10

The Passive Construction

10.1 Introduction

Perhaps the most extensively discussed syntactic phenomenon in generative grammar is the English passive construction. The active/passive alternation provided one of the most intuitive motivations for early transformational grammar, and it has played a role in the development of almost all subsequent theories of grammar.

In this chapter, we present an account of the English passive using the formal mechanisms we have developed in this text. Given the strongly lexical orientation of our theory, it should come as no surprise that we treat the active/passive relationship primarily as a relationship between two verb forms, and we use a lexical rule to capture the generality of that relationship.

We begin with some data to exemplify the phenomenon in question. We then formulate our rule and explain how it works. Finally, we turn to the question of the status of the forms of the verb *be* that characteristically occur in passive sentences.

10.2 Basic Data

Consider sets of sentences (and nonsentences) like the following:

(1) a. The dog bit the cat.
  b. The cat was bitten (by the dog).
  c. *The cat was bitten the mouse (by the dog).

(2) a. Pat handed Chris a note.
  b. Chris was handed a note (by Pat).
  c. *Chris was handed Sandy a note (by Pat).

(3) a. TV puts ideas in children's heads.
  b. Ideas are put in children's heads (by TV).
  c. *Ideas are put notions in children's heads (by TV).

The (b)-sentences in (1)–(3) are what are standardly called 'passive'; the (a)-sentences are referred to as their 'active' counterparts. There is clearly a close semantic relationship between active and passive pairs. In particular, the semantic roles of the arguments are the same – in (1), the dog is the biter, and the cat is the one being bitten. To put it informally, in an active sentence and its passive counterpart, 'who does what to whom' is the same. The crucial difference between active and passive sentences is that the subject of the passive corresponds to the object of the active. The participant denoted by the subject of the active, if expressed at all in the passive, is referred to by the object of the preposition *by*. Consequently, the verb in a passive sentence always has one fewer object (that is, NP complement) than the verb in its active counterpart. This is illustrated in the (c)-sentences of (1)-(3). It follows that sentences with intransitive verbs, like (4a), normally do not have passive counterparts, as in (4b).

(4) a. The patient died.
 b. *The patient was died (by the doctor).
 c. *The doctor died the patient.

Moreover, aside from this one difference, active sentences and their corresponding passives have identical valence requirements. This is illustrated in (5), where the absence of an obligatory complement renders both the active and passive sentences ungrammatical.

(5) a. *Pat handed Chris.
 b. *Chris was handed (by Pat).
 c. *TV puts ideas.
 d. *Ideas are put (by TV).

It would not be hard to formulate lexical entries for passive forms of verbs. To capture the generalizations stated informally above, however, we need to formulate a rule that can relate actives and passives. As was the case with the rules discussed in Chapter 8, our passive rule is motivated by more than just parsimony. Faced with novel transitive verbs – either new coinages like *email* or rare words like *cark* – English speakers can (and often do) immediately use them correctly in passive sentences. Hence a rule-governed treatment of the active/passive alternation will be psychologically more realistic than a mere listing of the passive forms for all transitive verbs.

Intuitively, then, we want a rule that does the following:

- turns the first NP complement into the subject;
- allows the subject either to turn into the object of a PP headed by *by* or to be omitted altogether;
- leaves the valence features otherwise unchanged;
- leaves the semantics unchanged; and
- makes the appropriate morphological change in the form of the verb.

This last item is one we have not mentioned until this point. A moment's reflection should reveal that the morphology of the passive form of a verb (or 'passive participle', as it is commonly called) is always identical to that of the past participle; this is especially clear if we consider verbs with exceptional past participles, such as *do* (*done*), *sink* (*sunk*) and *cut* (*cut*). This generalization is captured easily in our framework by invoking the same morphological function, F_{PSP}, for both the Past Participle Lexical Rule and the Passive Lexical Rule.

The following is a lexical rule that satisfies these desiderata:

(6) Passive Lexical Rule

$$\left\langle \boxed{1}\,,\ \begin{bmatrix} \textit{tv-lxm} & \\ \text{ARG-ST} & \langle \text{NP}_i \rangle \oplus \boxed{a} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \text{F}_{PSP}(\boxed{1})\,,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{pass}\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \boxed{a} \oplus \left\langle \left(\text{PP}\begin{bmatrix}\text{FORM} & \text{by}\\ \text{P-OBJ} & \text{NP}_i\end{bmatrix}\right)\right\rangle \end{bmatrix}\right\rangle$$

There are several points of explanation that need to be made here.

First, notice that most of the effects of the rule (which applies to any lexeme belonging to a subtype of *tv-lxm*) are in the ARG-ST. At a coarse level of description, what the rule does is rearrange the elements of the ARG-ST list. Because of the Argument Realization Principle (Chapter 7), these rearrangements also affect the values of the valence features. Specifically, (6) eliminates the first element of the input's ARG-ST list, moves up the other elements, and introduces an optional PP at the end of the new list. More precisely, the second element (corresponding to the direct object) of the input becomes the first element (corresponding to the subject) of the output; whatever follows the second element in the input also moves up in the list. Also, an optional 'PP[FORM by]' is added to the end of the list, to indicate that the PP must be headed by the preposition *by*. We will abbreviate ‘PP[FORM by]’ as ‘PP[by]’ (and similarly with other values of FORM). We will return to the question of what this means formally, and discuss closely related matters in the next chapter.

Second, recall that subscripts indicate values of the feature INDEX; so (6) says that the optional PP[by] in the rule output has a P-OBJ value that is coindexed with the subject of the lexical rule input. This means that whatever semantic role the verbal lexeme assigns to its subject will be assigned to the P-OBJ value of the PP[by] of the passive word, and hence to the prepositional object within the PP[by] (see below). Likewise, since the verbal lexeme's object – the first element in the list $\boxed{a}$ – is identified with the subject of the passive word, it follows that the index of the subject of the passive word is the same as that of the verbal lexeme's direct object. Therefore, since the semantics remains unchanged by this lexical rule (in virtue of not being mentioned), the semantic role of the active object will be the same as that of the passive subject. The overall result of this rule, then, is to shift the role assignments from subject to PP[by] and from object to subject.

Third, note that the passive rule does not mention case at all. Verbal lexemes do not specify CASE values for any of their arguments (in English); hence, though the lexeme's object NP becomes its subject, there is no need to ‘unassign’ an accusative case specification. All non-subject arguments of verbs must be accusative, but the constraint that guarantees this (namely, the Case Constraint – see Chapter 8, section 8.2) applies to lexical trees (word structures), not to lexemes. (See the definition of lexical satisfaction in Chapter 9, section 9.2.4.) Nor does the passive rule assign nominative case to the first argument of the rule output, as one might expect on the basis of examples like (7).

(7) a. He was arrested by the police.
b. *Him was arrested by the police.

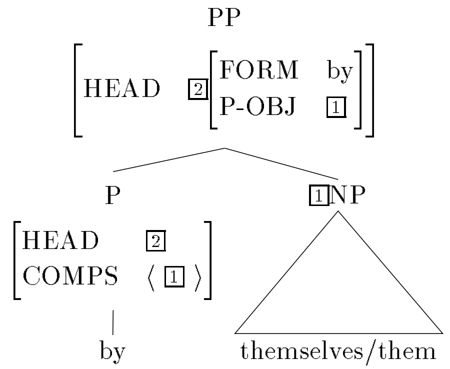
The nominative case of the subject in examples like (7) is determined by the auxiliary verb *was*, whose SPR value is unified with that of the passive VP, as discussed in the next section. There are in fact instances of passive verbs whose subjects are not nominative, as in (8).

(8) $\left\{\begin{array}{l}\text{Him}\\ \text{His}\\ \text{*He}\end{array}\right\}$ being arrested by the police upset many people.

Our passive rule achieves the desired effect in such instances by leaving the subject of the passive word unspecified for CASE. Hence, whatever case requirements the particular grammatical context imposes will determine the CASE value of a passive verb's subject.[1]

Fourth, the rule says that passive verbs are [FORM pass]. The justification for having a separate value ‘pass’ for the FORM of passive verbs has not yet been provided; this will be addressed in the next section.

Returning to the use of the FORM feature on the PP in (6), recall that FORM has so far been used primarily for distinguishing among verb forms. But in the Agent Nominalization Lexical Rule presented in Chapter 8, we already made use of the FORM feature on PPs: a PP specified as [FORM of] was meant to be one that could only be headed by the preposition *of*. In fact, we want to emply the feature FORM more generally, to mark the choice of preposition in other contexts as well. Since the set of prepositions in English is a relatively small, closed set, we might (in the limiting case) have a separate value of FORM for each preposition. Having FORM values for prepositions allows us, for example, to represent the fact that the verb *rely* requires a PP complement headed by either *on* or *upon*. The FORM value of the lexical preposition will be shared by the entire PP (since FORM is a HEAD feature and hence is governed by the Head Feature Principle), and it will therefore allow for *by*-phrases of the sort sketched in (9).

(9)


Crucially, we assume *by* is an argument-marking preposition that bears an NP category as its P-OBJ value. Thus whatever index the passive participle assigns to the P-OBJ value of its PP[by] complement will be identified with the index of the NP object within that PP, along with all the other information identified as $\boxed{1}$ in (9).

The effect of the Passive Lexical Rule, then, is to map lexical entries like (10) into word entries like (11).

[1] Verbal gerunds like *being* in (8), for example, might lexically specify the case of their subject (which is identified with the subject of the passive participle in (8)).

(10)
$$\left\langle \text{love}\ , \begin{bmatrix} \textit{stv-lxm} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \textit{verb}\\ \text{SPR} & \langle [\ ] \rangle\end{bmatrix} \\ \text{ARG-ST} & \langle\ \text{NP}_i\ , \text{NP}_j\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{love}\\ \text{SIT} & s \\ \text{LOVER} & i \\ \text{LOVED} & j\end{bmatrix}\right\rangle \end{bmatrix}\end{bmatrix}\right\rangle$$

(11)
$$\left\langle \text{loved}\ , \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{FORM} & \text{pass}\end{bmatrix}\\ \text{SPR} & \langle [\ ] \rangle\end{bmatrix} \\ \text{ARG-ST} & \left\langle \text{NP}_j \left(, \begin{matrix}\text{PP[by]}\\ \begin{bmatrix}\text{P-OBJ} & \text{NP}_i\end{bmatrix}\end{matrix}\right)\right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{love}\\ \text{SIT} & s \\ \text{LOVER} & i \\ \text{LOVED} & j\end{bmatrix}\right\rangle \end{bmatrix}\end{bmatrix}\right\rangle$$

Note that in both (10) and (11), the element on the SPR list is not identified with any member of the ARG-ST list. But in any word structure that satisfies a lexical entry like (11), the element on the SPR list must be identified with the first ARG-ST member, courtesy of the ARP.

10.3 The Verb *Be* in Passive Sentences

What about the forms of *be*, which in all our examples (so far) immediately precede the passive participle? The first thing to observe is that passive participles can also occur in environments that lack any form of *be*. Some examples are given in (12).

(12) a. The cat got bitten (by the dog).
  b. Liked by many people but respected by few, Jean will have to run an aggressive reelection campaign.
  c. Anyone handed a note will be watched closely.

Hence, though some form of *be* is typical in passive sentences, it would have been a mistake to try to build it into the rule introducing the passive form of verbs. Rather, we need to provide an analysis of the relevant lexical entry for *be* that links its occurrence to the presence of a passive participle.[2]

More precisely, our analysis needs to say that the passive *be* takes a VP[FORM pass] argument – that is, its ARG-ST list contains a VP[FORM pass]. A few points are worth noting here. First, this is the first time we have considered VP arguments/complements in detail, though our Head-Complement Rule permits them. We will see many more soon. Second, since FORM is a HEAD feature, a verb's FORM value will show up on its mother VP node. This allows us to say that this *be* must have a passive complement.

The trickiest and most important aspect of our analysis of *be* in passives is how we deal with the subject (i.e. with the value of SPR). In a sentence like (1b), the agreement indicates that *the cat* should be treated as the subject (that is, the SPR) of *was*; note the unacceptability of **The cat were bitten.* But in our discussion of passive participles in the previous section, *the cat* was treated as the subject of *bitten.* This was necessary for semantic reasons (i.e. to ensure that the cat functions semantically as the thing bitten, rather than as the biter), and to capture the correspondence between the valence values of the active and passive forms. It seems we need to treat *the cat* as the subject of both *was* and *bitten.* The data about the case marking on the subjects of passive verbs, illustrated in (7)-(8), point to the same conclusion: The finite forms of *be* (e.g. *was*) are the only forms of *be* that allow a nominative case subject – an instantiation of the more general fact that all finite verb forms take nominative case subjects.

To represent the fact that *be* and its passive VP complement share the same subject, we use the familiar device of tagging, specifying that two SPR values are identical. We can now formulate the lexical entry for the passive *be* as follows:

[2] We'll return to the issue of whether we can analyze other uses of *be* in terms of this same lexical entry.

(13)
$$\left\langle \text{be}\ , \begin{bmatrix} \textit{be-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{1}\ , \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{pass} \end{bmatrix} \\ \text{SPR} & \langle\ \boxed{1}\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{3} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{3} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

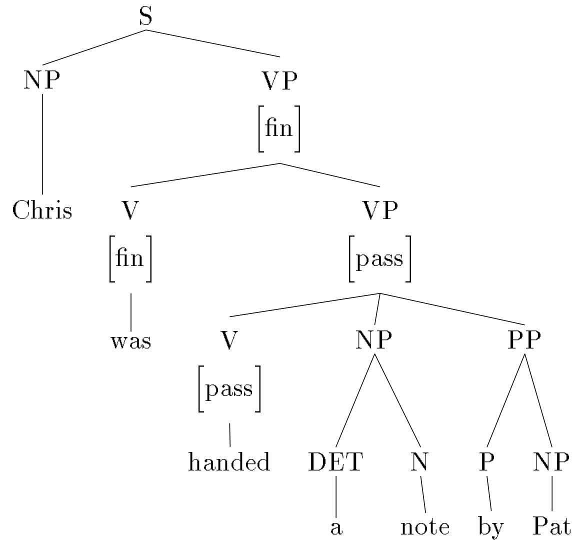
What this entry says is that *be* belongs to a new type *be-lxm* (a subtype of *verb-lxm* whose properties do not yet concern us) and takes a VP argument headed by a passive participle. In addition, the subject of the sentence serves as subject for both this form of *be* and for its passive argument. And because *be* adds nothing to the meaning except the information that the complement's INDEX value is the same as that of *be* (which ensures that that index is also the INDEX value of the VP *be* heads), (13) also guarantees that the semantics of the verb phrase headed by *be* is identical to the semantics of *be*'s VP complement.

We will see in the next two chapters that the idea of having a verb and its argument share a subject is extremely useful in describing a number of phenomena. In Chapter 13, we will see in addition how using lexical types can simplify lexical entries such as these.

