: diehard

¹³ It of course says nothing about how we actually do interpret them.

Compounds of this class are clearly neither as abundant nor as productive as those discussed in the previous section. However, this follows from the Argument-linking Principle (8); since the compounds in (12) have one stem which is argument-taking, this constraint is applicable. Specifically, these compounds are of the sort illustrated schematically in (10). The first stem does not supply any of its features to the compound as a whole. It must therefore satisfy whatever argument structure it has within the compound. These compounds should then be possible only under limited conditions: either (a) the P or V which is the first stem must be able to satisfy its argument structure with the second stem, or (b) if the P or V has no internal argument in its argument structure, the second stem in the compound is free and must be interpretable as a semantic argument. By this reasoning, the compounds in (13a) are predicted to be possible new words, and those in (13b) to be impossible:

(13) a. Compounds predicted to be possible

P N: *between-class*, *above-ground*

V N: *drop-curtain*, *push-bicycle*, *show-bread*, *draw-sheet*¹⁴

P A:

V A: *be-good*, *play-dead*, *appear-productive*¹⁵

b. Compounds predicted to be impossible

V N: **put-box*, **seem-dog*

P A: **during-warm*, **above-green*, **among-legal*

P N should be a fairly free compound type, since most Ps can occur with an object. That is, a semantically appropriate noun should always be able to satisfy the argument structure of the preposition (e.g. *between-class*, *above-ground*). On the other hand, since most Ps require noun arguments, we might predict that P A compounds would be unlikely; an adjective cannot serve as an argument to a preposition.¹⁶ Compounds like **among-legal* and **during-happy* are in fact outlandish, as predicted.

V N compounds are also quite restricted, as the Argument-linking Principle predicts.¹⁷ They should be possible if the verb stem has a single internal noun argument, as does *show* in *show-bread*. However, if the verb stem has two obligatory internal

¹⁴ All of the "new" V N compounds listed here are in fact cited as nonce words by Marchand (1969).

¹⁵ Although new compounds of this sort do seem odd to many speakers, the majority of my informants accepted the compound *appear-productive* in the sentence *Moe's appear-productive attitude didn't fool anyone*.

¹⁶ Of course, there are adjectives like *overabundant* and *overtired* which seem to be composed of a preposition followed by an adjective. It is not at all apparent that these forms are compounds, however, since *over-* when attached to adjectives conveys the meaning 'excessive', which is not at all like its meaning as a freely occurring preposition. It is possible that *over-* is better treated as a prefix which attaches to adjectives and produces adjectives.

¹⁷ Marchand (1969, 74) points out that certain transitive verbs seem to occur fairly productively in V N compounds like *drawbridge* (e.g. *drift*, *drip*, *pay*, *rattle*, *show*, *draw*, *drop*), whereas other verbs resist such constructions (e.g. *boil*, *climb*, *dress*, *drink*, *eat*). The latter verbs do however occur in their present participle forms (arguably as adjectives) as first stems in compounds: *boiling-water*, *climbing-bars*, *drinking-water*, *eating-apples*. Neither Marchand nor I have any principled way of explaining why particular verbs prefer one sort of compound over the other.

arguments of any sort (e.g. *put*) or an internal argument which belongs to some category other than noun (e.g. *seem*), V N compounds containing these verbs are predicted to be impossible (e.g. **put-box*, **seem-dog*). Another sort of V N compound is also predicted to be impossible. As stated earlier, a compound of this class should be possible if the initial P or V lacks an internal argument entirely. This suggests that a compound like **die-man* should be possible, since *die* lacks internal arguments. But clearly it is not. The reason for this is found in (8b): the noun stem in **die-man* is free, since it remains unlinked by the verb, and therefore must be interpretable as a semantic argument of *die*. However, *man* is not easily interpretable as a Locative, Instrumental, Manner, Agentive argument, etc., and the compound is therefore uninterpretable.

Finally, V A compounds are predicted to be possible only if the verb stem normally takes an adjective argument (*be*, *appear*) or does not require an internal argument at all (*march*). Compounds such as *march-quick* and *appear-productive* are therefore predicted to be more likely as new words than **hit-happy* or **dislike-warm*, since *hit* and *dislike* require internal noun arguments. To my ear the former two compounds are in fact somewhat preferable to the latter two.

3.3. Second Stem Argument-taking

Example (14) illustrates some compounds of this type:

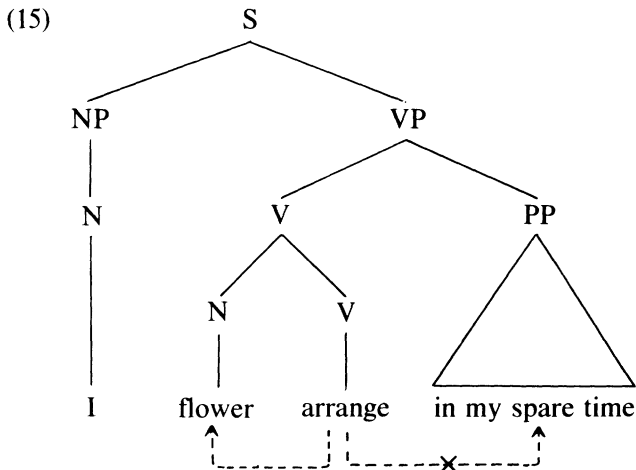
- (14) N V compounds: hand-make, spoon-feed, play-act, hand-wash
 A V compounds: dry-farm, double-coat, sweet-talk

At this point, a slight digression is necessary. Notice that (14) illustrates only two types of compounds with argument-taking second stems. Theoretically, there are two more which might have been listed, namely, A P and N P. Such compounds do not in fact seem to exist. There is good reason to believe, however, that all preposition-final compounds are ruled out by an independently needed constraint on the lexicon. Unlike the other lexical categories (noun, adjective, verb), prepositions constitute a closed class. We cannot coin new prepositions by any means. There are no affixes which attach to stems to yield new prepositions, nor can we coin an entirely new preposition as we can coin a new verb (e.g. *to scarf* 'to eat rapidly'). We must therefore have some constraint within the lexicon to rule out new prepositions, and this, however it is stated, will in turn predict the absence of preposition-final compounds independently of any constraints on compounding as such. Given this not unreasonable assumption, we are left with only two types of compounds to account for in this section.

The compounds in (14) are of the sort schematically illustrated in (9): the second stem, being an argument-taking stem, passes on to the compound as a whole (i.e. to the highest node in the lexical structure) its argument structure, along with its category and all of its other features. This argument structure must then (normally, but see below) be satisfied "outside" the compound in whatever syntactic structure the compound occurs. The first stem will remain unlinked to the argument structure of the second stem;

that is, it will be free in these compounds. Therefore, according to the constraint in (8), this first stem must in some way be interpretable as a semantic argument of the second stem in order for the compound to be judged well-formed. If the first stem is not easily interpretable as an Instrumental, Locative, Manner, Agentive, Benefactive, etc., the compound will normally be unacceptable.

I say “normally” because some speakers of English occasionally allow N V compounds of a different sort, namely, compounds like *flower-arrange* or *carol-sing* where the first noun is linked as the internal argument of the verb stem. Crucially, such speakers will only accept verbs of this sort if they are used intransitively.¹⁸ That is, some English speakers seem to allow a compounding strategy in which a second stem verb which requires an internal argument but which cannot link it syntactically will incorporate its first stem within the compound, as shown in (15):



Other English speakers (myself included) find all such compounds peculiar. Presumably this strategy of argument linking has a marginal or marked status in English; this does not, however, rule out the possibility that other languages may make fuller use of it.