10.4 An Example

We conclude this chapter with a detailed analysis of example (2b). The phrasal SD we need to license is the following:

(14)



And the entry for *was* is:

(15)
$$\left\langle \text{was}\ , \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ [\ ]\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}\begin{bmatrix} \text{AGR} & \textit{3sing} \\ \text{CASE} & \text{nom} \end{bmatrix}, \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{pass} \end{bmatrix} \\ \text{SPR} & \langle\ \boxed{1}\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{3} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{3} \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{t-precede} \\ \text{ARG1} & \boxed{3} \\ \text{ARG2} & \text{now} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

This is the same as (13), except that it is finite (i.e. [FORM fin]), has past tense semantics, and requires a third-person singular subject.[3] Note that the subject is identical to the complement's subject (as was the case in (13)) and that the verb's SPR value remains underspecified. However, the lexical entry in (15) gives rise to the lexical SD shown in (16), where the SPR and and ARG-ST lists share a member and the VP[pass] is included in the COMPS specification, both courtesy of the ARP.

(16)
$$\left[\begin{array}{ll} \textit{word} & \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\text{FORM} \;\; \text{fin}\right] \\ \text{SPR} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{2} \rangle \end{array}\right] \\ \text{ARG-ST} & \left\langle \boxed{1}\left[\text{AGR} \;\; \textit{3sing}\right], \boxed{2}\left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{ll} \textit{verb} & \\ \text{FORM} & \text{pass}\end{array}\right] \\ \text{SPR} \; \langle \boxed{1} \rangle & \\ \text{INDEX} \; \boxed{3} & \end{array}\right]\right\rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{INDEX} & \boxed{3} \\ \text{RESTR} & \left\langle \left[\begin{array}{ll} \text{RELN} & \text{t-precede} \\ \text{ARG1} & \boxed{3} \\ \text{ARG2} & \text{now}\end{array}\right]\right\rangle \end{array}\right] \end{array}\right]$$

was

So now let us consider the SD of the VP[pass], whose head is the passive participle *handed*. The basic lexical entry for *hand* is something like the following:

[3] The first-person singular pronoun *I* also occurs with *was*, as in *I was handed a note*. We are assuming here that *was* has distinct entries for its uses with first-person and third-person subjects. Alternatively, the entry could be elaborated to have a disjunction in the AGR value of the first element of the ARG-ST. See Chapter 8, footnote 18 for a discussion of this.

(17)
$$\left\langle \text{hand}\;, \left[\begin{array}{ll} \textit{dtv-lxm} & \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \textit{verb} \\ \text{SPR} \; \langle\, [\;] \,\rangle & \end{array}\right] \\ \text{ARG-ST} & \langle\, \text{NP}_i \;, \text{NP}_j \;, \text{NP}_k \,\rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{INDEX} & s \\ \text{RESTR} & \left\langle \left[\begin{array}{ll} \text{RELN} & \text{hand} \\ \text{SIT} & s \\ \text{HANDER} & i \\ \text{RECIPIENT} & j \\ \text{HANDED} & k \end{array}\right]\right\rangle \end{array}\right] \end{array}\right]\right\rangle$$

This lexeme undergoes the Passive Lexical Rule, yielding the following lexical entry:

(18)
$$\left\langle \text{handed}\;, \left[\begin{array}{ll} \textit{word} & \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{ll} \textit{verb} & \\ \text{FORM} & \text{pass}\end{array}\right] \\ \text{SPR} & \langle\, [\;] \,\rangle \end{array}\right] \\ \text{ARG-ST} & \left\langle \text{NP}_j \;, \text{NP}_k \left(, \overset{\text{PP}}{\left[\begin{array}{ll} \text{FORM} & \text{by} \\ \text{P-OBJ} & \text{NP}_i \end{array}\right]}\right)\right\rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{INDEX} & s \\ \text{RESTR} & \left\langle \left[\begin{array}{ll} \text{RELN} & \text{hand} \\ \text{SIT} & s \\ \text{HANDER} & i \\ \text{RECIPIENT} & j \\ \text{HANDED} & k \end{array}\right]\right\rangle \end{array}\right] \end{array}\right]\right\rangle$$

And this forms the basis for lexical SDs like (19):

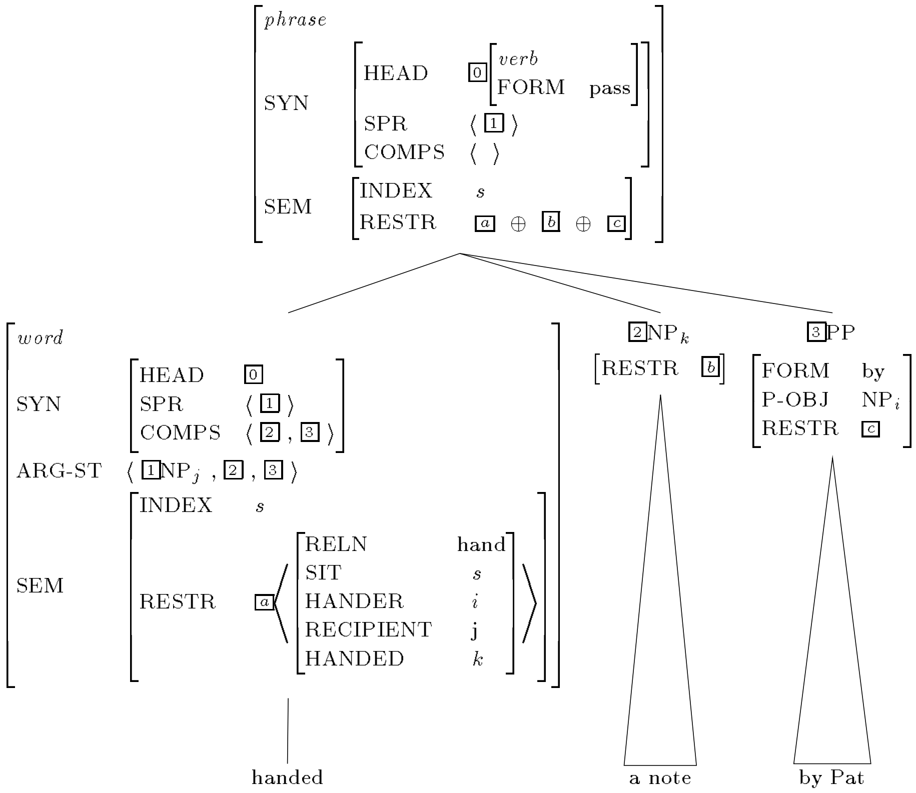
(19)

$$\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{pass} \end{bmatrix} \\ \text{SPR} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{2} , \boxed{3} \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}\text{NP}_j , \boxed{2}\text{NP}_k , \begin{matrix} \boxed{3}\text{PP} \\ \begin{bmatrix} \text{FORM} & \text{by} \\ \text{P-OBJ} & \text{NP}_i \end{bmatrix} \end{matrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{hand} \\ \text{SIT} & s \\ \text{HANDER} & i \\ \text{RECIPIENT} & \text{j} \\ \text{HANDED} & k \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

handed

This is consistent with the use of *handed* in (14). (19) fits into the larger SD corresponding to the VP[pass] shown in (20).

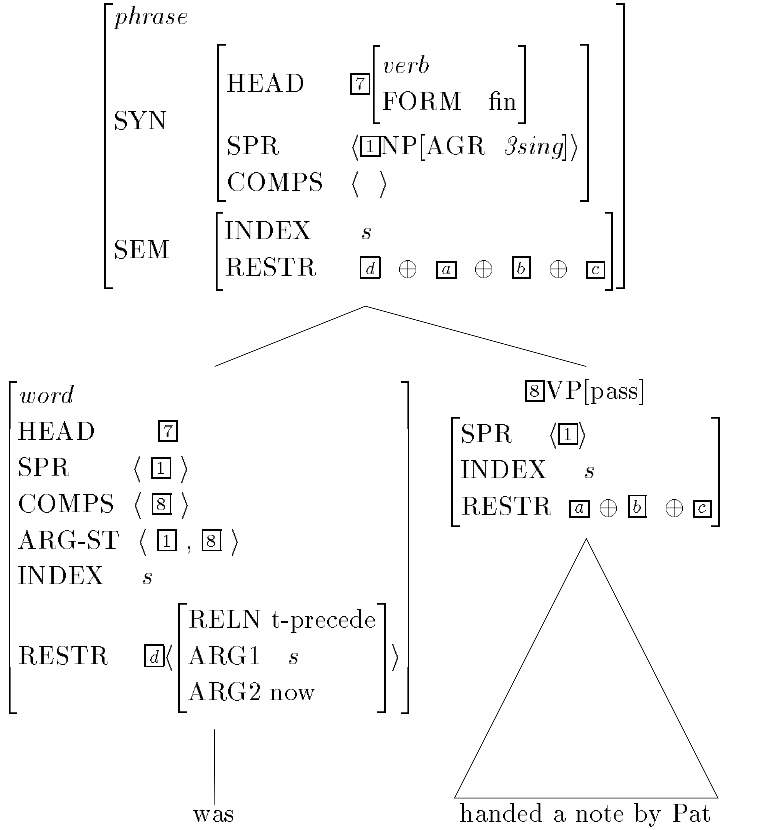
(20)



As usual, the HEAD, SPR, and INDEX values of the mother are the same as those of the head daughter (courtesy of the HFP, the Valence Principle, and the Semantic Inheritance Principle, respectively), and the mother's RESTR value is the sum of the daughters' RESTR values (courtesy of the Semantic Compositionality Principle).

This VP[pass] combines with the lexical SD in (16) to form the SD for the VP[fin] in (14), which is shown in more detail in (21).

(21)



Again note the effect of the HFP, the Valence Principle, the Semantic Compositionality Principle, and the Semantic Inheritance Principle.

And finally, this VP combines with the subject NP in (14). Since the NP dominating *Chris* is singular, it is consistent with the SPR specification in (21). Hence *Chris* (more precisely the synsem-struc of the mother of the SD dominating *Chris*) is the subject of both *was* and *handed*. This assigns the correct semantic interpretation to the sentence: *Chris*

plays the recipient role of the handing relation. The other two roles are straightforwardly determined by the indexing shown in (20).

⚠ **Problem 1: Passive and Binding Theory**

The analysis of passive just sketched makes some predictions about binding possibilities in passive sentences. Consider the following data:[4]

(i) She$_i$ was introduced to herself$_i$ (by the doctor).
(ii)*She$_i$ was introduced to her$_i$ (by the doctor).
(iii) The barber$_i$ was shaved (only) by himself$_i$.
(iv)*The barber$_i$ was shaved (only) by him$_i$.
(v) The students$_i$ were introduced to each other (by Leslie).
(vi)*The students$_i$ were introduced to them$_i$ (by Leslie).
(vii) Unfortunately, he$_i$ was introduced to the crowd by himself$_i$.
(viii)*Unfortunately, he$_i$ was introduced to the crowd by him$_i$.

Assuming that *to* and *by* in these examples are uniformly treated as argument-marking prepositions, does the treatment of passives sketched in the text correctly predict the judgements in (i)–(viii)? If so, explain why; if not, discuss the inadequacy of the analysis in precise terms. Be sure to provide a detailed justification of your answer.

Problem 2: Pseudopassives

Consider the following passive sentences:

(i) Dominique was laughed at by the younger kids.
(ii) This bed was slept in by the ambassador to Dalmatia.
(iii) This problem is talked about in every home.

A. Explain why our current passive rule does not allow sentences like (i)–(iii) to be generated.

[4]It may require a little imagination to construct contexts where such examples have a plausible meaning, e.g. a doctor dealing with an amnesia victim. Being able to construct such contexts is an essential part of being able to understand what conclusions to draw from the fact that some sentence you are interested in doesn't sound completely acceptable.

We know of cases where grammatical deviance has not been separated with sufficient care from semantic implausibility. For example, sentences like ?*I smell funny to myself* have on occasion been cited as ungrammatical. However, a bit of reflection will reveal, we think, that what is strange about such examples is the message they convey, not their grammar. If one needed to convey that one's own olfactory self-impression was strange (in whatever odd context such a need might arise), then *I smell funny to myself* is probably the most straightforward way the grammar of English allows such a meaning to be expressed.

B. Propose an additional lexical rule that will produce appropriate lexical entries for the passive participles in these sentences. [*Hints: This is difficult, but feasible if you make a few assumptions. First, don't try to generate the passive lexical entries for (i)–(iii) directly with one rule. Instead, formulate a rule whose outputs will then undergo the Passive Lexical Rule to provide the lexical entries you will need to account for these examples. Second, since the outputs of your lexical rule will always have to undergo the Passive Lexical Rule, you will want to specify this fact in the output of your rule (using the FORM feature). Third, assume that the prepositions involved in examples of this sort are all argument-marking prepositions – that is, they have P-OBJ values. Your rule will need to use these P-OBJ values (and the FORM values of the prepositions) in producing the entries that then get passivized, to license examples like (i)–(iii).*]

C. Illustrate how your rule works by sketching the input and appropriate output for one of the passive participles in (i)-(iii).

D. Assuming the lexical entry in (iv), does the rule you formulated in (B) predict that both (iii) and (v) are grammatical?

(iv)
$$\left\langle \text{talk}\ ,\ \begin{bmatrix} \textit{verb-lxm} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \textit{verb}\end{bmatrix} \\ \text{ARG-ST} & \langle\ \text{NP}\ (,\ \text{PP[to]})\ (,\ \text{PP[about]})\ \rangle \end{bmatrix} \right\rangle$$

(v) This person was talked to by every teacher.

Explain your answer.

Problem 3: The Dative Alternation

In Chapter 8, we mentioned the possibility of formulating a lexical rule describing the 'dative alternation' – that is, a class of verbs that appear in both of the valence patterns exemplified in (i) and (ii):

(i)
$$\text{Birch}\left\{\begin{array}{l}\text{gave}\\ \text{handed}\\ \text{sold}\\ \text{loaned}\\ \text{mailed}\end{array}\right\}\text{Brooke a book.}$$

(ii)
$$\text{Birch}\left\{\begin{array}{l}\text{gave}\\ \text{handed}\\ \text{sold}\\ \text{loaned}\\ \text{mailed}\end{array}\right\}\text{a book to Brooke.}$$

A. Provide an argument that this alternation is productive enough (that is, systematic enough) to warrant positing a rule of some sort.

B. Formulate a lexical rule for the dative alternation. [*Hint: You can choose either of the valences illustrated in (i) and (ii) as the input and the other as the output. It should not be easier one way than the other.*]

C. Show how your rule interacts with the Passive Lexical Rule to make possible the generation of both (iii) and (iv)

(iii) Brooke was handed a book by Birch.
(iv) A book was handed to Brooke by Birch.

D. Explain why your rule correctly fails to license (v) (or, more precisely, fails to license (v) with the sensible meaning that the book was the thing handed to Brooke).

(v) ?*A book was handed Brooke by Birch.

10.5 Further Reading

The English passive has been analyzed and reanalyzed throughout the history of generative grammar. Among the most influential works on the subject are: Chomsky (1957), Chomsky (1965), Chomsky (1970), Perlmutter and Postal (1977), Wasow (1977), Bresnan (1982b), Burzio (1986) and Postal (1986).

11

Nominal Types: Dummies and Idioms

11.1 Introduction

In the last chapter, we presented a lexical entry for the verb *be* as it occurs in passive sentences. We begin this chapter with a consideration of how to generalize the formulation of this lexical entry to cover other uses of *be* as well. This will lead us to the use of forms of *be* in combination with the subject *there* as a way of presenting an entity or asserting its existence, as in (1).

(1) a. There are storm clouds gathering.
    b. There is a monster in Loch Ness.

This, in turn, will take us to an examination of other NPs that seem to have very restricted distributions, and whose semantic contributions cannot readily be isolated from the meanings of the larger constructions in which they occur. Examples are the use of *it* in sentences like (2a) and *advantage* in (2b).

(2) a. It is obvious that Pat is lying.
    b. Pat took advantage of the opportunity.

11.2 *Be* Revisited

The lexical entry for *be* presented in the last chapter demanded a VP[FORM pass] complement, but of course forms of *be* occur with a variety of other types of complements:

(3) a. Pat is on the roof.
    b. Pat is the captain of the team.
    c. Pat is fond of Chris.
    d. Pat is singing the blues.

Such examples show that the possible complements of *be* include, besides VP[FORM pass], at least PP, NP, AP, and VP[FORM prp]. At first glance, one might think that this could be handled simply by removing the FORM feature (and hence, implicitly, the part of speech information) from the second element of the ARG-ST list in the lexical entry for passive *be* – that is, allowing any type of phrase (of the appropriate valence) as a complement. However, the distribution of *be* is not quite this free.

(4) a. *Pat is likes Chris.
b. *Pat is hate Chris.
c. *Pat is mere.

These examples show that only some verb forms can head a VP complement of *be* and that not all adjectives can head AP complements of *be*. The traditional name for the kind of phrase that can appear after *be* is 'predicative', so we will introduce a binary feature PRED to encode this distinction. So *fond* is [PRED +], while *mere* is [PRED −], though both have HEAD values of type *adjective*. Likewise, passive and present participles are [PRED +], and all other verb forms are [PRED −]. The type *verb-lxm* can thus be associated with the constraint: [PRED −].

Problem 1: Predicative Verb Forms
How could our grammar be modified to accommodate (in as general a way as possible) the fact that passive and present participles are [PRED +] but all other verbs are [PRED −]? Be as precise as you can. [*Hint: Lexical rules preserve all information that isn't explicitly contradicted.*]

Using the feature PRED, we can reformulate the lexical entry for *be* to handle not only passive VP complements, but also complements like those in (3). The new formulation[1] is the following:[2]

[1]We will incorporate this entry (in slightly revised form) into our lexical type hierarchy in Chapter 13, sec. 2.1.

[2]The formulation in (5) requires that predicative nominals (that is, NP[PRED +]) have a nonempty SPR – more specifically, that they are [SPR ⟨ NP ⟩] to handle examples like (i):

(i) Pat is a scholar.

Since NPs normally have empty SPR values, our account is incomplete. We will not attempt to provide a solution to this problem here. Notice, however, that this syntactic distinction between predicative and nonpredicative NPs reflects a semantic difference between two uses of certain NPs: one involving properties; the other individuals. Thus, the NP *a scholar* in (i) is used to predicate a property of Pat (scholarliness) and hence its semantic mode is actually prop, whereas the same string of words in (ii) is used simply to make reference to an individual, i.e. its semantic mode is ref.

(ii) A scholar arrived.

(5)
$$\left\langle \text{be}\ , \begin{bmatrix} \textit{be-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{1}\ , \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & [\text{PRED}\ +] \\ \text{SPR} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

As before, the semantic index of the verb *be* ($\boxed{2}$) is just the index of its predicative complement – the verb contributes nothing to the semantics of the sentences; it is just a syntactic placeholder. Indeed, in many languages (including some dialects of English) the meanings like those expressed by the sentences in (3) would normally be expressed without any verb at all, as in the following examples:

(6) a. *Ona xorošij vrač*
she good doctor
'She is a good doctor.'
(Russian)

b. *A magyar zászló piros-fehér-zőld.*
the Hungarian flag red-white-green
'The Hungarian flag is red, white, and green.'
(Hungarian)

11.3 The Existential *There*

Consider another sort of sentence that involves *be*:

(7) a. There is a unicorn in the garden.
b. There were many people fond of Pat.
c. There are people looking through the window.
d. There was a felon elected to the city council.

These involve a nonreferential subject, *there* (often called the 'dummy' *there*), an NP following *be*, and a [PRED +] phrase following the NP. We can see that there are in fact two complements and not just one complex one (that is, an NP with some kind of modifying phrase attached to it) on the basis of sentences like (8).

(8) a. There is a seat available.
 b. *A seat available was in the last row.
 c. *Pat took a seat available.
 d. *I looked for a seat available.

If *a seat available* in (8a) were a single NP, we would expect it to be able to appear in other typical NP positions, such as those in (8b-d). So *a seat* and *available* must be two separate arguments of *be*. But if this use of *be* takes a subject and two more arguments, then it cannot be subsumed under (5), whose ARG-ST list contains only two elements. Hence, we will need a separate lexical entry for this lexeme, which we will call the 'existential *be*'.

Stating the restrictions on the existential *be*'s complements is not difficult.[3] But restricting the subject to the word *there* is not entirely trivial. This is the first case we have seen in which a verb requires that a particular word be its subject. We have, however, previously encountered an instance in which a verb specified that a specific word must head one of its complements. This was in the passive construction: passive forms of verbs can always take an optional PP headed by *by* to express the argument of the passive that corresponds semantically to the subject of the active. Similar selections are involved with other verb-preposition pairs, such as *rely* and *on*. Indeed, the argument-marking prepositions discussed in Chapter 7 are often selected by verbs, sometimes quite idiosyncratically.

Recall that to deal with the argument-marking prepositions, we extended the feature FORM (previously used only for distinguishing verbal inflections) to prepositions, and introduced new FORM values such as 'by', 'to', etc. This same device can now be used with nouns and noun phrases. We can put the feature specification [FORM there] in the lexical entry for the existential *there*, and require that the subject of the existential *be* must be [FORM there].[4]

[3]This is an oversimplification (as is almost any claim that some aspect of grammar is easy). Examples like (i) and (ii) are markedly worse than sentences like (7):

(i) ?*There is each unicorn in the garden.
(ii) ?There was the felon elected to the city council.

It is often claimed that the postverbal NP in existential sentences must be indefinite, but this is too strong: examples like (ii) are acceptable if interpreted as part of a listing of exemplars of something, and sentences like *There is the cutest puppy outside* are commonplace (in certain styles, at least). We will not pursue the problem of characterizing the so-called definiteness restriction on the NPs in existential sentences, on the assumption that the restriction is actually a semantic one.

(9)
$$\left\langle \text{be}\ ,\ \begin{bmatrix} \textit{be-lxm} & \\ \text{ARG-ST} & \left\langle \begin{matrix}\text{NP}\\ \begin{bmatrix}\text{FORM} & \text{there}\end{bmatrix}\end{matrix}\ ,\ \boxed{2}\text{NP}_i\ ,\ \begin{bmatrix}\text{PRED} & + \\ \text{SPR} & \langle \boxed{2} \rangle \\ \text{COMPS} & \langle\ \rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{4}\end{bmatrix}\end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{4} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

Notice that existential *be* contributes nothing to the meaning of the sentence, except the identification of its index with that of its predicative complement. This index will be inherited by phrases projected from existential *be* (and words formed from *be*). Moreover, since the NP argument is identified with the SPR of the predicative complement, the semantics of these two will be combined within the VP in the same way as they would be in a simple subject-predicate sentence, namely, by merging the RESTR lists of the daughters.[5] Thus, the sentences in (7) are analyzed as paraphrases of those in (10).[6]

(10) a. A unicorn is in the garden.
 b. Many people were fond of Pat.
 c. People are looking through the window.
 d. A felon was elected to the city council.

We turn now to the lexical entry for the existential *there*. Its key feature is that it is the only word that is [FORM there]. Hence, the SPR

[4]By extending FORM to nouns in this way, we are allowing a potentially unlimited number of possible values for this feature. In actual practice, we believe that the number of words entering into such morphologically-sensitive co-occurrence relations in any language is quite manageable.

[5]The notation 'NP_i' means that this NP is required to bear an index; see below.

[6]This account of the semantics of the existential *there* construction is only a first approximation. For one thing, the use of *there* involves an explicit assertion of existence not associated with sentences like (10). In addition, it seems that the [PRED +] phrase in the *there* construction must denote a potentially transient property of the referent of the NP, whereas this is not required in the analogous examples without *there*. This is illustrated in (i)–(iv):

(i) A vase is blue.
(ii)*There is a vase blue.
(iii) A unicorn was the winner of the Kentucky Derby.
(iv)*There was a unicorn the winner of the Kentucky Derby.

We will not pursue these subtle semantic issues here.

value of (9) uniquely picks out this word as the subject. Non-dummy NPs (proper nouns, pronouns, and phrases headed by common nouns alike) will now be specified as [FORM none], in virtue of a default constraint which we will associate with the type *noun-lxm*. The existential *there* is also exceptional in that, although it is a pronoun, it has no referential function, and under our analysis, as noted in the preceding paragraph, it does not contribute to the meaning of the sentences in which it occurs (but see footnote 6).

The lexical entry for existential *there*, then, is the following:

(11)
$$\left\langle \text{there}\ ,\ \begin{bmatrix} \textit{pron-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{there} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{none} \\ \text{INDEX} & \text{none} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

The requirement that the HEAD value in (11) be of the type *noun* is inherited from the type *noun-lxm* (a supertype of *pron-lxm*); and the requirement that the argument structure be empty is inherited (by default) from this type as well. Note that the AGR specification in (11) is underspecified for number; this is because *there* can be plural, as in (7b,c). Note in addition that the empty list specification for the feature RESTR guarantees that *there* will not contribute to the RESTR list of phrases that contain it. And finally, the 'none' values that we have introduced for the features MODE and INDEX reflect the fact that *there* has no referential potential and no referential index.[7]

This last fact is particularly significant, as it allows us to explain the restricted distribution of existential *there*. The verbs we have considered thus far (except for *be*) have lexical entries which state that the indices of the NP (if there are any) are assigned semantic roles (e.g. LOVER, GIVEN). But because existential *there* has no index, it follows that any attempt to combine *there* with a role-assigning verb will produce a conflicting SD. Thus from the semantic vacuity of existential *there*, it follows immediately that examples like the following are ungrammatical:

(12) a. *There loved Sandy.
b. *Merle gave there a book.
c. *We talked to them about there.

[7] The [INDEX none] specification also guarantees that *there* can never be the NP_i argument of (9). This ensures the ungrammaticality of examples like (i):

(i) *There is [there] [being someone missing].

Problem 2: *There* and Agreement
The analysis of existential *there* sentences presented so far says nothing about verb agreement.

A. Consult your intuitions (and/or those of your friends, if you wish) to determine what the facts are regarding number agreement of the verb in *there* sentences. Give an informal statement of a generalization covering these facts, and illustrate it with both grammatical and ungrammatical examples. [*Note: Intuitions vary regarding this question, across both individuals and dialects. Hence there is more than one right answer to this question.*]
B. How would you elaborate or modify our analysis of the *there* construction so as to capture the generalization you have discovered? Be as precise as you can.

11.4 Extraposition

Consider the following pairs of sentences:

(13) a. That Cleveland lost the series sucks.
b. It sucks that Cleveland lost the series.

(14) a. That dogs bark annoys people.
b. It annoys people that dogs bark.

(15) a. That Chris knew the answer (never) occurred to Pat.
b. It (never) occurred to Pat that Chris knew the answer.

(16) a. That the Cardinal won the game gave Sandy a thrill.
b. It gave Sandy a thrill that the Cardinal won the game.

This seems to be a systematic alternation that we would like to account for. Moreover, it is productive: an English speaker unfamiliar with the verb *cark* who heard (17a) would know that (17b) is also well formed.

(17) a. That many languages are dying out carks linguists.
b. It carks linguists that many languages are dying out.

And speakers who have acquired the lexical item *bite* as a synonym for *suck* (as in 'be bad') should find both the following sentences to be well formed.

(18) a. That Cleveland lost the series (really) bites.
b. It (really) bites that Cleveland lost the series.

Thus the alternation illustrated in (13)–(16) has some claim to psychological reality.

The (b)-sentences in (13)–(18) all have a nonreferential pronoun *it* as their subject and a *that*-clause at the end. In our treatment of another 'dummy' (i.e. non-referential) NP earlier in the chapter, we gave it an empty RESTR list, and the value 'none' for INDEX. It seems natural to do the same with this use of *it*. As was the case with the existential *there*, the dummy *it* is very restricted in its distribution. In examples like (19)–(20), which do not fit the pattern of (13)–(18), the uses of *it* are referential.

(19) a. *That Pat is innocent proves.
  b. It proves that Pat is innocent.

(20) a. *That Sandy had lied suggested.
  b. It suggested that Sandy had lied.

Following the treatment of the existential *there*, then, we are led to posit lexical entries for the verbs in the (b)-sentences of (14)–(18) that specify that their subjects must be the nonreferential *it*. We can do this as we did with *there* by positing a FORM value 'it', which uniquely identifies the dummy *it*.

The lexical entry for the dummy *it* is therefore the following:

(21)
$$\left\langle \text{it}, \left[\begin{array}{ll} \textit{pron-lxm} & \\ \text{SYN} & \left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\text{FORM} & \text{it}\\ \text{AGR} & \left[\begin{array}{ll}\text{NUM} & \text{sg}\end{array}\right]\end{array}\right]\end{array}\right] \\ \text{SEM} & \left[\begin{array}{ll}\text{MODE} & \text{none}\\ \text{INDEX} & \text{none} \\ \text{RESTR} & \langle\ \rangle\end{array}\right]\end{array}\right]\right\rangle$$

Note that the dummies *it* and *there* have slightly different AGR values: *it* is specified as [NUM sg] and is also [PER 3rd] (by default inheritance from the type *noun-lxm*), but *there* is only specified as third person (again by default), with the number left underspecified. This underspecification permits a single lexical entry *there* to appear with *are* and *were*, as well as with *is* and *was*.

Like the dummy existential *there*, and for exactly the same reasons, dummy *it* can never appear in a role-assigned position:

(22) a. *It loved Sandy.
  b. *I gave it to Pat.

Such examples are fully grammatical, of course, if we interpret *it* as the personal pronoun *it* (i.e. as a pronoun referring to something in the context), rather than as the dummy *it*.

To capture the regularity of the alternation illustrated in (13)–(18), we will want to posit a lexical rule whose output is the version of the verbs taking the dummy subject *it*. But before we can do this, we need to consider how to analyze the *that*-clauses that occur in the examples in question.

The part after *that* is just a finite S (i.e. a phrase headed by a finite verb, with empty COMPS and SPR specifications – as noted in Chapter 4, we sometimes call such a phrase 'saturated'). It is less obvious how to deal with *that*, which might be thought of as simply 'marking' the sentence that follows it. We propose to treat *that* as a head, taking a finite S as its only argument (note that in this respect, *that* is similar to the argument-marking prepositions such as *to* and *of* first discussed in Chapter 7). In order to handle words like *that*, however, we will have to introduce a new part of speech type: *comp* (for 'complementizer'). *That*-clauses, then, are complementizer phrases (CPs, for short).

Some verbs (largely verbs of thinking or communicating, such as *guess, know, promise, remember, say,* and *think*) can take *that*-clauses as complements. Most of these can also take clausal complements without *that*. A clever way of handling this is to say that *that* is [FORM fin], just like finite verbs. Under this assumption, the lexical entries for verbs such as *guess* can have an ARG-ST specification like the following:

(23)
$$\left[\begin{array}{ll}\text{ARG-ST} & \left\langle \text{NP}\ , \left[\begin{array}{ll}\text{FORM} & \text{fin}\\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle\end{array}\right]\right\rangle\end{array}\right]$$

This specification then allows the second argument to be either a *that*-clauses or a finite clause without *that*. Our feature system thus attributes a common property to this class of categories, predicting that they are a 'natural class' – that is, that they should behave alike in some ways. And we just noted that they can appear as complements to many of the same verbs.