¹⁸ Hall (1956) amasses a couple of dozen such examples, along with the contexts in which they were used (most seem to be examples he has heard himself; a few are from newspapers). The citations for *flower-arrange* and *carol-sing* are typical:

- (i) J — is flower-arranging. (Ithaca, 1955)
- (ii) “As on previous Christmas Eves, they’ll be carol-singing for appreciative audiences.” (from *Radio Call*, 1954)

That is, such nonce forms are always used intransitively. This agrees with results of my own inquiry. For my informants who accepted such compounds at all, *Fred bread-sliced* was far better than **Fred bread-sliced the baguettes*.

Note that English has a few existing compounds of this sort, e.g. *henpeck*, *hero-worship* (Marchand (1969) cites about 20, not all of which are still perceived as existing words). English speakers who will not accept new forms like *flower-arrange* will of course accept these. In fact, it seems that the less semantically compositional the existing compound has become, the more likely it is to be used transitively; for example, my informants much preferred *She has a tendency to henpeck Tom* to **She has a tendency to hero-worship Tom*. Of the two, *henpeck* is by far the less compositional in meaning.

Given the Argument-linking Principle (together with the marginal strategy discussed above), we can make the following predictions about what N V and A V compounds are likely to be coined:

- (16) a. Possible compounds
 N V: *mallet-crack*, *knife-slice*, *stream-wade*
 A V: *fast-dance*, *blind-walk*, *slow-dry*
- b. Possible as intransitives for some speakers (impossible for others)
 N V: *flower-arrange*, *carol-sing*, *map-study*
- c. Impossible compounds
 A V: **green-dry*, **high-walk*, **blue-shave*

In (16a) the initial noun stems can easily be interpreted as Instruments (*mallet*, *knife*) or as Locatives (*stream*), and the adjectives in the A V compounds as Manner arguments (*fast*, *blind*, *slow*); that is, they can easily be interpreted as semantic arguments of their various verb stems. Therefore, the analysis predicts that the forms in (16a) are potential compounds. In (16b) the initial noun stems are considerably less conducive to Instrumental, Locative, Agentive, or Manner interpretations; such compounds will only be possible for some speakers under the conditions described above. The A V compounds in (16c) are predicted to be unacceptable because the adjective stem cannot be given a coherent Manner interpretation. Thus, *slow-dry* in (16a) is possible because *slow* is a possible Manner argument, but *green-dry* in (16c) is predicted to be impossible—*green* is not a likely Manner adjective, nor can it receive a plausible Locative, Instrumental, or Agentive interpretation. It therefore follows from this analysis that the A V and N V class of compounds will be less than fully productive.

3.4. Both Stems Argument-taking

The final class contains primary compounds in which both stems are argument-taking. As argued in section 3.3, we can rule out the P-final compounds on the basis of an independently needed constraint which prevents the formation of new prepositions. This leaves P V and V V compounds to be accounted for. The analysis outlined in section 2 makes the following predictions with respect to this class of compounds. The second argument-taking stem will supply the compound as a whole with its argument structure, and this argument structure will therefore be satisfied outside the compound (as in schema (9)). In contrast, the first argument-taking stem will have to satisfy its argument structure within the compound (schema (10)). Clearly, any P or V which has an internal N or A argument is predicted to be impossible in this position:

- (17) Compounds predicted to be impossible
 P V: **during-run*, **above-arrive*
 V V: **give-hit*, **appear-eat*, **hit-elapse*

These do in fact seem to be as bad as predicted.

What is not entirely clear at this point is what, exactly, is predicted to be possible. If the initial P or V stem does not have an internal N or A argument to be fulfilled, the second stem is, by our definition, free; and free stems, according to (8b), must be interpretable as semantic arguments. However, a verb stem clearly cannot be a semantic argument, since it cannot be an argument at all. What seems likely is that (8b) in fact holds only if the free stem is of a category which can act as an argument; if the free stem is a verb, no restriction is placed upon it. If this is true, compounds such as those in (18) are predicted to be possible:

(18) Compounds predicted to be possible

P V: oncome, upcome, overshoot

V V: fly-drive, slip-slide, fall-float

These are certainly more plausible as potential coinages than the forms in (17).

V V compounds also prove to be problematic in another respect. A few V V compounds that do exist (*freeze-dry*, *drop-kick*, *stir-fry*, *slam-dunk*, *roll-start*) actually seem to run counter to the predictions made above; here the first verb stem does seem to require an internal noun argument (*freeze*, *drop*, *stir*, *slam*, *roll* are transitive), and yet the compounds are possible. One explanation might be this: in all five cases, both the first and the second stems are transitive, and since they share the same argument structure, they can somehow satisfy that argument structure with the same noun—one which must be found outside the compound. The best I can say at this point is that there seem to be very few compounds of this type, and that it seems difficult to think of plausible new ones.

3.5. Summary

Proposal (8), the Argument-linking Principle, allows us to formulate a fairly detailed set of predictions about what sorts of compounds should be most productive (N N, N A, A N, A A) and what sorts should be nonexistent or less than fully productive (P A, N V, A V, V V, P V, V N, V A, P N). In general, a compound type containing an argument-taking stem will never be as productive as compound types containing no argument-taking stems. (8) also allows us to make fairly detailed predictions about possible and impossible combinations of stems within each compound type. As can be seen from the discussion in sections 3.1–3.4, these predictions seem to be reasonably accurate, except perhaps with respect to V V compounds.

4. Synthetic Compounds

Synthetic compounds (sometimes called verbal compounds) are compounds whose second stems are deverbal (see fn. 2):

- (19) a. truckdriver, lawnmower, bread-baker
 b. ballad-singing, sweet-smelling, home-wrecking
 c. hand-made, carefully-considered, fresh-baked

Synthetic compounds are abundant in English and new ones are frequently coined, but (as with most of the primary compound types discussed in section 3) the formation and interpretation of synthetic compounds is not completely free. For example, *green-driver* might be a potential compound, but only with a meaning analogous to the one given in footnote 7 for *green-lady*, i.e. 'a driver who wears green'. It is not possible with an interpretation analogous to that of *truckdriver*, i.e. 'one who drives green'. Many speakers find the synthetic compound *quick-considering* better if it is used as the progressive form of the verb (*They are quick-considering the proposal*) than if it is used as an adjective (**a quick-considering task force*). The same speakers find the compound *proposal-considering* better as an adjective than as the progressive form of the verb (*a proposal-considering task force* vs. **They are proposal-considering the offer*).¹⁹ Finally, both *hand-carved* and *hand-carving*, *fish-baked* and *fish-baking* are potential compounds, but the *-ed* members of these pairs are interpreted rather differently from the *-ing* compounds: *hand-carved* and *fish-baked* can mean respectively 'carved by hand' and (oddly) 'baked by fish', but *hand* and *fish* cannot be interpreted as instrumental or agentive in the *-ing* forms. Instead, they must be interpreted as 'carving hands' and 'baking fish'. Any analysis of compounding must be able to account for such facts and to predict when a given synthetic compound will be acceptable.

Some of these observations have in fact been made in previous generative studies. Roeper and Siegel (1978) (henceforth RS) have proposed a generalization which they claim governs the acceptability of synthetic (verbal) compounds (p. 208):

(20) *First Sister (FS) Principle*

All verbal compounds are formed by incorporation of a word in first sister position of the verb.

That is, if a noun, adjective, or adverb is an acceptable complement to a verb when it occurs in a sentence, the same noun, adjective, or adverb will be acceptable as a first stem when the verb occurs in a synthetic compound: *He made peace* → *peacemaker*, but **He thought peace* → **peacethinker*. RS also provide a series of rules which capture this generalization within a framework of word formation rather different from the one assumed here. This analysis, to which I will return in section 4.2, claims at least implicitly that the formation of synthetic compounds is governed by different principles than the

¹⁹ These judgments are often relative. Some speakers dislike most compound progressive verbs. However, presented with pairs like *a quick-considering task force* and *They are quick-considering the proposal*, they quite consistently report the judgments given above; even if they do not like compound progressives, such speakers almost always find the adjectival use worse than the verbal. I have no explanation, however, for their failure to find compound progressives fully acceptable.

formation of primary compounds. Here I will assume, on the contrary, that primary and synthetic compounds do obey the same principles; and I will argue that with no additional theoretical machinery the analysis developed in section 2 will suffice to account for the facts mentioned above.

4.1. *Argument Linking and Synthetic Compounds*

In order to extend the analysis from primary to synthetic compounds, we must carefully examine the internal structure of the latter. Compounds which are most often called synthetic are those like *truckdriver* (which contain the agentive *-er* suffix), those like *child-supporting* (which have the progressive, adjectival, or gerundive *-ing*), and those like *home-baked* (whose last element is a passive participle). Affixes such as *-er*, *-ing*, and the *-ed* of the passive participle have lexical entries within the word formation framework of Lieber (1980). Among other things, these lexical entries will contain the category and subcategorization of each affix, along with its distinctive argument structure, if any. The category and subcategorization of each affix are crucial in determining the sort of structures into which it can be inserted and therefore the way in which the Argument-linking Principle (8) will apply. In the following sections I will consider each affix separately.

4.1.1. *Agentive -er in Synthetic Compounds.* Agentive *-er* will have something like the following partial lexical entry:

- (21) $-er \quad]_V \text{ — }]_N$
 argument structure: ϕ
 semantic rep.: agentive
 etc.

-er lacks an argument structure because it is nominal. It can attach to any item with the category Verb.²⁰ In the simplest case, the result is a derived word like the one in (22):

- (22) $[[drive]_V \text{ er}]_N$

This derived noun can itself form part of a compound.

- (23) $[[\quad]_\alpha [[drive]_V \text{ er}]_N]_N$

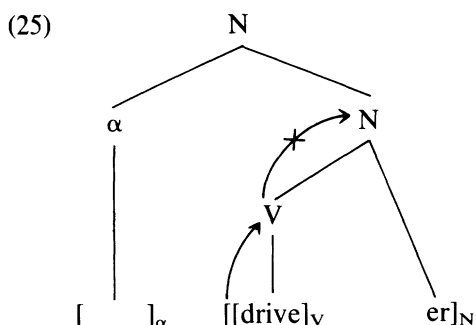
Alternatively, *-er* could attach to a primary compound whose last stem is verbal:

- (24) $[[[\quad]_\alpha [drive]_V]_V \text{ er}]_N$

²⁰ The subcategorization frame will in fact have to be somewhat more detailed than the one suggested here. Specifically, *-er* will have to attach to a verb stem, rather than to a past tense verb or a progressive. This can be accomplished if we assume that verbs and verbal affixes carry features—e.g. $[\pm \text{past}]$, $[\pm \text{progressive}]$ —and that *-er* attaches only to a verb with a certain array of features—perhaps $[- \text{past}, - \text{progressive}]$.

That is, the simplest lexical structure system possible actually makes two different structures available for synthetic compounds in *-er*. This fact, together with the Feature Percolation Conventions and the Argument-linking Principle (8), allows us to make a number of predictions about the acceptability of these compounds.

First, the Argument-linking Principle (8) is not applicable at all in structure (23), as (25) illustrates:

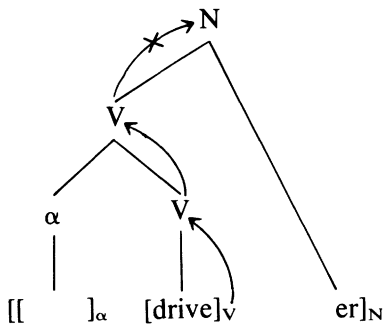


Remember that principle (8) requires a verb to satisfy its argument structure only if it is in one of the two following configurations: []_α []_V or []_V []_α. The verb stem in (25) is not in such a configuration. Moreover, since it is contained within a noun, its argument structure cannot percolate to any node higher in the compound tree. (It is assumed that features of one category cannot percolate to a node dominated by another category.) The compound schematized in (25) is therefore very much like a primary compound whose second stem is non-argument-taking; the acceptability of any new coinage should depend upon what category α assumes, and the conditions discussed in section 3 should hold true.

For example, suppose that α is an adjective like *green*: the resulting compound *green-driver* would then be exactly analogous to the compound *green-lady*. The compound could mean 'driver who wears green' or something of that sort, but not 'someone who drives green', since *green* is not incorporated as an argument of *drive*. Similarly, α could be a noun like *truck*. Rather than having the usual meaning 'someone who drives trucks' (cf. immediately below) in this structure, the compound *truckdriver* might mean 'driver owning a truck' or 'driver wearing a shirt with a truck'. If this seems rather farfetched, consider a compound like *apprentice welder* in which the primary N N compound interpretation is more readily available: *apprentice welder* is for obvious reasons more easily interpretable as 'a welder who is an apprentice' than as 'someone who welds apprentices'. The former interpretation stems from the structure in (25). Finally, in configuration (25) α might also be V or P; the resulting compounds will be judged well-formed if the conditions discussed in section 3.2 are met.

Consider next the structure schematized in (24); here the Argument-linking Principle is applicable, as (26) illustrates:

(26)



Here, the argument structure of the verb stem *drive* can percolate to the branching V node, but not any farther. *Drive* is in the configuration []_α []_V and must therefore be able to satisfy its argument structure; moreover, since the node to which the argument structure percolates is not uppermost, the argument structure of *drive* cannot be satisfied “outside” the compound, but rather must be satisfied by α. Since *drive* requires an internal noun argument, a noun like *truck* could be in the position of α in (26)—with the interpretation ‘someone who drives trucks’ resulting. Consider the verb stem *weld* instead of *drive* in the same configuration. *Weld* also requires an internal noun argument. If the noun *apprentice* occurs in the position of α, it will be linked as the internal argument of *weld*, with the strange interpretation ‘someone who welds apprentices’ as the outcome. (Compare *steel welder*, where the noun in the α position is more felicitous under this interpretation.) An adjective like *green* would be ruled out entirely in the α position for either *drive* or *weld*, since neither can satisfy its argument structure with an adjective (**green-driver*, **green-welder*). Compounds allowed in structure (26) are thus limited to those whose first stem can serve as an argument of the verb. This in fact corresponds to RS’s FS Principle. Items which would be possible following the verb *drive* in a sentence are just those which would be possible as first stem in the structure in (26); the reason is that in both environments that stem serves to satisfy the argument structure of the verb.