Returning to examples with *that*-clause subjects, notice that the complementizer is obligatory:

(24) *Dogs bark annoys people.

This can be handled by saying that a verb like *annoy* takes a finite complementizer phrase as its subject – that is, (25) is the ARG-ST specification found in the relevant lexical entries:

(25)
$$\begin{bmatrix}\text{ARG-ST} & \left\langle \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\textit{comp} & \\ \text{FORM} & \text{fin}\end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle\end{bmatrix}, \ldots \right\rangle\end{bmatrix}$$

We can now turn to the problem of formulating our lexical rule, which we will call 'extraposition'.[8] Given our analysis of *that*-clauses, the crucial step in formulating the rule is ensuring that the *that*-clause plays the same semantic role in both sentences.

So far, our SEM values have been specifications (in referential or propositional mode) where the RESTR list has contained simple predications, that is, predications where the semantic role features (LOVER, INSTANCE, etc.) take indices as their arguments. These indices in general correspond to individuals that are referred to by NPs within the sentence. One important exception to this had to do with modification. In Chapter 5, we allowed situational indices to be the value of the feature ARG(UMENT) that appeared in certain predications introduced by adverbial modifiers, for example, as in (26).

(26)
$$\begin{bmatrix}\text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{today} \\ \text{SIT} & s \\ \text{ARG} & t\end{bmatrix} \right\rangle\end{bmatrix}$$

This in fact is the general technique we will use for semantic embedding – for making one semantic complex the argument of another. That is, we will never embed one feature structure within another inside the value of SEM, as is done in (27):

(27)
$$\begin{bmatrix}\text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{today} \\ \text{SIT} & s \\ \text{ARG} & \begin{bmatrix}\text{RELN} & \ldots \\ \text{SIT} & t \\ \ldots & \end{bmatrix}\end{bmatrix} \right\rangle\end{bmatrix}$$

[8] In this we follow terminology introduced by the renowned Danish grammarian Otto Jespersen (1860–1943).

Instead, we will use sameness of situational indices to get the same semantic effect. We will use various (hopefully intuitive) feature names to designate the roles whose value is an embedded proposition. In this way, we can express meanings that involve arbitrarily deep semantic embeddings, but we can keep the RESTR lists inside our semantic structures 'flat'.[9]

On this view, we will be able to deal with the semantics of subordinate clauses in terms of index identity, using the kind of semantic analysis we have already developed. For example, we can make the reasonable assumption that the semantics of *Fido barks* in *That Fido barks annoys me* is the same as that of the stand-alone sentence *Fido barks*, namely, (28).

(28)
$$\begin{bmatrix}\text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{name} \\ \text{SIT} & t \\ \text{NAME} & \text{Fido} \\ \text{NAMED} & i\end{bmatrix}, \begin{bmatrix}\text{RELN} & \text{bark} \\ \text{SIT} & s \\ \text{BARKER} & i\end{bmatrix} \right\rangle\end{bmatrix}$$

How do we construct such a semantics?

The complementizer *that* belongs to a new type of lexeme associated with the constraints in (29):[10]

(29)
$$\textit{comp-lxm}: \begin{bmatrix}\text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\textit{comp} & \\ \text{CASE} & \{\text{nom, acc}\} \\ \text{FORM} & \boxed{2}\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \ldots, \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{FORM} & \boxed{2}\end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{1}\end{bmatrix}\end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{1} \\ \text{RESTR} & \langle\ \rangle\end{bmatrix}\end{bmatrix}$$

[9] We are simplifying here in not providing any apparatus for distinguishing embedded propositions from embedded questions, exclamations, etc.

[10] The type *comp-lxm* is a subtype of *const-lxm* (though some varieties of certain Germanic languages show what appear to be inflected forms of complementizers!).

(29) says that all instances of this type of lexeme share the semantic index of their last argument.[11] In addition, it is required that the complementizer and its last argument share values for the feature FORM. Finally, we have constrained complementizers to take values for CASE. This is necessary in order to permit CPs to occur as subjects (as in the (a)-examples in (13)–(18), since finite verbs require that their SPR values be [CASE NOM]. For uniformity, we will also generalize the Case Constraint (introduced in Chapter 8) so that it requires that CPs, as well as NPs, be [CASE acc] when they are noninitial in an ARG-ST.

With these type constraints in place, the lexical entry for *that* need say nothing more than what is shown in (30).

(30)
$$\left\langle \text{that}\ ,\ \begin{bmatrix} \textit{comp-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle\ [\text{SPR}\ \langle\ \rangle]\ \rangle \end{bmatrix} \right\rangle$$

The constraints passed on through type inheritance thus interact with those that are lexically specified to ensure that the complementizer *that* has the INDEX and FORM value of its only argument, which in turn must be a saturated finite clause. Type inheritance thus gives us the fully specified lexical entry in (31).

[11] Other complementizers, e.g. the complementizer *to* discussed in the next chapter, allow more than one argument.

(31)
$$\left\langle \text{that}\ ,\ \begin{bmatrix} \textit{comp-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{comp} \\ \text{FORM} & \boxed{2} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{FORM} & \boxed{2}\text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & \boxed{1} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

Given this lexical entry and its interaction with the semantics principles of Chapter 5, it follows that the semantics of *that*-clauses is identical to the semantics of the clause that *that* takes as its complement. The meaning of a clause like *That Fido barks annoys me* will then be represented as follows:

(32)
$$\begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & u \\ \text{NAME} & \text{Fido} \\ \text{NAMED} & i \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{bark} \\ \text{SIT} & t \\ \text{BARKER} & i \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{annoy} \\ \text{SIT} & s \\ \text{ANNOYED} & j \\ \text{ANNOYANCE} & t \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{t-overlap} \\ \text{ARG1} & s \\ \text{ARG2} & \text{now} \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{speaker} \\ \text{SIT} & v \\ \text{INSTANCE} & j \end{bmatrix} \right\rangle \end{bmatrix}$$

This will result from combining the CP subject *that Fido barks* with the VP *annoys me*. As before, we are simply following the Semantic Compositionality Principle and the Semantic Inheritance Principle. Hence, we identify the INDEX of the S with that of its VP head, and we form the S's RESTR list by concatenating the RESTR lists of the subject and the VP.

We are now almost ready to state our extraposition rule. We want the rule to take as input a lexeme whose first argument is a CP and produce as output a lexeme with the CP at the end of its ARG-ST list and an NP[FORM it] at the beginning. This change affects the length of the ARG-ST list, since the NP[FORM it] is added and nothing is removed. That means that the output lexeme cannot, in general, be of the same type as the input, for many of our lexeme types (e.g. those for verbs) specify how many items are on the ARG-ST list. Our earlier encounters with lexical rules that changed the order of elements on the ARG-ST list (such as the Passive Lexical Rule) produced outputs of type *word*, so there was no issue of conflict between constraints on the output's type and those specified for the output by the rule. The type *word*, for example, imposes no constraint on ARG-ST lists. In the case of extraposition, however, the output needs to undergo further inflectional rules. For instance, both (33a) and (33b) are possible, indicating that the output of the Extraposition Lexical Rule must be able to undergo both the Past Tense Verb LR and the 3rd Singular Verb LR.

(33) a. It annoyed me that Fido barked.
b. It annoys me that Fido barked.

Hence, the output of the Extraposition Rule should belong to some subtype of *lexeme*.

We handle this problem by introducing a new lexeme type, *derived-lxm*, that has no constraints associated with it. We then assign the output of the Extraposition Lexical Rule to this new type. This way, the type of the input lexeme will be changed, allowing for the increased length of the ARG-ST list on the output without contradicting any constraints associated with the input type. All other input information will either be carried forward to the output lexeme or else will be explicitly overridden by the rule itself. The following statement of the rule incorporates this idea:

(34) Extraposition Lexical Rule

$$\left\langle \boxed{1}\ ,\ \begin{bmatrix} \textit{lxm} \\ \text{ARG-ST} \quad \boxed{\text{a}}\left\langle \begin{bmatrix}\text{HEAD} & \textit{comp}\end{bmatrix} \right\rangle \oplus \boxed{\text{b}} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{1}\ ,\ \begin{bmatrix} \textit{derived-lxm} \\ \text{ARG-ST} \quad \left\langle \text{NP}\begin{bmatrix}\text{FORM} & \text{it}\end{bmatrix} \right\rangle \oplus \boxed{\text{b}} \oplus \boxed{\text{a}} \end{bmatrix} \right\rangle$$

This rule creates new lexemes from any lexeme (not just *verb-lxm*s, as we will see) whose first argument is a CP. The output lexeme always takes a dummy *it* as its subject and takes as a final argument whatever kind of CP was specified as the input's first argument. Notice that in this analysis we do not need new phrase structure rules to handle extraposition. Any word formed from the lexeme outputs of this rule fits one of the general patterns already provided for by our existing grammar rules. All we have needed to handle this new phenomenon was a new value for the feature FORM. It was then straightforward to formulate a lexical rule that captures the regularity illustrated by the sentence pairs at the beginning of this section.[12]

[12] There remains the question of where the new type *derived-lxm* fits into our type hierarchy. If we make the simplifying assumption that only verbs undergo the Extraposition Lexical Rule, then *derived-lxm* can be an immediate subtype of *verb-lxm*. However, extending the treatment of extraposition to include adjectives as well will lead us to introduce a number of refinements that are beyond the scope of this text.

Problem 3: An Annoying Exercise

Assume that the lexical entry for the verb *annoy* is the following. (Note that the first argument of this lexeme overrides the default condition – associated with the type *verb-lxm* – requiring the first argument to be an NP.)

(i)
$$\left\langle \text{annoy}\ ,\ \begin{bmatrix} \textit{stv-lxm} & \\ \text{ARG-ST} & \left\langle \begin{bmatrix} \text{HEAD} & \textit{comp} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{1} \end{bmatrix} \end{bmatrix}, [\ ]_i \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{annoy} \\ \text{SIT} & s \\ \text{ANNOYED} & i \\ \text{ANNOYANCE} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

A. Show the lexical entry that results from applying the Extraposition Lexical Rule to (i).

B. Using the lexical entry given in the text for the complementizer *that*, describe in a few sentences (with an appropriate SD) the analysis of the clause *that Fido barks*. Make sure you explain exactly how this clause is assigned the semantics shown in (28).

C. Using the lexical entry you gave in (A) and the analysis of *that Fido barks* you came up with in (B), sketch the analysis of *It annoys Lee that Fido barks*. Your solution should show the lexical entry for *annoys* in this sentence (explaining where it came from), the lexical SD it gives rise to, and how it is embedded in the SD for the whole sentence. Be sure that the semantics that results from your analysis is like (32), except for the difference between *me* and *Lee* (and the ordering of the items in the RESTR list).

D. Modify the lexical entry in (i) so that it also allows sentences like *Sandy annoys me*.

11.5 Idioms

We have now encountered two nonreferential NPs with highly restricted distributions, namely, the dummies *there* and *it*. Other NPs that share the properties of nonreferentiality and restricted distribution can be

found in idioms – that is, in fixed (or partially fixed) combinations of words that are used to express meanings that aren't determined in the usual way from those words. For example:

(35) a. Carrie kicked the bucket last night. ('Carrie died last night')
b. The FBI kept (close) tabs on Sandy. ('The FBI (carefully) observed Sandy')
c. The candidates take (unfair) advantage of the voters. ('The candidates exploit the voters (unfairly)')

The idioms *kick the bucket*, *keep tabs on*, and *take advantage of* each has an idiosyncratic meaning, which requires that all of its parts co-occur. That is, the words in these idioms take on their idiomatic meanings only when they appear together with the other parts of the idioms. For example, the following sentences do not have interpretations related to those in (35) (if they are acceptable at all):

(36) a. Chris dreads the bucket.
b. The police put tabs on undocumented workers.
c. The candidates bring advantage to the voters.

Since the lexical entries for verbs contain information about the arguments they co-occur with (but not vice versa), one way to capture the idiosyncratic properties of idioms is to encode them in the entries of the verbs. That is, we can treat idiomatic nouns, such as *tabs* and *advantage* by:

- giving them their own FORM values;
- marking them as [MODE none] and [INDEX none]; and
- specifying that they are [RESTR ⟨ ⟩]

This amounts to treating idiom parts (or 'idiom chunks', as they are often called) similarly to the dummies just considered.

We can now have entries for *keep* and *take* specifying that their objects must be [FORM tabs] and [FORM advantage], respectively. These verbal entries will contain all of the idioms' semantic information.[13] The detailed entries for idiomatic nouns *tabs* and *advantage* and the verbs that go with them are given in (37) and (38).[14]

[13] This treatment (like a number of others in this book) is a simplification. For a more thorough discussion of the authors' views on the semantics of idioms, see Nunberg, Sag, and Wasow (1994).

[14] Note that the entries for *tabs* and *advantage* override default specifications for both ARG-ST and SPR.

(37) a.

$$\left\langle \text{tabs}\ , \left[\begin{array}{ll} \textit{cn-lxm} & \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{ll} \text{FORM} & \text{tabs} \\ \text{AGR} & \left[\begin{array}{ll} \text{PER} & \text{3rd} \\ \text{NUM} & \text{pl} \end{array}\right] \end{array}\right] \\ \text{SPR} & \langle\ \rangle \end{array}\right] \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{MODE} & \text{none} \\ \text{INDEX} & \text{none} \\ \text{RESTR} & \langle\ \rangle \end{array}\right] \end{array}\right] \right\rangle$$

b.

$$\left\langle \text{advantage}\ , \left[\begin{array}{ll} \textit{cn-lxm} & \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{ll} \text{FORM} & \text{advantage} \\ \text{AGR} & \textit{3sing} \end{array}\right] \\ \text{SPR} & \langle\ \rangle \end{array}\right] \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{MODE} & \text{none} \\ \text{INDEX} & \text{none} \\ \text{RESTR} & \langle\ \rangle \end{array}\right] \end{array}\right] \right\rangle$$

(38) a.

$$\left\langle \text{keep}\ , \left[\begin{array}{ll} \textit{ptv-lxm} & \\ \text{ARG-ST} & \left\langle \text{NP}_i\ , \begin{array}{c}\text{NP} \\ \left[\text{FORM tabs}\right]\end{array} , \begin{array}{c}\text{PP} \\ \left[\begin{array}{ll} \text{FORM} & \text{on} \\ \text{P-OBJ} & \text{NP}_j \end{array}\right]\end{array} \right\rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{INDEX} & s \\ \text{RESTR} & \left\langle \left[\begin{array}{ll} \text{RELN} & \text{observe} \\ \text{SIT} & s \\ \text{OBSERVER} & i \\ \text{OBSERVED} & j \end{array}\right] \right\rangle \end{array}\right] \end{array}\right] \right\rangle$$

b.

$$\left\langle \text{take}\ , \left[\begin{array}{ll} \textit{ptv-lxm} & \\ \text{ARG-ST} & \left\langle \text{NP}_i\ , \begin{array}{c}\text{NP} \\ \left[\text{FORM advantage}\right]\end{array} , \begin{array}{c}\text{PP} \\ \left[\begin{array}{l} \text{FORM of} \\ \text{P-OBJ NP}_j \end{array}\right]\end{array} \right\rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{INDEX} & s \\ \text{RESTR} & \left\langle \left[\begin{array}{ll} \text{RELN} & \text{exploit} \\ \text{SIT} & s \\ \text{EXPLOITER} & i \\ \text{EXPLOITED} & j \end{array}\right] \right\rangle \end{array}\right] \end{array}\right] \right\rangle$$

Notice that we have given no entry for *kick the bucket*. There is a reason for this: different idioms exhibit different syntactic behavior, so not all idioms should be analyzed in the same fashion. In particular, *kick the bucket* differs from *keep tabs on* and *take advantage of* in its lack of a passive form. That is, while (39a,b) allow idiomatic interpretations, (39c) can only convey its literal meaning, which entails that Pat's foot made contact with an actual bucket.