Notice that the predictions made above regarding synthetic compounds in *-er* go well beyond those made by RS’s FS Principle. Since in general RS are not concerned with the manner in which primary compounds are generated and interpreted, their principle fails to allow for the primary compound interpretation which is not unreasonable for *truckdriver*, *apprentice welder*, and *green-driver*. However, principles of lexical structure, together with the Argument-linking Principle (8), predict this whole range of facts.

4.1.2. Synthetic Compounds in -ing. Synthetic compounds in *-ing* have a wider range of structural possibilities than do synthetic compounds in agentive *-er*, because *-ing* forms lexical items belonging to several different categories.²¹ *-ing* can attach to verb stems

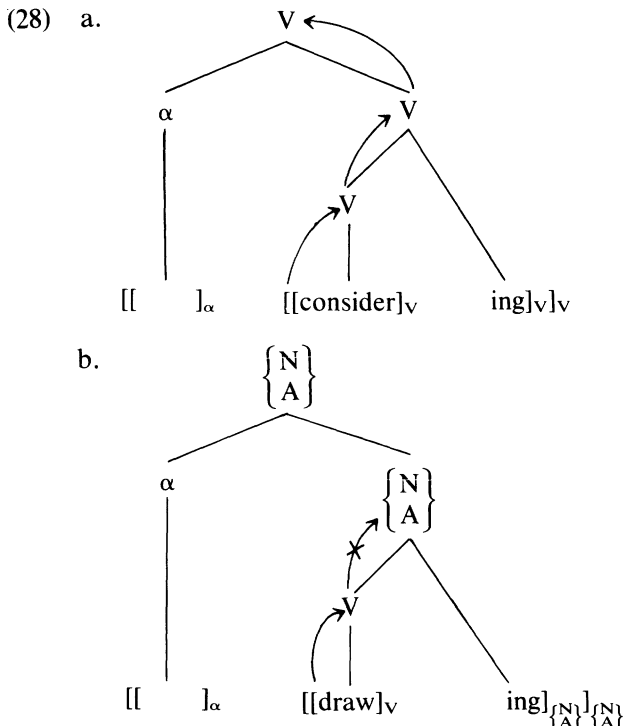
²¹ It is of no consequence here whether this fact is represented by giving *-ing* three separate lexical entries or by giving it a single lexical entry with three separate subcategorization frames and semantic representations.

to form adjectives, nouns, or the progressive form of the verb, as the partial lexical entries in (27) indicate:

- (27) a. $-ing \]_V \text{ --- }]_V$
 argument structure: ϕ
 semantic rep.: progressive
- b. $-ing \]_V \text{ --- }]_A$
 argument structure: ϕ
 semantic rep.: participial adjective
- c. $-ing \]_V \text{ --- }]_N$
 argument structure: ϕ
 semantic rep.: gerundive noun

-ing therefore has three separate subcategorization frames. As the progressive affix, it lacks any distinctive argument structure (the progressive form of the verb characteristically has the same argument structure as the verb to which it attaches, something that the Feature Percolation Conventions will automatically account for if we leave verbal *-ing* unspecified for argument structure). The adjectival and nominal *-ings* lack argument structures simply by virtue of being adjectival and nominal.

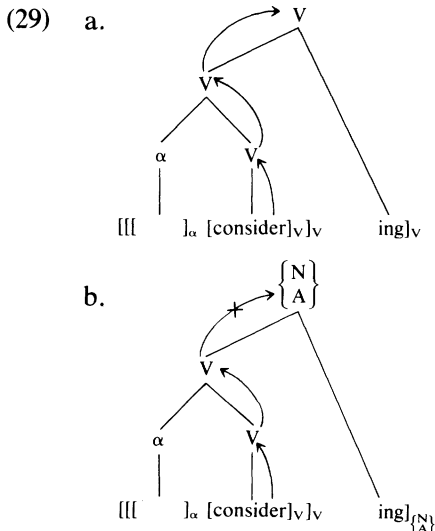
The three *-ings* can first of all attach to a verb stem, forming a derived verb, adjective, or noun which can itself compound with another stem to form a structure rather like that of a primary compound. This is illustrated in (28):



First consider (28a): since *-ing* does not have an argument structure of its own, the argument structure of *consider* is passed on to the first branching node. Then, by Convention IV, all features of *considering* are passed on to the entire compound. *Considering* must therefore satisfy its arguments outside the compound.²² Since the stem α is free in (28a), it must be interpretable as some semantic argument of the verb. Compare stems like *proposal* and *quick* in the α position: for most speakers, *quick-considering* is more acceptable as a progressive verb (*They are quick-considering the proposal*) than *proposal-considering* (**They are proposal-considering the offer*). In the former, *quick* easily receives a Manner interpretation, but *proposal* cannot be interpreted as any type of semantic argument. In other words, given the structure in (28a), our analysis predicts that an *-ing* synthetic compound will be acceptable as a progressive verb just in case the first stem in the compound can be interpreted as a Manner, Locative, Instrumental, Agentive, etc., argument.

In (28b), the argument structure of the verb stem will percolate no farther than the nonbranching node dominating the verb, since no feature of one category will percolate to a node dominated by another category. Compounds having the structure (28b) should therefore be like primary compounds whose second stem is non-argument-taking (cf. sections 3.1, 3.2). Take as an example the compound *prize-drawing* in structure (28b): $[[[\text{prize}]_N [[\text{draw}]_V \text{ing}]_N]_N]$. With this structure we might expect the interpretation 'drawing which won a prize', analogous to a possible interpretation for the primary compound *prize-cat*. In theory, any stem ought to be possible in the position of α as long as the conditions in sections 3.1 and 3.2 are met and a primary compound interpretation is possible.

The three *-ings* can also attach to compound verbs, as schematized in (29):



²² Except, of course, in cases like those discussed in section 3.3 in which some speakers marginally allow the first stem in the compound to satisfy the internal argument of a second stem which occurs in an intransitive structure. That is, (28a) is exactly analogous to primary compounds whose second stems are Vs.

Again, these structures allow us to make various predictions about possible and impossible synthetic compounds in *-ing*. (29a) illustrates the progressive *-ing*. The innermost verb stem supplies its argument structure, along with all of its other features, to the first branching node. This argument structure is then passed on (by Convention IV) to the highest branching node, since *-ing* does not itself have an argument structure to give this node. The verb stem *consider* therefore provides the argument structure for the compound as a whole, and this argument structure must normally be satisfied outside the compound (but cf. fn. 22). The stem α is free in (29a); that is, it must be interpretable as some semantic argument of *consider*. This in fact yields the same range of predictions as structure (28a).

Finally, in (29b), *consider* passes on its argument structure (and all of its features) to the first branching node, but the argument structure percolates no farther, since the next branching node belongs to a different category. *Consider* must therefore satisfy its argument structure inside the compound with α . Since *consider* has a single internal noun argument, α must be a noun. Thus, we expect compounds like *proposal-considering*, *offer-considering*, and *paper-considering* to be possible nouns and adjectives, whereas we predict *quick-considering* to be worse, since the adjective *quick* cannot satisfy the argument structure of *consider*:

- (30) a proposal-considering task-force
 The proposal-considering went on for a week.
 *a quick-considering task force
 *The quick-considering went on for a week.

Again, judgments are often relative, but most speakers seem to agree with the predicted pattern.

The availability of all the structures in (28) and (29), and of all the predictions they yield, may seem to be an embarrassment of riches. However, the abundance of possible structures arises from the simplest possible assumptions about lexical structure: affixes can attach to anything that meets their subcategorization restrictions, whether it be a stem or a complex form created by the compounding of two stems. To restrict the formation of *-ing* compounds in any way would complicate the lexical structure system unnaturally. Moreover, the array of predictions that can be derived from this analysis actually reduces to the three summarized in (31):

- (31) a. Synthetic compounds in *-ing* are possible progressive verbs only if the first stem can be interpreted as a semantic argument of the verb ((28a), (29a)) (but cf. fn. 22).
- b. Synthetic compounds in *-ing* are possible nouns and adjectives if
 - i. the first stem is interpretable as the internal argument of the verb if it has one, or otherwise as a semantic argument if the verb lacks an obligatory internal argument, as in (29); or
 - ii. the compound can receive a primary compound type of interpretation, as in (28b).

4.1.3. *Synthetic Compounds with Passive Participles.* Like the *-er* and *-ing* compounds already discussed, synthetic compounds whose second members are passive participles are extremely productive; but the two types differ in one respect. Whereas we can talk about *-er* and *-ing* as affixes which always maintain a uniform shape, in the case of the passive participle it is not at all clear that we are dealing with a single affix. That is, unlike forms in *-er* and *-ing*, passive participles in English exhibit a great deal of allomorphy. Although most verbs take *-ed*, as do all newly coined verbs (e.g. *He was Richard Nixoned*), many verbs still form the passive participle in *-en* (*written*), by vocalic ablaut (*sung*, *held*), or by a combination of ablaut and consonantal increments (*bought*, *sold*). In the lexical structure theory of Lieber (1980), allomorphs (unpredictable variants of some morpheme) must be listed in the lexicon;²³ the regular *-ed* affix attaches only to those verb stems which do not already have a listed passive participle allomorph. Thus, our lexicon will contain (partial) entries like those in (32):

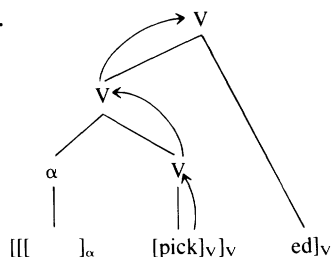
- ²³ See Lieber (1980) for justification of this proposal.

These fragments of lexical entries can be interpreted in the following way. Verbs like *write* and *hold* have lexical entries containing, among other things, an argument structure. For the purposes of this article, the exact manner of representing this structure is not crucial. In (32) I have merely indicated that *write* has an Agent, a Theme, and optionally a Goal, and that the Agent corresponds to the external argument, i.e. the subject; *hold* has an Agent and a Theme, the Agent being the subject. Each of these verbs also has as part of its lexical entry a listing of its unpredictable passive participle (*written*, *held*); and each of these in turn has its own argument structure (discussed immediately below). The regular participle affix *-ed* has its own entry indicating that it attaches to a verb stem to form a participle, e.g. [[admire] ed], and that this affix has its own argument structure as well.

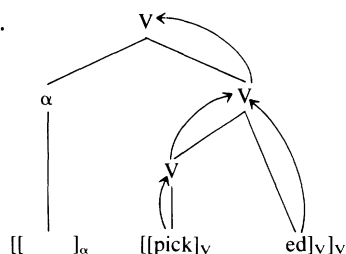
The argument structures for *-ed*, for *written* and *held*, and in fact for all other listed passive participle allomorphs will be identical. Again, the exact manner of stating this argument structure is not crucial here. (32) represents one formalism, which draws upon the work of Williams (1980), Marantz (1981), and others on the passive construction. Essentially, the argument structure of the passive participle is viewed here as an operation on the argument structure of the verb stem to which the participle is related; this operation removes the original external argument (most often the Agent) and makes the internal argument the new external argument. This captures the standard observations about the relationship between active and passive sentences, namely, that the object of the active becomes the subject of the passive and that the subject of the active is no longer an obligatory argument of the passive.

Given these preliminaries, we can now examine the structures which our lexical structure framework makes available for synthetic compounds on passive participles. For passive participles which are formed with the regular *-ed* affix, two structures are possible:

(33) a.



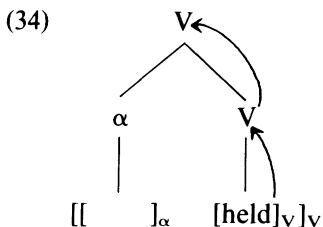
b.



In (33a), the *-ed* affix attaches to the verbal compound formed from some stem α and a verb (*pick* is chosen arbitrarily here; I assume that its argument structure is something like (Agent, Theme)). The verb stem *pick* supplies its category and features, including its argument structure, to the first branching node. This argument structure then percolates to the next V node, to be operated on by the argument structure supplied by *-ed*. The result is that the internal argument of *pick* (its Theme) becomes its external argument. Since this argument structure is now a property of the highest V node, it must in any case be satisfied outside the compound. The stem α therefore remains free in (33a), predicting that α can be any stem that can be interpreted as a semantic argument of *picked*, e.g. a Locative, Manner, Agentive, etc. The following compounds are predicted to be acceptable: *home-picked* (α is Locative), *quick-picked* (α is Manner), *existentialist-picked* (α is Agentive). Predicted to be unacceptable are compounds like **ballad-picked*, where *ballad* is not easily interpretable as a Locative, Manner, Instrument, etc.; **wade-picked*, where the verb stem *wade* is also not interpretable as a semantic argument; and so on. It is predicted that the stem α will never be interpreted as object of the verb *pick*, since the participle *picked* does not have an object argument. Thus, a compound like *strawberry-picked* can have only the rather odd interpretation 'picked by strawberries'; it can never be interpreted as being analogous to *strawberry-picking*.

In (33b), first the *-ed* affix attaches to the verb stem, and then the participle compounds with the stem α . The argument structure of *pick* again percolates to the first branching V node, to be operated on by the argument structure of the *-ed* participial affix. As in (33a), the result is that *pick*'s internal argument becomes its external argument. This modified argument structure then percolates to the highest branching V node, along with all of the other features of the participle *picked*. Since the argument structure now belongs to the highest V node, it must be satisfied outside the compound. α is again free in the compound and therefore must be interpretable as a semantic argument. That is, structure (33b) actually yields exactly the same prediction as (33a): synthetic compounds with this structure should be possible only if α can be interpreted as a Locative, Instrumental, Manner, Agentive, etc., argument. α cannot be interpreted as the internal argument of *pick*.