(39) a. Tabs are kept on suspected drug dealers by the FBI.
b. Advantage is taken of every opportunity for improvement.
c. The bucket was kicked by Pat.

The analysis of *keep tabs on* and *take advantage of* presented above correctly allows them to have passive forms. These idiomatic verb entries meet the input conditions of the Passive Lexical Rule, and so can give rise to passive forms. The FORM restrictions on the NP complements of the active idiomatic verbs are restrictions on the subjects (that is, SPRs) of their passive versions. Hence, idiomatic *taken* (as a passive) requires that its subject be *advantage*.

Problem 4: Idiomatic *Kept*

A. Give the lexical entry for the passive of the idiomatic *kept* – that is, the result of applying the Passive Lexical Rule to (38a).

B. Explain precisely how the contrast between (i) and (ii) is explained on our analysis:

(i) Tabs were kept on Chris by the FBI.
(ii)*Advantage was kept on Chris by the FBI.

Be sure to discuss the role of the verb *be*.

If *kick the bucket* were to be analyzed in a parallel fashion, we would incorrectly predict that (39c) had an idiomatic interpretation (namely, 'Pat died'). To avoid this, we need a different analysis of this idiom. The most straightforward treatment is to say that the whole string, *kick the bucket*, is the verb.[15] Thus, there is a single lexical entry for the entire idiom *kick the bucket*, given in (40).

(40)
$$\left\langle \langle \text{kick, the, bucket} \rangle , \begin{bmatrix} \textit{iv-lxm} & \\ \text{ARG-ST} & \langle \text{NP}_i \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{die} \\ \text{CORPSE} & i\end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

This entry is an intransitive multi-element verbal lexeme, so it doesn't have a passive form. Or, to put it more formally, entry (40) does not satisfy the conditions necessary to serve as input to the Passive Lexical Rule: since it is not a *tv-lxm*, it does not passivize.

11.6 Conclusion

In this chapter, we have extended the use of the FORM feature to NPs and made use of it in the analysis of existential sentences containing the dummy *there*, the extraposition construction, and idioms. Each of these three constructions involves nonreferential NPs. The distribution of such NPs is more than an idle curiosity, however. In more complex sentences, it plays a crucial role in motivating the analysis of infinitival and other kinds of complements, which is precisely the concern of the next chapter.

11.7 Further Reading

Influential early discussions of the existential *there* and extraposition include Rosenbaum (1967), Milsark (1977), and Emonds (1975). See also Chomsky (1981) and Postal and Pullum (1988). Of the many generative discussions of idioms, see especially Fraser (1970), Chomsky (1980), Ruwet (1991), and Nunberg et al. (1994).

[15] In order to ensure that the verbal morphology appears on the first word in this multiword lexical entry, we adopt the general convention that morphological functions apply only to the first element of such entries. This also covers a number of other cases, such as the locations of the plural *-s* in *runs batted in* and the comparative suffix *-er* in *harder of hearing*.

12

Infinitival Complements

12.1 Introduction

In our discussion of extraposition in the last chapter, we encountered for the first time sentences expressing complex meanings – those in which one situation functions as a semantic argument of another.[1] In this chapter, we will investigate additional constructions involving this sort of complex semantics. In particular, we will focus on infinitival complements in sentences such as (1).

(1) a. Pat continues to avoid conflict.
b. Pat tries to avoid conflict.

We will see that, despite their superficial parallelism, examples (1a) and (1b) are quite different in their semantics and in certain associated syntactic properties. These two examples are representative of two basic ways in which propositions can be combined into complex meanings.

12.2 The Infinitival *To*

Before we delve into the distinction illustrated in (1), we need to provide an analysis for the word *to* that appears in both sentences. Like the lexeme *that* discussed in the previous chapter, the infinitival *to* is a complementizer and hence belongs to the type *comp-lxm*. An important difference between the two complementizers, however, is that while *that* introduces a subordinate clause, *to* introduces a subordinate VP. Like *that*, *to* does not appear to contribute to the semantics of the sentences in any substantive way. This is evident in those rare cases where it is optional. For example, there is no apparent difference in meaning between (2a) and (2b).

[1] As we noted, the semantic analysis we have given for a sentence like *That dogs bark annoys people* (or its extraposed counterpart) involves not the embedding of one feature structure within another, but rather the unification of the SIT value of one predication with the ARG value of another.

(2) a. Pat helped Chris to solve the problem.
b. Pat helped Chris solve the problem.

We can capture both the similarities and the differences between *that* and *to* with the following lexical entry.

(3)
$$\left\langle \text{to}\ ,\ \begin{bmatrix} \textit{comp-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{FORM} & \text{inf}\end{bmatrix} \\ \text{SPR} & \langle\ [\ \ ]\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}\ ,\ \begin{bmatrix}\text{SPR} & \langle \boxed{1} \rangle\end{bmatrix} \right\rangle \end{bmatrix} \right\rangle$$

This interacts with the constraints on the type *comp-lxm*, introduced in the last chapter, to give us, via constraint inheritance, the following fully specified entry for the complementizer *to*.

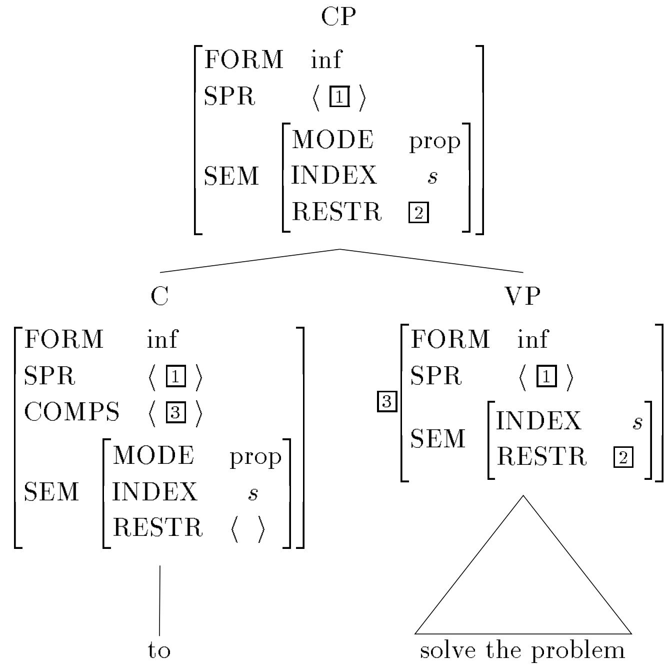
(4)
$$\left\langle \text{to}\ ,\ \begin{bmatrix} \textit{comp-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{comp} & \\ \text{FORM} & \boxed{3}\end{bmatrix} \\ \text{SPR} & \langle\ [\ \ ]\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}\ ,\ \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{FORM} & \boxed{3}\text{inf}\end{bmatrix} \\ \text{SPR} & \langle \boxed{1} \rangle \\ \text{SEM} & \begin{bmatrix}\text{MODE} & \text{prop} \\ \text{INDEX} & \boxed{2}\end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix}\text{MODE} & \text{prop} \\ \text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \ \rangle\end{bmatrix} \end{bmatrix} \right\rangle$$

One constraint that the complementizer *to* inherits from *comp-lxm* is that its FORM value is unified with that of its last argument. Note that *to* (unlike *that*) and its complement are both [FORM inf]. Hence *to* is a complementizer that selects as its second argument an infinitival VP with an element on its SPR list that is identified with the first argument of *to*. (*To* is like *be* in this respect.) *To* differs from *that* in requiring an element on its SPR list. But since *to* is like *that* in bearing the semantic specification [RESTR ⟨ ⟩], it follows that when *to* combines with its VP complement, only the latter contributes to the semantic restriction

of the resulting CP. Moreover, the VP's index is the same as *to*'s index and hence becomes the index of the CP that *to* heads.

With this complementizer added to our lexicon, our grammar rules and principles interact to license structures like the following:

(5)



12.3 The Verb *Continue*

Recall that the dummies *it* and *there*, as well as idiom chunks like *(close) tabs* or *(unfair) advantage*, have a restricted distribution – they occur only as subjects or objects of verbs that select them in those positions. What these NPs all have in common is that they are nonreferential – that is, they take 'none' as their value for MODE and INDEX. They are therefore inherently unsuited to play a role in any predication. Consequently, on semantic grounds, we have already explained the ungrammaticality of (6) and the fact that *it* must be referential in (7).

(6) a.
$$\text{*I hate} \begin{Bmatrix}\text{advantage} \\ \text{tabs} \\ \text{there}\end{Bmatrix}.$$

b. $*\left\{\begin{array}{l}\text{Advantage}\\ \text{tabs}\\ \text{there}\end{array}\right\}$ really affected us.

(7) a. I hate it.
b. It really affected us.

It might seem surprising, then, that there are some other verbs that allow subject NPs without referential indices. *Continue* is one such example:

(8) a. Sandy continues to eat oysters.
b. There continued to be riots in Freedonia.
c. It continues to bother me that Chris lied.
d. (Close) tabs continue to be kept on Bo by the FBI.
e. (Unfair) advantage continues to be taken of the refugees.

A nonreferential subject can occur with *continue* only if the verb within the infinitival CP is one that selects it.[2]

(9) a. *There continues to $\left\{\begin{array}{l}\text{eat oysters}\\ \text{bother me that Chris lied}\\ \text{be kept on Bo by the FBI}\\ \text{be taken of the refugees}\end{array}\right\}$.

b. *It continues to $\left\{\begin{array}{l}\text{eat oysters}\\ \text{be riots in Freedonia}\\ \text{be kept on Bo by the FBI}\\ \text{be taken of the refugees}\end{array}\right\}$.

c. *(Close) tabs continue to $\left\{\begin{array}{l}\text{eat oysters}\\ \text{be riots in Freedonia}\\ \text{bother me that Chris lied}\\ \text{be taken of the refugees}\end{array}\right\}$.

d. *(Unfair) advantage continues to $\left\{\begin{array}{l}\text{eat oysters}\\ \text{be riots in Freedonia}\\ \text{bother me that Chris lied}\\ \text{be kept on Bo by the FBI}\end{array}\right\}$.

The contrast between (8) and (9) suggests that the verb *continue* is in an intuitive sense transparent to the co-occurrence restrictions between the subject and the verb in its complement.

[2]The versions with *it* are, of course, acceptable on the irrelevant reading where *it* is referential.

We can capture this intuition by specifying that *continue* and its complement must have the same subject. We do this as we did earlier for the passive *be* and for the infinitival *to* above: the first element in *continue*'s ARG-ST list (the subject) will be identical to the SPR value of the second element in the ARG-ST list (the complement). Since the complement is a CP headed by *to*, the SPR value of the CP will be identical to the SPR value of the embedded VP. Hence the co-occurrence restrictions involving the nonreferential NPs will be transmitted from the verbs heading the infinitival VPs through *to* up to the subject of the verb *continue*.

Notice also that if we passivize the complement's verb, making the accompanying change in the subject of *continue*, the meaning of the sentence does not change. That is, examples (10a) and (10b) are essentially paraphrases.[3]

(10) a. The FBI continues to visit Lee.
b. Lee continues to be visited by the FBI.

In what follows, we will informally describe the relationship between pairs of sentences like (10a) and (10b) by saying that 'passivizing the complement verb' of the former yields the latter. The relationship is of course more complex, but it is convenient to have a simple way of referring to it, since we will use it as a diagnostic test.

The observation that passivizing the complement of *continue* does not change its meaning suggests that, semantically, *continue* takes only one argument – the situation of its CP complement – and predicates of it simply that it continues to be the case. Thus, both sentences in (10) mean that it continues to be the case that the FBI visits Lee. Crucially, the subject of *continue* is not assigned a role in the predication whose RELN is 'continue' (otherwise the nonreferential NPs we looked at above would be impossible as subjects of *continue*, since they have no index that can be assigned a role). All of this can be formalized by assigning the sentences in (10) a semantics like the following:

[3]We say 'essentially' because there are subtle differences in emphasis between the two sentences. The crucial test, for our purposes, is that there are no conceivable conditions under which one of the sentences would be true and the other would be false. This is the operational test we will use throughout to determine whether sentences do or do not mean the same thing.

(11)
$$\begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{continue}\\ \text{SIT} & s \\ \text{ARG} & t\end{bmatrix}, \begin{bmatrix}\text{RELN} & \text{visit}\\ \text{SIT} & t\\ \text{VISITOR} & i\\ \text{VISITED} & j\end{bmatrix}, \begin{bmatrix}\text{RELN} & \text{name}\\ \text{SIT} & u\\ \text{NAME} & \text{The FBI}\\ \text{NAMED} & i\end{bmatrix}, \begin{bmatrix}\text{RELN} & \text{name}\\ \text{SIT} & v\\ \text{NAME} & \text{Lee}\\ \text{NAMED} & j\end{bmatrix} \right\rangle \end{bmatrix}$$

Putting this together with our observation about the subject-sharing between *continue* and its complement, we may postulate the following lexical type, which is a kind of (i.e. an immediate subtype of) *verb-lxm*:[4]

(12) *subject-raising-verb-lxm* (*srv-lxm*):

$$\begin{bmatrix}\text{ARG-ST} & \left\langle \boxed{1}, \begin{bmatrix} \textit{phrase} & \\ \text{SPR} & \langle \boxed{1} \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

And in terms of this type, we can formulate the lexical entry for *continue*:

(13)
$$\left\langle \text{continue}, \begin{bmatrix} \textit{srv-lxm} & \\ \text{ARG-ST} & \left\langle [\ ], \overset{\text{CP}}{\begin{bmatrix}\text{FORM} & \text{inf}\\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{2}\end{bmatrix}\end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{continue}\\ \text{SIT} & s\\ \text{ARG} & \boxed{2}\end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

This analysis, where the lexeme *continue* inherits information not only from the type *srv-lxm* but also from the supertype *verb-lxm*, achieves the desired effects:

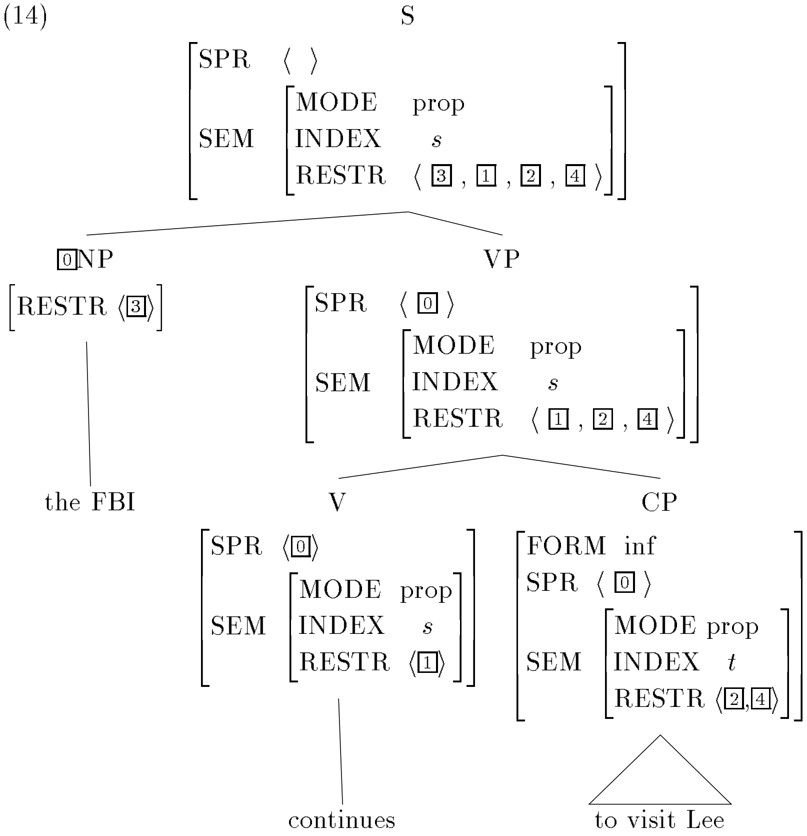
- the CP is the semantic argument of *continue*,
- the subject of *continue* is the subject of the CP complement.
- the subject of *continue* plays no role in the continue relation, and

[4]See footnote 6 for a brief discussion of the term 'subject raising'.