Unpredictable allomorphs of passive participles, for example *written* and *held*, do not have any internal structure. Therefore, when they occur in compounds they will always have the structure shown in (34):

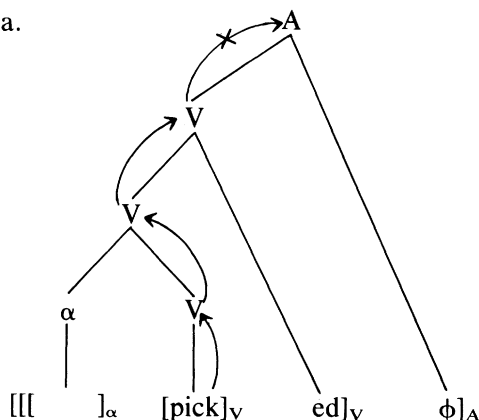


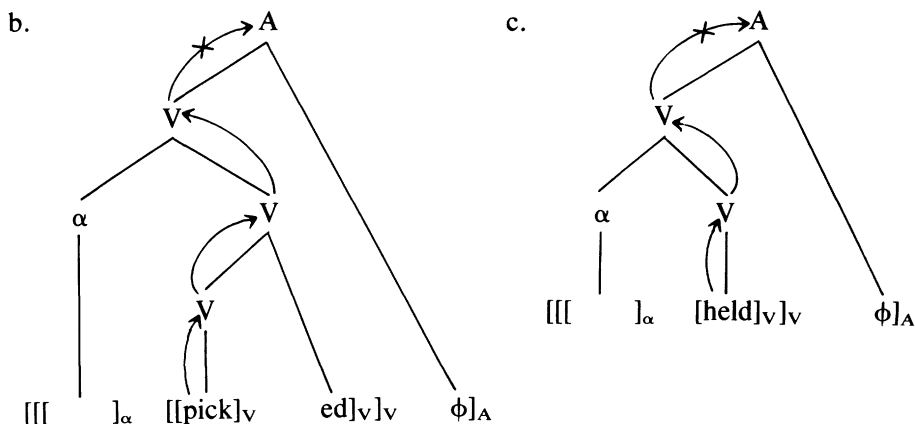
A participle like *held* will be inserted as is into a lexical tree with another stem. Its

argument structure, which is identical to that of the *-ed* affix, is assumed to have operated on the argument structure of *hold*, yielding an output in which the Theme has again become the external argument. It is this modified argument structure that is passed on to the highest V node to be satisfied outside the compound. Again, α is free in these compounds and therefore must be interpretable as a semantic argument. Compounds like *hand-held*, *firmly-held*, *French-held*, and *town-held* are predicted to be possible, and compounds like **green-held*, **ballad-held*, and **wade-held* to be absolutely unacceptable or at least extremely bizarre (for example, *ballad-held* could only mean 'held by ballads').

One more comment must be made here about synthetic compounds containing passive participles. Like forms in *-ing*, passive participles can function as adjectives as well as verbs; passive participles, as has been noted frequently in recent literature (e.g. Freidin (1975), Lieber (1979), Bresnan (1980)), can occur preminally (*an annoyed glance*), with *un-* as prefix (*uninhabited*), and as complements to verbs like *seem*, *appear*, and *become* (*Fritz appears annoyed*). It might be thought that we would need to postulate two *-ed* affixes for the passive participle, one forming verbs and the other adjectives, just as we postulated three *-ing* affixes. However, Lieber (1980) argues that such an analysis would be costly: in addition to postulating two *-ed* affixes for regularly formed participles, we would have to list each irregular allomorph twice, once as an adjective and once as a verb. Such a system, cumbersome to begin with, has another disadvantage: it counts as accidental the fact that, for any given verb, the allomorph listed as a verb and the one listed as an adjective are always identical (that is, it does not explain why *write* has the form *written* as both its adjectival participle and its verbal participle). Rather than accepting two *-ed* affixes and two listings for each irregular allomorph, Lieber (1980) proposes that the adjectival participle be derived from the verbal by a process of ϕ -affixation. The identity of adjectival and verbal passive participles is thereby ensured. Like any other verbal passive participle, those in synthetic compounds will be able to become adjectives. However, this operation does not at all alter the predicted possibilities for synthetic compounds in this class:

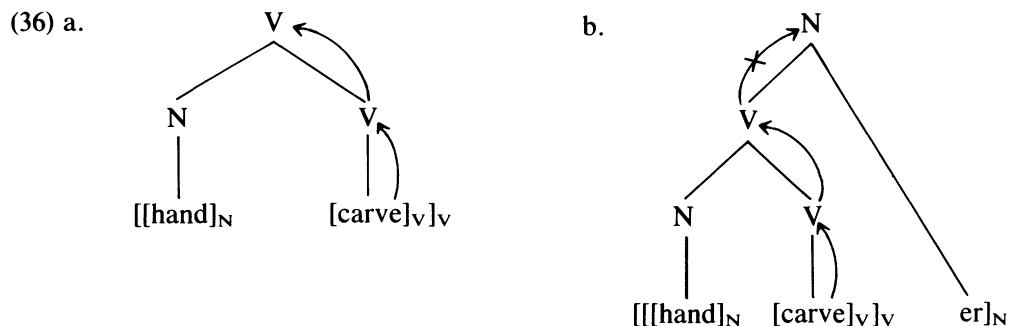
(35) a.

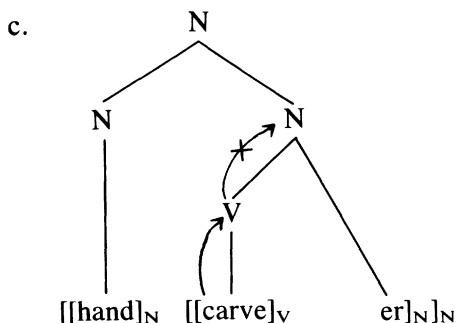




The only difference between these structures and (33a,b)/(34) is that the highest node is now in each case dominated by A. The argument structures of the highest V nodes cannot percolate to the A node and therefore, unlike the ones discussed in (33) and (34), must be satisfied within the compound. But these argument structures, by virtue of being argument structures of passive participles, will lack internal arguments. The stem in the position of α will therefore still be free, and the predicted adjectival passive participle compounds will be identical to the verbal ones. That is, the analysis predicts that compounds like *hand-picked*, *quick-picked*, *existentialist-picked*, *tweezer-picked*, *hand-held*, *French-held*, *town-held*, etc., will be potential compounds as both verbs and adjectives, whereas compounds like **ballad-picked*, **strawberry-picked*, **wade-held*, etc., will be impossible as both verbs and adjectives.

4.1.4. Further Predictions. Before I contrast it with the analysis of RS (1978), I would like to point out several other predictions that my account makes. First, it predicts that compounds like *hand-carve* and *hand-carver* will be interpreted in a rather different way. The internal structures of these compounds are illustrated in (36):



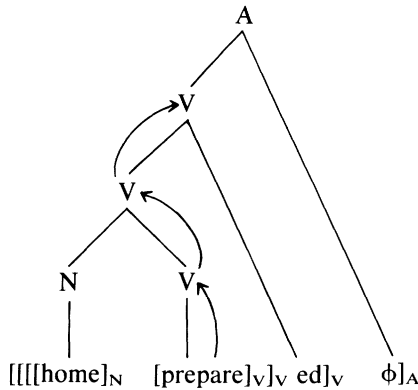


In (36a), the only structure available for the compound *hand-carve*, we can see that the verb stem *carve* supplies its argument structure to the compound as a whole and therefore normally satisfies its argument outside the compound. The noun stem *hand* is free in (36a) and acts as a semantic argument of *carve*, in this case a Manner or Instrumental argument. Thus, *hand-carve* is predicted to have only a single interpretation for most speakers: 'to carve by hand'. Given the arguments in section 4.1.1, we know that two structures are available for agentive *-er* compounds, namely, (36b) and (36c). In (36b), the argument structure of *carve* percolates as far as the branching V node. Since this is not the uppermost node in the tree, *carve* cannot satisfy its argument structure outside the compound, but rather must find its argument inside. *Hand* is therefore incorporated as the internal argument of *carve*, giving the interpretation 'one who carves hands'. (36c) is also a possible structure for *hand-carver*; here the argument structure of *carve* does not need to be fulfilled, since according to principle (8) it is not in the relevant structural configuration. The compound *hand-carver* in this structure will be interpreted as any other N N primary compound might be. For example, it might mean 'carver who has a hand' or 'carver who wears a hand', under admittedly farfetched circumstances. What is significant is that neither structure (36b) nor structure (36c) allows the compound *hand-carver* to be interpreted in the same way as *hand-carve*, with *hand* as an Instrumental or Manner argument. I believe that this prediction does in fact conform fairly well to intuitions about possible meanings for these compounds.