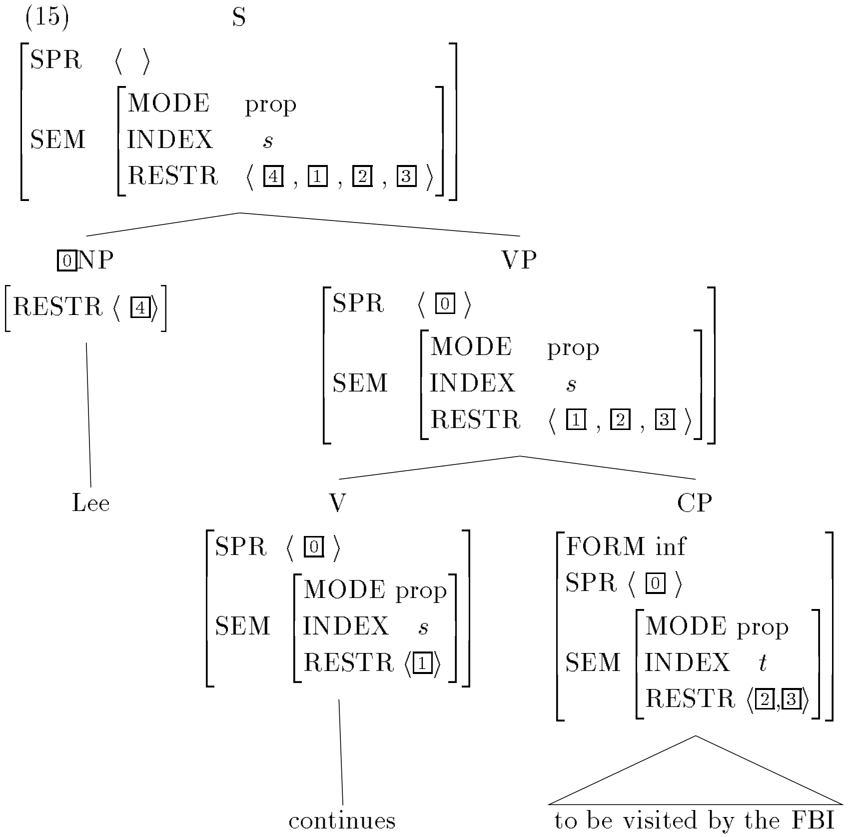
- as a result of the above points, the sentences in (10) both receive a semantic analysis equivalent to the one sketched in (11).

These properties are illustrated in (14) and (15); note that the tags $\boxed{1}$–$\boxed{4}$ refer to the same feature structure descriptions in (14)–(16):

(14)



(15)



Here the relevant predications are those given earlier and tagged appropriately in (16).

(16)
$$\begin{bmatrix}\text{MODE} & \text{prop}\\ \text{INDEX} & s\\ \text{RESTR} & \left\langle \boxed{1}\begin{bmatrix}\text{RELN} & \text{continue}\\ \text{SIT} & s\\ \text{ARG} & t\end{bmatrix}, \boxed{2}\begin{bmatrix}\text{RELN} & \text{visit}\\ \text{SIT} & t\\ \text{VISITOR} & i\\ \text{VISITED} & j\end{bmatrix}, \boxed{3}\begin{bmatrix}\text{RELN} & \text{name}\\ \text{SIT} & u\\ \text{NAME} & \text{The FBI}\\ \text{NAMED} & i\end{bmatrix}, \boxed{4}\begin{bmatrix}\text{RELN} & \text{name}\\ \text{SIT} & v\\ \text{NAME} & \text{Lee}\\ \text{NAMED} & j\end{bmatrix}\right\rangle\end{bmatrix}$$

The two semantic values are thus equivalent, differing only in the order of elements on the RESTR list, a matter of no semantic consequence.

12.4 The Verb *Try*

The analysis of the verb *continue* we just developed was motivated by two observations: (i) that *continue* is transparent to co-occurrence restrictions between its subject and its complement's verb; and (ii) that passivizing its complement had no essential semantic effect.

Turning to the superficially similar verb *try*, we see that it differs from *continue* with respect to both (i) and (ii). Thus the analogues to (8b–e), with nonreferential subjects, are systematically ill formed:

(17) a. Sandy tried to eat oysters.
b. *There tried to be riots in Freedonia.
c. *It tried to bother me that Chris lied.
d. *(Close) tabs try to be kept on Bo by the FBI.
e. *(Unfair) advantage tries to be taken of the refugees.

Likewise, the following two sentences are not synonymous:

(18) a. The FBI tried to find Lee.
b. Lee tried to be found by the FBI.

(18a) could be true under circumstances where (18b) would be false; indeed, it is quite likely that most people whom the FBI is trying to find are not trying to be found by them (or by anybody else!). Since the analysis of *continue* was designed to account for points (i) and (ii) above, it is clear that we need to analyze *try* quite differently.

Let us begin with the semantics of *try*. Unlike the continue relation, which takes only one semantic role (ARG, whose value is a situation), situations of trying involve two things: an individual (the entity that is trying) and some situation or state of affairs that the trier is trying to bring about. This is why the examples in (18) differ in meaning: the two triers are not the same. Notice also what the trier is trying to bring about always involves the trier. That is, it is not possible to express a meaning in which, say, what Kim is trying is for Sandy to visit Bo.[5] These remarks are synthesized in the following semantic structure for *Sandy tries to visit Bo*:

[5]Maybe you could force an interpretation on this, something like 'Kim tried to bring it about that Sandy visit Bo', but notice that in so doing you are coercing the interpretation of the complement to a meaning that does contain the trier. We will ignore such coercions here.

(19)
$$\begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{try} \\ \text{SIT} & s \\ \text{TRIER} & i \\ \text{ARG} & t \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{visit} \\ \text{SIT} & t \\ \text{VISITOR} & i \\ \text{VISITED} & j \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & u \\ \text{NAME} & \text{Sandy} \\ \text{NAMED} & i \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & v \\ \text{NAME} & \text{Bo} \\ \text{NAMED} & j \end{bmatrix} \right\rangle \end{bmatrix}$$

Semantic structures like this immediately rule out the use of nonreferential subjects (i.e. dummies and idiom chunks) with *try*. This is because the subject position of *try* always corresponds to a semantic argument slot, namely, TRIER. Since nonreferential NPs have no INDEX feature, it follows that there can be no semantics for examples like (17b–e) – the index of the TRIER cannot be unified with the subject NP's index.

Verbs like *continue*, on the other hand, can take nonreferential subjects, as we saw in the previous section, because their subjects do not correspond to semantic argument slots. This is the critical difference between what are referred to as 'raising' verbs and 'control' verbs.[6] We represent this difference formally by assigning the index of the subject to a role in the semantics of control verbs, but not of raising verbs.

As before, we will want to use lexical types to express constraints general to this class of verbs. So we will want to introduce another subtype of *verb-lxm* like the one shown in (20):

(20) *subject-control-verb-lxm* (*scv-lxm*):

$$\begin{bmatrix} \text{ARG-ST} & \left\langle \text{NP}_i\ ,\ \begin{bmatrix} \textit{phrase} & \\ \text{FORM} & \text{inf} \\ \text{SPR} & \langle\ \text{NP}_i\ \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

And the following lexical entry for *try*, taken together with the constraints it inherits from its various types, accounts for the facts we have been considering:

[6] These perhaps non-mnemonic terms reflect commonly used terminology in the field. They derive from the analysis of this distinction that was developed in standard theory transformational grammar (see Appendix B).

(21)
$$\left\langle \text{try}\ ,\ \begin{bmatrix} \textit{scv-lxm} & \\ \text{ARG-ST} & \left\langle [\ ]_i\ ,\ \overset{\text{CP}}{\begin{bmatrix} \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{try} \\ \text{SIT} & s \\ \text{TRIER} & i \\ \text{ARG} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

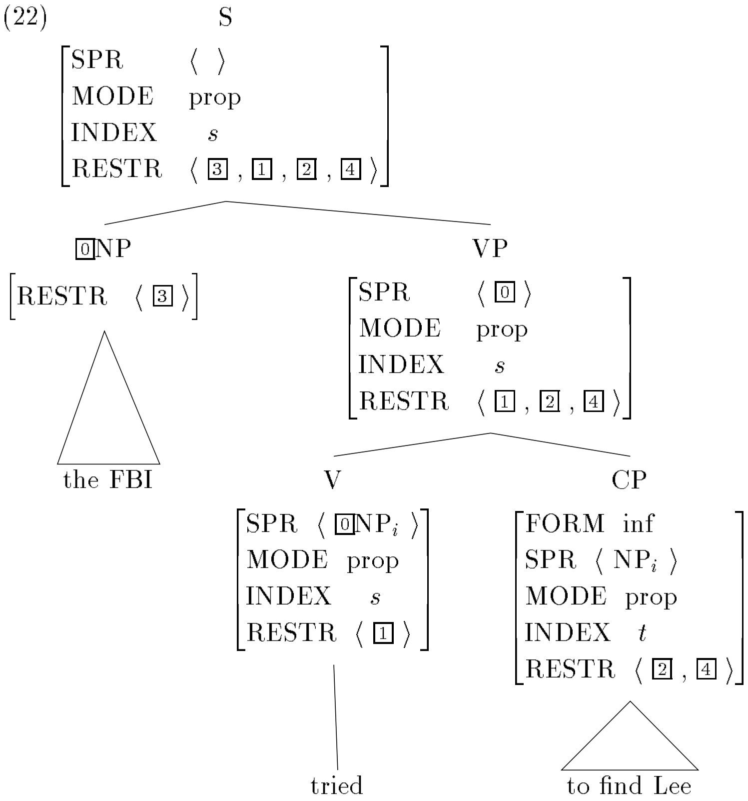
Note that the first argument of *try* and the subject of the CP are not unified. Rather, only their indices must be identical. This difference in the formal analysis of raising verbs and control verbs has not yet been motivated. The unification analysis is necessary for raising verbs, because *continue* accepts a nonreferential subject just in case that subject satisfies the co-occurrence restrictions imposed by the CP complement. But we have given no argument for using coindexing rather than unification to express the relation between the subject and the complement's subject with control verbs. Such an argument is provided in Problem 5 of this chapter.

Our analysis of control verbs like *try* ensures:

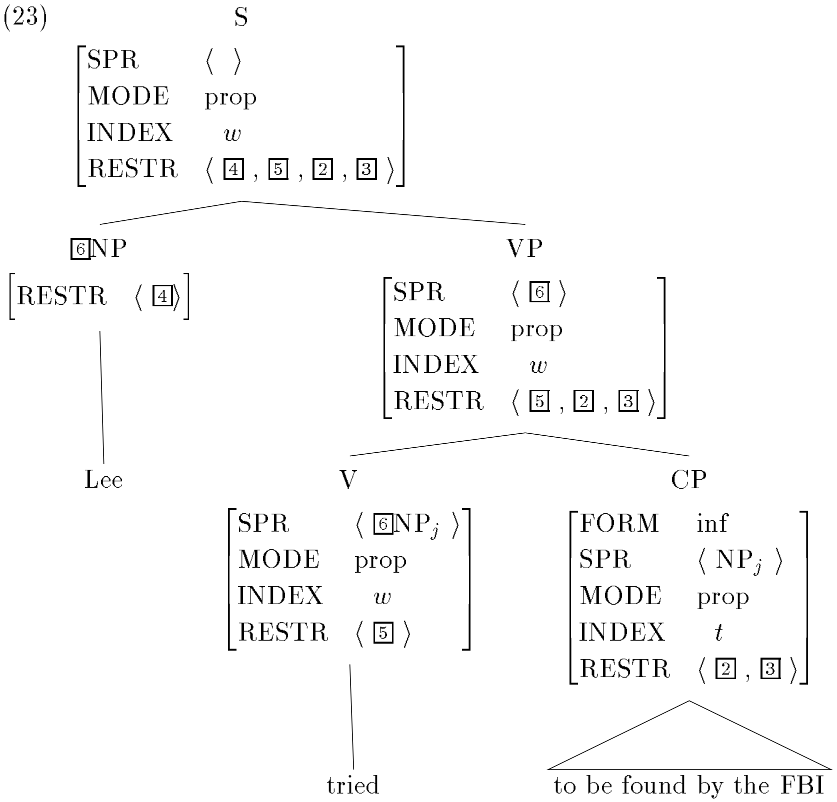
- that the subject of *try* is assigned to the TRIER role; and hence
- that nonreferential NPs can never be the subject of *try*;
- that the infinitival complements can never be of a kind that requires a nonreferential subject (because they must have an index identified with the trier); and
- that (18a) and (18b) have different meanings (because in one case the FBI is the trier and in the other, Lee is).

This analysis is illustrated in the following pair of SDs.

(22)



(23)



The first of these has the semantics shown in (24).

(24)
$$\begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \boxed{3}\begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & u \\ \text{NAME} & \text{The FBI} \\ \text{NAMED} & i \end{bmatrix}, \boxed{1}\begin{bmatrix} \text{RELN} & \text{try} \\ \text{SIT} & s \\ \text{TRIER} & i \\ \text{ARG} & t \end{bmatrix}, \right. \\ & \left. \boxed{2}\begin{bmatrix} \text{RELN} & \text{find} \\ \text{SIT} & t \\ \text{FINDER} & i \\ \text{FOUND} & j \end{bmatrix}, \boxed{4}\begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & v \\ \text{NAME} & \text{Lee} \\ \text{NAMED} & j \end{bmatrix} \right\rangle \end{bmatrix}$$

In contrast, the sentence with the passive complement in (23) has the semantics given in (25), where the trier is j, the index of Lee, not the FBI.

(25)
$$\begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & w \\ \text{RESTR} & \left\langle \begin{array}{l} \boxed{4}\begin{bmatrix}\text{RELN} & \text{name}\\ \text{SIT} & v \\ \text{NAME} & \text{Lee}\\ \text{NAMED} & j\end{bmatrix}, \boxed{5}\begin{bmatrix}\text{RELN} & \text{try}\\ \text{SIT} & w \\ \text{TRIER} & j\\ \text{ARG} & t\end{bmatrix}, \\ \boxed{2}\begin{bmatrix}\text{RELN} & \text{find}\\ \text{SIT} & t \\ \text{FINDER} & i\\ \text{FOUND} & j\end{bmatrix}, \boxed{3}\begin{bmatrix}\text{RELN} & \text{name}\\ \text{SIT} & u \\ \text{NAME} & \text{The FBI}\\ \text{NAMED} & i\end{bmatrix} \end{array} \right\rangle \end{bmatrix}$$

By positing a lexical distinction between raising and control verbs in the hierarchy of lexemes, we thus correctly account for their differing properties without adjusting our grammar rules or any other aspect of our theory.

12.5 Subject Raising and Subject Control

The verbs *continue* and *try* are not arbitrarily chosen examples: each one is representative of a class of verbs that share the properties we have been discussing. Subject raising verbs (or sometimes just 'raising' verbs) like *continue* express properties (relations of one argument) of propositions, allow nonreferential subjects (so long as their complements are compatible with them), and don't change meaning when their complements are passivized. Control verbs (sometimes also known as 'subject control' or 'equi' verbs) like *try* express a relation between an individual and a situation (referred to via its situational index), never take nonreferential subjects, and can induce a change of meaning when their complements are passivized.

In fact, it is not just verbs that can be divided into these two classes; there are also raising adjectives and control adjectives. They are exemplified in (26), with the diagnostic properties illustrated in (27)–(29).[7]

(26) a. Pat is likely to scream.
b. Pat is eager to scream.

(27) a. There is likely to be a letter in the mailbox.
b. It is likely to upset Pat that Chris left.
c. Tabs are likely to be kept on participants.
d. Advantage is likely to be taken of unwary customers.

[7] Here we use the symbol '$\approx$' to indicate sameness of truth conditions, and '$\neq$' to indicate difference of truth conditions.

(28) a. The doctor is likely to examine Pat. $\approx$ Pat is likely to be examined by the doctor.
b. The doctor is eager to examine Pat. $\neq$ Pat is eager to be examined by the doctor.

(29) a. *There is eager to be a letter in the mailbox.
b. *It is eager to upset Pat that Chris left.
c. *Tabs are eager to be kept on participants.
d. *Advantage is eager to be taken of unwary customers.

This suggests that our system of lexical types should be somewhat more abstract (perhaps introducing a type like *subject-raising-lxm* as a supertype of *srv-lxm* and a similar type of adjectival lexeme), in order to accommodate generalizations that cut across the various part of speech distinctions such as verb vs. adjective.[8] Even the lexical entry for the infinitival complementizer *to* given at the beginning of this chapter could be simplified, if *to* were classified in terms of a cross-categorial type such as *subject-raising-lxm*.

Problem 1: Lexical Entries
Provide lexical entries for the raising and control adjectives *likely* and *eager*. Be as detailed as you need to be to represent the distinctions that account for the differences in their behavior discussed above. This should include discussing the role of *be* in mediating the relationship between these adjectives and their subjects. Do not assume the existence of a *subject-raising-lxm* type, unless you are prepared to give a precise characterization of that type.

Problem 2: Classifying Predicates

A. Classify the following verbs as raising or control. Give as many distinct tests as you can to justify your classifications, constructing three or four interestingly different examples for each verb.
- tend
- condescend
- manage
- fail
- happen

[8] This matter is taken up again in Chapter 16.

Make sure you restrict your attention to cases of the form: NP V *to* VP. That is, ignore cases like *Kim manages a store*, *Carrie failed physics*, and any other valence that doesn't resemble the *continue* vs. *try* pattern.

B. Classify the following adjectives as raising or control. Justify your classifications, constructing three or four interestingly different relevant examples for each adjective.
   - anxious
   - apt
   - certain
   - lucky

   Make sure you restrict your attention to cases of the form: NP *be* Adj *to* VP. That is, ignore cases like *Kim is anxious about the exam*, *Carrie is certain of the answer*, and any other valence that doesn't resemble the *likely* vs. *eager* pattern.

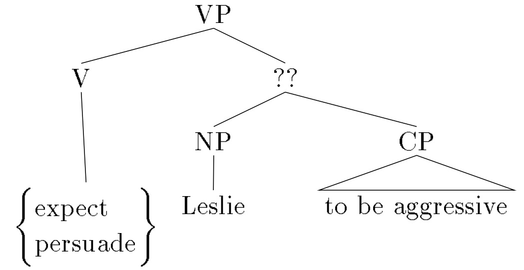
12.6 Object Raising and Object Control

Consider now two new verbs: *expect* and *persuade*. These two verbs are similar in that both can occur in examples like the following.

(30) a. I expected Leslie to be aggressive.
 b. I persuaded Leslie to be aggressive.

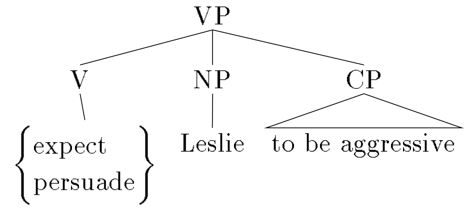
There are two possible analyses one could imagine for these verbs. There could be some kind of phrase that includes both the NP and the infinitival CP *to be aggressive*, as in:

(31)



Alternatively, it is possible that the NP is the direct object of the verb and the infinitival CP is also a complement of the verb:

(32)



But in fact, only the latter structure is consistent with the analyses of other phenomena presented in earlier chapters.

Problem 3: Justifying the Structure

Use passivization to justify the choice of the structure in (32) over the alternative in (31).[9]

The difference between *expect* and *persuade* in structures like (32) is analogous to the distinction we just drew between *continue* and *try*. *Expect* is an example of what is usually called an 'object raising' verb (or 'subject-object raising' verb) and *persuade* is an 'object control' (or 'object equi') verb. Hence we will want to introduce the two types in (33) with the indicated constraints and then provide lexical entries for *expect* and *persuade* like the ones shown in (34).

(33) a. *object-raising-verb-lxm* (*orv-lxm*):

$$\left[\text{ARG-ST} \left\langle \text{NP}\ ,\ \boxed{1}\ ,\ \begin{bmatrix} \textit{phrase} & \\ \text{SPR} & \langle \boxed{1} \rangle \end{bmatrix} \right\rangle \right]$$

b. *object-control-verb-lxm* (*ocv-lxm*):

$$\left[\text{ARG-ST} \left\langle \text{NP}\ ,\ \text{NP}_i\ ,\ \begin{bmatrix} \textit{phrase} & \\ \text{SPR} & \langle\ \text{NP}_i\ \rangle \end{bmatrix} \right\rangle \right]$$

[9] Again, make sure you ignore all cases of finite CP complements, e.g. *persuade NP that ...* or *expect that ...* and anything else not directly relevant. So ignore sentences like *I expect to go*, *I am expecting Kim*, and *She is expecting*.

(34) a.

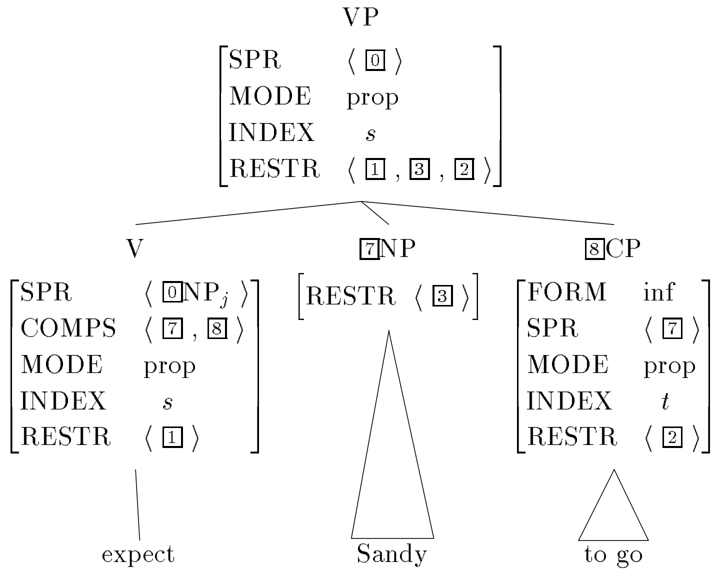
$$\left\langle \text{expect} , \begin{bmatrix} \textit{orv-lxm} & \\ \text{ARG-ST} & \left\langle [\ ]_j , [\ ] , \overset{\text{CP}}{\begin{bmatrix} \text{FORM} & \text{inf} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{expect} \\ \text{SIT} & s \\ \text{EXPECTER} & j \\ \text{ARG} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

b.

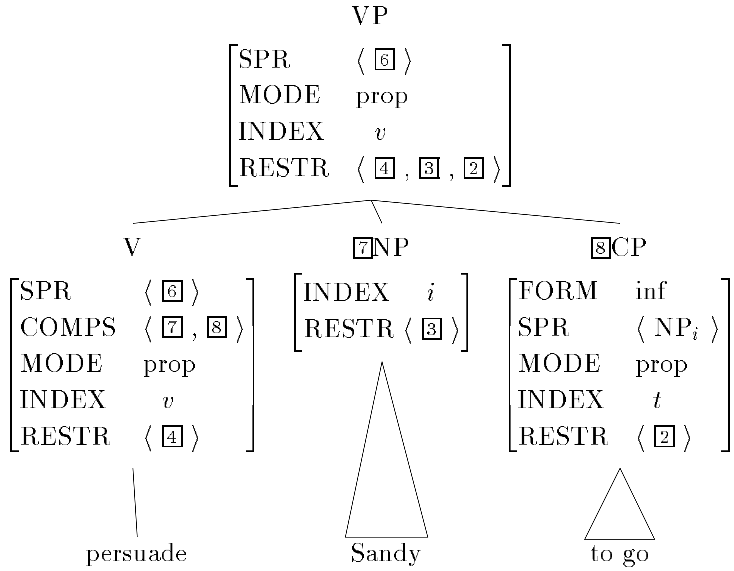
$$\left\langle \text{persuade} , \begin{bmatrix} \textit{ocv-lxm} & \\ \text{ARG-ST} & \left\langle [\ ]_j , [\ ]_i , \overset{\text{CP}}{\begin{bmatrix} \text{FORM} & \text{inf} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{persuade} \\ \text{SIT} & s \\ \text{PERSUADER} & j \\ \text{PERSUADEE} & i \\ \text{ARG} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

The words derived from these lexemes will then give rise to SDs like the following.

(35)



(36)



And the semantic analyses associated with these SDs are as shown in (37) and (38).

$$(37)\ \left[\begin{array}{ll} \text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \boxed{1}\left[\begin{array}{ll}\text{RELN} & \text{expect}\\ \text{SIT} & s \\ \text{EXPECTER} & j \\ \text{ARG} & t\end{array}\right], \boxed{3}\left[\begin{array}{ll}\text{RELN} & \text{name}\\ \text{SIT} & u\\ \text{NAME} & \text{Sandy}\\ \text{NAMED} & i\end{array}\right], \boxed{2}\left[\begin{array}{ll}\text{RELN}&\text{go}\\ \text{SIT} & t\\ \text{GOER} & i\end{array}\right]\right\rangle \end{array}\right]$$

$$(38)\ \left[\begin{array}{ll} \text{MODE} & \text{prop} \\ \text{INDEX} & v \\ \text{RESTR} & \left\langle \boxed{4}\left[\begin{array}{ll}\text{RELN} & \text{persuade}\\ \text{SIT} & v \\ \text{PERSUADER} & j \\ \text{PERSUADEE} & i \\ \text{ARG} & t\end{array}\right], \boxed{3}\left[\begin{array}{ll}\text{RELN} & \text{name}\\ \text{SIT} & u\\ \text{NAME} & \text{Sandy}\\ \text{NAMED} & i\end{array}\right], \boxed{2}\left[\begin{array}{ll}\text{RELN}&\text{go}\\ \text{SIT} & t\\ \text{GOER} & i\end{array}\right]\right\rangle \end{array}\right]$$

Problem 4: ***Expect*** **vs.** ***Persuade***

We have just sketched an analysis of the verbs *expect* and *persuade* without providing justification for the fundamental distinction between the two types of lexeme we have posited. The purpose of this problem is to make you construct the arguments that underlie the proposed distinction between *orv-lxm* and *ocv-lxm*.[10]

A. Construct relevant examples with dummy *there* to support the proposed distinction.

B. Construct relevant examples with dummy *it* to support the proposed distinction.

[10] Again, make sure you ignore all irrelevant uses of these verbs, including cases of finite CP complements, e.g. *persuade NP that ...* or *expect that ...* and anything else not directly relevant (*I expect to go*, *I am expecting Kim*, *She is expecting*, and so forth).

C. Construct relevant examples to support the proposed distinction involving sentences containing parts of idioms.

D. Construct examples to support the proposed distinction involving paraphrase relations (or the lack thereof) between relevant pairs of sentences containing active and passive complements.

Problem 5: Icelandic, Again

As noted in an earlier problem, Icelandic has verbs that assign idiosyncratic cases to their subjects. Thus we get contrasts like the following (where other case markings on the subjects are unacceptable):

(i) *Hun er vinsael.*
She-NOM is popular

(ii) *Hana vantar peninga.*
Her-ACC lacks money

(iii) *Henni batanadi veikin.*
Her-DAT recovered-from the-disease

In infinitival constructions, two patterns are observed (again, other case markings on the subjects are unacceptable):

(iv) *Eg vonast til ad vanta ekki peninga*
I-NOM hope for to lack not money

(v) *Eg vonast til ad batnad veikin*
I-NOM hope for to recover-from the-disease

(vi) *Hana virdist vanta peninga.*
Her-ACC seems to-lack money

(vii) *Henni virdist hafa batnad veikin.*
Her-DAT seems to-have recovered-from the-disease

Use these examples to argue for a distinction between control and raising verbs in Icelandic, and explain how our analysis of the distinction accounts for the two patterns.

Problem 6: There, There....

In an earlier problem, you were asked to develop an analysis of verb agreement in sentences with *there* as the subject. Simplifying somewhat, finite forms of *be* that take *there* as their subject agree in number with the NP following *be*. This could be formalized in either of two ways:

- the relevant lexical entries for *is*, *are*, *was*, and *were* could stipulate the value of the NUM feature of the second element of their ARG-ST list; or
- the entry for the lexeme *be* could stipulate that the NUM value on *there* was the same as the NUM value on the second element of the ARG-ST list (and this basic entry would then undergo the normal inflectional lexical rules).

Both analyses cover the data in simple *there* sentences.

A. Explain how each analysis covers the data in simple *there* sentences.

The two analyses make different predictions, however, with regard to the interaction of *there* with raising.

B. Discuss the relevance of the following data for choosing between the two competing analyses of *there*-sentences:

(i) There continues to be a bug in my program.
(ii)*There continue to be a bug in my program.

Problem 7: Reflexives in Infinitival Complements

In Problem 4 above, you justified our analysis of *expect* and *persuade*.

A. Does that analysis, together with the analysis of reflexive and pronoun binding we developed in Chapter 7 account for the following contrasts?