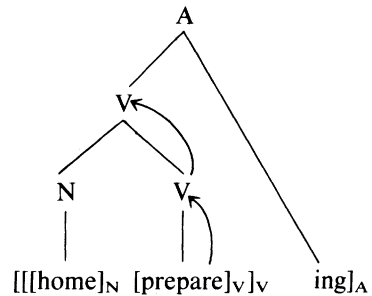
Similarly, the present analysis predicts different sorts of interpretations for compounds like *home-prepared* and *home-preparing* (as adjectives):²⁴

²⁴ Actually, it predicts a number of possible interpretations for the adjective *home-preparing*, depending upon the particular structure that the compound exhibits (section 4.1.2). Here I have chosen to illustrate the contrast between *home-prepared* and *home-preparing* using the most readily available interpretation for *home-preparing*, the one predicted by structure (29b), i.e. 'preparing homes'.

(37) a.



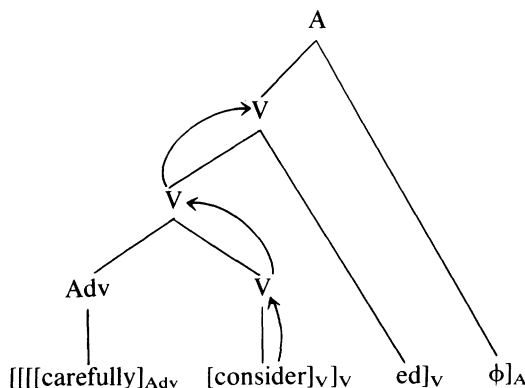
b.



In (37a), the argument structure of *prepare* percolates as far as the highest V node, where it is operated on by the argument structure of the participial *-ed*; this changes the internal argument of *prepare* (its Theme) into its external argument. Since the highest V node is not uppermost in this tree, the argument structure of *prepared* must be satisfied inside the compound. However, *prepared*, not having an internal argument, leaves *home* unlinked, i.e. free, and *home* is then interpreted as a semantic argument. This predicts the meaning 'prepared at home', with *home* as a Locative. In (37b), the argument structure of *prepare* percolates only as far as the branching V node. Since this is not the highest node in the tree, *prepare* must seek its argument inside the compound. The result here is that *home* satisfies the internal argument of *prepare*. It is predicted that a *home-preparing service* can only be a service that prepares homes, and not one that prepares (something else) at home. Again, intuition about possible meanings for these compounds seems to coincide with the predictions.

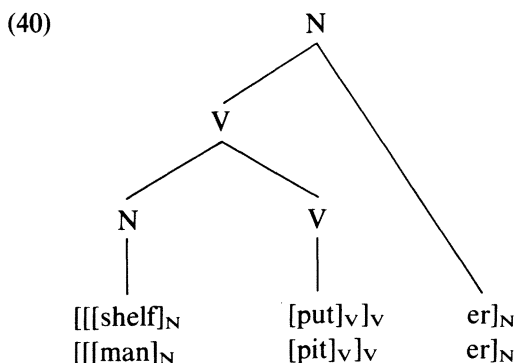
The present analysis also predicts the difference in acceptability that we perceive between the synthetic compounds *carefully-considered* (a *carefully-considered offer*) and **carefully-considering* (*a *carefully-considering offer*). Again, the prediction derives from differences in the percolation of argument structures within these compounds:

(38) a.



this argument outside the compound. *Fresh* is therefore free. However, it is not easily interpreted as a semantic argument of *smell*—that is, *fresh* does not lend itself to being interpreted as a Manner, Locative, Agentive, etc., argument. The result is that **fresh-smell* is predicted to be an unacceptable primary compound. The synthetic compound *fresh-smelling* is a different case. Given (39b), which is one of the possible structures for this compound, the argument structure of *smell* percolates as far as the branching V node. Here, since this node is not uppermost in the tree, *smell* must satisfy its internal argument inside the compound. *Fresh* can therefore be incorporated as an internal adjective argument of *smell*. This compound is therefore predicted to be possible. This difference in acceptability stems from the simple fact that *fresh* is free in the primary compound *fresh-smell* but is not free in the synthetic compound *fresh-smelling*.

Finally, the present analysis accounts for the following observation made by RS (1978): synthetic compounds such as **shelf-putter* and **man-pitter* are not possible. Consider the structure in (40):



Since verbs like *put* and *pit* do not pass their argument structures on to the highest node, these argument structures must be satisfied within the compound. But since both *put* and *pit* require more than one internal argument (*Put the book on the shelf*, *Pit the men against the bears*), their argument structures will never be fulfilled. Such compounds are therefore predicted to be unacceptable.

4.2. Comparison with RS (1978)

From the examples given in sections 3 and 4.1, we can see that the present analysis makes a wide range of predictions about both primary and synthetic compounds, predictions that seem largely to be borne out by the data. Here I will briefly compare this analysis to that of Roeper and Siegel (1978),²⁵ which is the most thorough treatment of

²⁵ Also see Allen (1978) and Botha (1980) for critiques of Roeper and Siegel (1978).

synthetic compounds in generative literature to date, and show that the former is superior both in terms of simplicity and in the range of predictions it makes available.

As mentioned at the beginning of section 4, the basic observation around which RS build their analysis is that the first stem in a synthetic compound often seems to correspond to the constituent which could occur in a sentence immediately after the verb from which the second stem in the compound is derived. This observation is embodied in what RS call the *First Sister Principle* (1978, 208), repeated here as (41):

(41) *First Sister (FS) Principle*

All verbal compounds are formed by incorporation of a word in first sister position of the verb.

RS then propose the following mechanisms to produce synthetic compounds that conform to the FS Principle. First, their account requires three word formation rules which attach the affixes *-er*, *-ing*, and *-ed* to a verb stem and at the same time add an empty stem position before the verb (p. 210):

(42) *Affixation Rules*

- a. [verb] W $\Rightarrow$ [[empty] + verb + er]_N W
 b. [verb] W $\Rightarrow$ [[empty] + verb + ing] _{$\left\{ \begin{smallmatrix} N \\ Adj \end{smallmatrix} \right\}$} W
 c. [verb] W $\Rightarrow$ [[empty] + verb + ed]_{Adj} W

In addition to (42c), which affixes the participial *-ed* and creates an empty preverbal stem position, RS's analysis has need of another morphological rule which eliminates the internal argument of a verb when it becomes a passive participle (p. 210):

$$(43) \text{ verb + ed [NP] } \left\{ \begin{array}{l} [\text{Adj}] \\ [\text{NP}] \end{array} \right\} Y \Rightarrow \text{ verb + ed } Y$$

1 2 3 4 1 ϕ ϕ 4

where Y and W range over subcategorization frames²⁶

Finally, RS state a compound rule which operates on the outputs of (42)–(43) (p. 209):

(44) *Compound Rule*

[[empty] + verb + affix] [_{X+N} + word] W $\Rightarrow$

$$\begin{array}{ccccccccc} 1 & & 2 & & 3 & & & 4 & 5 \\ [[+ \text{ word}] + \text{ verb} + \text{ affix}] & & & & & & & & W \\ & & 4 & & 2 & & 3 & \phi & 5 \end{array}$$

where W ranges over subcategorization frames and X_{+N} stands for lexical categories N, A, Adv

²⁶ RS (1978) use the term *subcategorization frame* in a sense different from mine. RS's subcategorization frames are comparable to what I have been calling *argument structures*—that is, they indicate the NPs, As, and PPs with which a verb must (or can) be associated in order to form a grammatical sentence.

(44) is what RS call a *lexical transformation*; it takes a word in an immediately postverbal subcategorization frame and moves it into the empty preverbal position. The fact that this rule only moves an item from the first postverbal subcategorization frame ensures that the FS Principle will be maintained.

A typical derivation would proceed as follows. In the lexicon, a verb like *drive* will have a subcategorization frame requiring a noun object immediately following the verb: *drive*, ____ [N]. Rule (42a) can apply to this lexical entry to give [[empty] *drive* + er]_N [N]. The Compound Rule (44) then moves the postverbal noun into the preverbal empty slot: [[N] *drive* + er]_N ϕ . *Truckdriver* could result, but never **green-driver*, since an adjective could not be incorporated into the preverbal position.

In many cases (but not all; see below), RS's analysis yields predictions similar to those that can be derived from mine; both claim that *truckdriver* can mean 'one who drives trucks' but that *green-driver* cannot mean 'one who drives green', and both predict *often-heard* as a possible synthetic compound, but not **often-hearer* and **often-hearing*. However, to arrive at these predictions, RS's analysis requires a great deal more theoretical machinery than mine. The analysis that I am proposing contains one lexical entry for each affix which can be involved in synthetic compounds; a single lexical entry for *-er*, for example, allows both a derived word like *driver* or *carver* and the synthetic compounds discussed earlier. RS's analysis needs the three affixation rules in (42) to obtain the structures on which Compound Rule (44) operates to give synthetic compounds like *truckdriver*, *fresh-smelling*, and *hand-carved*. It also needs three more affixation rules to give the derived forms *driver*, *smelling*, and *carved*. That is, forms like these require a new set of word formation rules which simply add an affix without also adding an empty preverbal frame.

Of the two analyses, Roeper and Siegel's also makes use of the more powerful machinery, since it requires a lexical transformation, that is, a rule which can move or delete part of a lexical entry. In principle, if such a rule is allowed in the lexicon, many other sorts of lexical transformations might also be sanctioned (for example, rules which take Locative arguments and make them objects, or rules which delete obligatory object arguments entirely). Apparently rules of this sort are never needed. Thus, the availability of transformational rules within RS's lexicon results in a less restrictive theory of word formation than we might hope for. In contrast, the analysis presented above accounts for the relevant data without lexical transformations, and in fact without the addition of any extra rules to the lexicon. The principles of lexical structure are independently needed for all types of derivation and compounding, and some sort of argument-linking principle such as (8) is also required within most syntactic frameworks. No special lexical rule, transformational or otherwise, is needed to rule out impossible compounds.

Another point might be made here about the mechanics of RS's analysis. In order to produce compounds like *well-written* or *hand-carved*, RS must postulate the following outputs of affixation rule (42c) and the subcategorization adjustment rule (43):

- (45) a. [[empty] written] [well]_{Adv}
- b. [[empty] carved] (by) [hand]_N

The preposition *by* is deleted during the course of compound formation when rule (44) inserts *well* and *hand* into the empty preverbal position. Although such derivations give the proper results, they rely on the assumption that adverbs, Agentives, Locatives, and other sorts of nonobligatory semantic arguments should be represented in the lexical entry of a verb. However, most current theories of syntax (e.g. Marantz (1981), Chomsky (1981)) allow only obligatory arguments to be represented in lexical argument structures (what RS call subcategorization frames). Thus, the verbs *write* and *carve* would both have an obligatory object; this object argument would not be represented for their passive participles, although theories vary as to how this is accomplished. Neither verb's lexical entry would state that it could take an adverb, Agentive, Locative, or other optional argument. RS must therefore postulate more detailed lexical argument structures than are necessary for the current purposes of syntax. The analysis that I propose requires no such complication in argument structures.

The present account is therefore preferable to RS's on the grounds of simplicity. I have already pointed out a number of instances in which it makes predictions that RS's cannot. First, since RS are almost entirely concerned with synthetic compounds, they fail to observe that primary compounds adhere to exactly the same constraints that synthetic compounds do: we have seen that in both cases argument-taking stems must be able to satisfy their arguments. Thus, **put-shelf* is ruled out within the present framework on the same grounds as **shelf-putter*. RS's FS Principle, being specifically designed for synthetic compounds, can explain the unacceptability of the latter but not the former. RS's analysis can explain why a compound like *green-driver* cannot have the interpretation 'one who drives green', but it cannot predict the availability of a primary compound interpretation such as 'driver who wears green'; the analysis I have given predicts the latter interpretation to be possible because of the different internal structures possible for forms in *-er*. Finally, the present analysis explains why synthetic compounds like *fresh-smelling* and *ballad-singing* are acceptable and easily coined, whereas the corresponding primary compounds **fresh-smell* and **ballad-sing* are worse for most English speakers: again, Argument-linking Principle (8), together with our principles of lexical structure, tells us that the argument structures of *smell* and *sing* can be satisfied in the former compounds but not usually in the latter. RS's analysis cannot explain this contrast.

We have also seen (section 4.1.2) that the present account makes some rather subtle predictions about the relative acceptability of *-ing* synthetic compounds that function as progressive verbs, as opposed to those that function as nouns and adjectives: *quick-considering* was better as a verb, *proposal-considering* better as a noun or adjective. RS's system predicts otherwise. Since *consider* has an obligatory object argument, it would always have to have a noun as its first sister. The compound formation machinery made available by RS's analysis could therefore produce *proposal-considering* by incorporating the first sister noun into the preverbal position. On the other hand, *consider* will never have the adjective *quick* available as a first sister, and *quick-considering* will

therefore never be generated. RS's system offers no way of predicting when a given verb in a synthetic compound will be able to incorporate a stem other than its first sister.

RS (1978) partially capture the basic insight on which the present analysis is based. The FS Principle is intended to express the generalization that in some way the first stems possible when a verb occurs in a synthetic compound are linked to the syntactic patterns exhibited by that verb. The generalization runs much deeper than their analysis suggests, however. Both the syntactic patterns and potential compounds, primary and synthetic, are governed by a general and pervasive principle of argument linking, which is itself neither purely syntactic nor purely lexical. Whether a verb can satisfy its argument structure is a function not only of the particular syntactic structure in which it finds itself, but also of the particular lexical structure in which it occurs. Only by looking at argument linking within this broader context do we succeed in simplifying the lexicon and explaining the rich variety of compounds found in English.

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