(i) We expect the doctor to examine us.
(ii)*We expect the doctor to examine ourselves.
(iii) We expect them to examine themselves.
(iv)*We expect them$_i$ to examine them$_i$.
(v) We persuaded the doctor to examine us.
(vi)*We persuaded the doctor to examine ourselves.
(vii) We persuaded them to examine themselves.
(viii)*We persuaded them$_i$ to examine them$_i$.

Explain clearly why or why not.

(B) Consider the following contrasts.

(i) They appeared to us to support themselves.
(ii)*They$_i$ appeared to us to support them$_i$.
(iii)*They appealed to us to support themselves.
(iv) They$_i$ appealed to us to support them$_i$.

Develop an analysis of *appear* and *appeal* (that fits with our binding theory) that explains these contrasts. Do not worry too much

about the details of the type hierarchy your analysis will require; it is sufficient to give the lexical entries needed for the lexemes *appeal* and *appear* and to explain how these interact with binding theory and other aspects of our grammar to explain the relevant data.

12.7 Further Reading

The raising/control distinction was first introduced into the generative literature (but with different terminology) by Chomsky (1965) and Rosenbaum (1967). Other discussions of these phenomena include Jackendoff (1972), Postal (1974), Bach (1979), Bresnan (1982c), and Sag and Pollard (1991).

13

Auxiliary Verbs

13.1 Introduction

In this chapter, we investigate the English auxiliary verb system. This is one of the most extensively analyzed (and frequently reanalyzed) empirical domains in the literature on generative syntax. Chomsky's transformational treatment of auxiliaries in *Syntactic Structures* was immensely influential; it galvanized the field in support of transformational grammar. In the intervening four decades, numerous alternative treatments have been advanced within a wide range of theoretical frameworks.

The auxiliary verb system is a particularly attractive domain for syntacticians because it involves a relatively small number of elements (basically, just a handful of verbs and the word *not*) which interact with each other in intricate and apparently complex ways. Moreover, though the English auxiliary system is quite language-specific (even closely related languages like Dutch and French have verbal systems that behave very differently), there are analogous elements in many other languages. Thus, this is a fertile domain for examining the interaction of universal grammatical principles with language-specific variation.

Cross-linguistically, the elements that are called 'auxiliaries' tend to share the following semantic and syntactic characteristics: (i) they express notions of time (past, present, future; continuation, completion), necessity, possibility, obligation, permission, negation, or questioning; and (ii) they occur in fixed positions in sentences, usually at or near the beginning or end. English auxiliaries are a special kind of verb, including what are called 'modals' (*can, could, may, might, must, shall, should, will, would*), and uses of *be, do,* and *have* as 'helping verbs'.

Our analysis treats auxiliaries as a special kind of subject raising verb, an idea originally proposed by J. R. Ross in the 1960s. We proceed from this basis to show how the special properties of auxiliaries with respect to such phenomena as negation and questioning can be handled in terms of syntactic features, and how the relevant generalizations about them can be expressed in terms of lexical rules.

13.2 Basic Facts about Auxiliaries

Consider the following data:

(1) Pat tap-danced.

(2) a. Pat can tap-dance.
 b. *Pat can $\left\{\begin{array}{l}\text{tap-danced}\\ \text{tap-dancing}\end{array}\right\}$.
 c. Pat is tap-dancing.
 d. *Pat is $\left\{\begin{array}{l}\text{tap-dance}\\ \text{tap-danced}\end{array}\right\}$.
 e. Pat has tap-danced.
 f. *Pat has $\left\{\begin{array}{l}\text{tap-dance}\\ \text{tap-dancing}\end{array}\right\}$.

(3) a. Pat could have tap-danced.
 b. Pat could be tap-dancing.
 c. Pat has been tap-dancing.
 d. Pat could have been tap-dancing.
 e. *Pat has could tap-danced.
 f. *Pat is having tap-danced.
 g. *Pat could be having tap-danced.

(4) a. *Pat could will tap-dance.
 b. *Pat has had tap-danced.
 c. *Pat is being tap-dancing.

These examples illustrate the following generalizations about auxiliary verbs:[1]

(5) a. Auxiliaries are optional.
 b. Auxiliaries determine the FORM of the following verb.
 c. Auxiliaries can co-occur with each other, but only in a fixed order.
 d. Auxiliaries (of any given type) cannot iterate.

[1] In some dialects of English,certain sequences of modals, such as in *Pat might could tap-dance* are possible, apparently violating (5d). However, even in those dialects, such sequences are restricted to certain combinations. This suggests that the variation should be handled in terms of differences in individual lexical entries (e.g. in their lexical types or in their possible FORM values), rather than through a wholly different analysis of modals as a class. Investigating this dialect variation is beyond the scope of this book.

We find in the literature two basic approaches to the analysis of English auxiliaries. The first, going back to Chomsky's original treatment, involves introducing a new (phrasal) category called AUX which dominates all auxliary verbs. AUX is expanded with a rule something like the following:[2]

(6) AUX $\rightarrow$ (M)(PERF)(PROG).

This approach has the attractive feature that it straightforwardly captures the optionality, the ordering, and the non-iterability of auxiliaries – that is, the properties listed in (5a, c, d). On the other hand, it doesn't say anything about the FORM dependencies – so it needs augmentation if it is to rule out the starred alternatives in (2).

The other type of analysis treats auxiliaries as verbs that take VP complements. This has the immediate advantage that it provides the tools for restricting the FORM value of the head of the following VP. Its potential disadvantage is that the mechanisms expressing the ordering and iteration constraints are somewhat less direct.

The second approach fits much better with the grammar we have been developing. This is because the AUX constituent doesn't seem to have a head, so it isn't clear how to fit it in with our phrase structure rules or with our way of handling co-occurrence restrictions such as the FORM dependencies between auxiliaries. In what follows, we will pursue the VP complement analysis of auxiliary verbs. In fact, as will become clear below, this treatment can be incorporated into our grammar without assuming any new grammar rules – all the essential information will be in the lexical entries for auxiliary verbs.

13.2.1 Lexical Entries for Auxiliary Verbs

We have already seen one auxiliary verb's entry, namely, the verb *be*. We will use this as a model for the others and then return to the issues of ordering and iteration.

The entry for *be* that we originally used for the passive was generalized in Chapter 11 to cover other uses of *be*, including the progressive. The entry we gave for *be* (which was intended to cover its co-occurrence with both passive and progressive VP complements) was the following:

[2] 'M' in (6) stands for 'modal', 'PERF' for 'perfective', and 'PROG' for 'progressive'. The latter two are fairly standard terms for the uses of *have* and *be* under discussion.

(7)

$$\left\langle \text{be}\ , \left[\begin{array}{ll} \textit{be-lxm} & \\ \text{ARG-ST} & \left\langle \boxed{1}\ , \left[\begin{array}{ll} \text{SYN} & \left[\begin{array}{ll}\text{HEAD} & \left[\text{PRED} \ \ +\right] \\ \text{SPR} & \langle \boxed{1} \rangle\end{array}\right] \\ \text{SEM} & \left[\text{INDEX} \ \ \boxed{2}\right]\end{array}\right] \right\rangle \\ \text{SEM} & \left[\begin{array}{ll}\text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \rangle\end{array}\right]\end{array}\right] \right\rangle$$

Recall that the specification [PRED +] distinguishes predicative phrases (certain APs, PPs, and NPs, as well as passive and present participial VPs) from other phrases. (See section 2 of Chapter 11.)

Note that (7) clearly bears a close resemblance to the type *srv-lxm*, which we introduced in Chapter 12. Thus instead of listing such shared properties in the lexical entries of *be* and the other auxiliary verbs, we posit a new subtype of *srv-lxm*, which we will call *auxv-lxm*.

In the analyses of negation, inversion, contraction, and ellipsis given below, we make use of a HEAD feature AUX to distinguish auxiliary verbs from all others. The constraint needed for the type *auxv-lxm* is thus minimally the following:

(8)

$$\textit{auxv-lxm}\text{:} \left[\text{SYN} \ \ \left[\text{HEAD} \ \ \left[\text{AUX} \ \ +\right]\right]\right]$$

Once the type *auxv-lxm* is part of the lexical type hierarchy, the type *be-lxm* can then be eliminated in favor of a simpler analysis where *be* is assigned to the type *auxv-lxm*. This allows us to simplify the lexical entry of *be*, relying on inheritance to express further properties that *be* shares with other lexemes. Thus the lexical entry specified in (9) is enriched to (10) through constraint inheritance.

(9)

$$\left\langle \text{be}\ , \left[\begin{array}{ll} \textit{auxv-lxm} & \\ \text{ARG-ST} & \left\langle [\ \ ]\ , \left[\begin{array}{ll} \text{SYN} & \left[\text{HEAD} \ \ \left[\text{PRED} \ \ +\right]\right] \\ \text{SEM} & \left[\text{INDEX} \ \ \boxed{2}\right]\end{array}\right] \right\rangle \\ \text{SEM} & \left[\begin{array}{ll}\text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \rangle\end{array}\right]\end{array}\right] \right\rangle$$

(10)

$$\left\langle \text{be}\ , \left[\begin{array}{ll} \textit{auxv-lxm} & \\ \text{SYN} & \left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\textit{verb} & \\ \text{AUX} & +\end{array}\right] \\ \text{SPR} & \langle [\ \ ] \rangle\end{array}\right] \\ \text{ARG-ST} & \left\langle \boxed{3}\ , \left[\begin{array}{ll} \text{SYN} & \left[\begin{array}{ll}\text{HEAD} & \left[\text{PRED} \ \ +\right] \\ \text{SPR} & \langle \boxed{3} \rangle\end{array}\right] \\ \text{SEM} & \left[\text{INDEX} \ \ \boxed{2}\right]\end{array}\right] \right\rangle \\ \text{SEM} & \left[\begin{array}{ll}\text{MODE} & \text{prop} \\ \text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \rangle\end{array}\right]\end{array}\right] \right\rangle$$

And the entry for auxiliary *have* will look something like this:

(11)

$$\left\langle \text{have}\ , \left[\begin{array}{ll} \textit{auxv-lxm} & \\ \text{ARG-ST} & \left\langle [\ \ ]\ , \left[\begin{array}{ll} \text{SYN} & \left[\text{HEAD} \ \ \left[\begin{array}{ll}\textit{verb} & \\ \text{FORM} & \text{psp}\end{array}\right]\right] \\ \text{SEM} & \left[\text{INDEX} \ \ \boxed{3}\right]\end{array}\right] \right\rangle \\ \text{SEM} & \left[\begin{array}{ll}\text{INDEX} & s \\ \text{RESTR} & \left\langle \left[\begin{array}{ll}\text{RELN} & \text{have} \\ \text{SIT} & s \\ \text{ARG} & \boxed{3}\end{array}\right] \right\rangle\end{array}\right]\end{array}\right] \right\rangle$$

This entry differs from (9) in two essential ways: first, the complement (i.e. the second element of ARG-ST) must be a VP headed by a past participle (indicated with the specification [FORM psp]); second, the semantics of auxiliary *have*, unlike that of *be*, is not vacuous. The form of the complement and the meaning are, in fact, what distinguishes *have* from other auxiliary verbs in English. Again, no constraint needs to be stated in (11) to identify the first element of the ARG-ST list with the VP complement's SPR value, as this information is inherited from the supertype *srv-lxm*.

The modals have a peculiarity, illustrated by the following examples, that should be represented in our lexical entry.

(12) a. *Pat hopes to can study syntax.

b. *Sandy has musted study syntax.

These examples show that modals don't have entries with [FORM inf] or [FORM psp]. In fact, the only contexts in which modals can occur are ones where we normally expect finite verbs. Notice, by the way, that this restriction appears not to be semantically based, since appropriate forms of *be able to* (which is virtually synonymous with *can*) are fine in these contexts. So our entry for a modal could look like (13).

(13)
$$\left\langle \text{can}\ ,\ \begin{bmatrix} \textit{auxv-lxm} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \left\langle [\ ]\ ,\ \begin{bmatrix}\text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{FORM} & \text{inf}\end{bmatrix}\end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{2}\end{bmatrix}\end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{can} \\ \text{SIT} & s \\ \text{ARG} & \boxed{2}\end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

Notice that unlike most lexemes of type *verb*, (13) specifies a FORM value. The FORM values that we use for verbs (e.g. fin, psp) are, in most cases, introduced into lexical entries by inflectional rules like the Past-Tense Verb Lexical Rule or the Passive Lexical Rule. The stipulation that the lexeme *can* is [FORM fin] means that it cannot serve as the input to any lexical rule that introduces another FORM value, since the output FORM value would fail to unify.

Problem 1: Modals and Imperatives

Explain in detail why modals cannot occur in imperatives, as illustrated by the following:

(i)*Can solve all the problems! (cf. Be able to solve all the problems!)

Before we look at the ordering and iteration constraints on auxiliaries, notice that our analysis entails that auxiliaries are treated semantically like raising verbs. That is, they assign no semantic role to their subjects; rather, the subject of an auxiliary verb gets its semantic role – and various syntactic properties – from the complement of the auxiliary. Given this, our analysis makes predictions regarding the possibility of auxiliaries occurring in sentences with dummy subjects or idiom chunk subjects. Specifically, we correctly predict that sentences like the following are grammatical:

(14) a. There might be a unicorn in the garden.
b. There has been a unicorn in the garden.
c. It will annoy people that dogs are barking.
d. It is annoying people that dogs are barking.
e. Tabs have been kept on Pat by the FBI.
f. Tabs are being kept on Pat by the FBI.

We also predict that there is no difference in truth conditions between *A doctor must have been examining Pat* and *Pat must have been being examined by a doctor*. This also seems correct.

13.2.2 Co-Occurrence Constraints on Auxiliaries

Some of the facts we noticed earlier about the ordering among auxiliaries and the constraints on their iteration fall out naturally from our lexical entries. Others require some work.

- The fact that modals must come first in any string of auxiliaries follows from the fact that they only have finite entries. Since the complements to the auxiliaries *have* and *be* must have some FORM specification other than finite (namely, psp, prp, or pass), modals can't head complements to *have* or *be*.
- The fact that modals don't iterate also follows from their obligatory finiteness, together with the requirement that the head of the complement to a modal must be [FORM inf].
- The fact that perfective *have* can't follow progressive *be* can be seen as a manifestation of a wider generalization. Not all verbs can appear in the progressive. Specifically, verbs (often referred to as 'stative' verbs) whose semantics involves a state rather than an action or an activity, generally sound bad in the progressive:

  (15) a. *Pat is owning a house.
  b. *Chris is knowing the answer.

  This is pretty clearly a semantic restriction: making something progressive turns an action or activity into a state, namely, the state of that action or activity being in progress; for stative verbs such as *own* or *know*, it doesn't make sense to talk about the state being in progress. The perfective *have* is also used to denote states, namely, the state of completion for whatever its complement VP denotes. Since stative verbs don't have progressives, the perfective *have* doesn't either. Hence (16) is unacceptable for the same reason as (15).

(16)*Pat is having slept.

We will not attempt to formalize this restriction in our lexical entry, since it depends on dealing with aspects of semantics that go beyond the scope of this text.

- The same semantic restriction accounts for the failure of progressive *be* to iterate, since it, too, denotes a state, and hence can't be the complement to another occurrence of progressive *be*, ruling out (17).[3]

  (17)*Chris is being sleeping.

  Again, we'll leave the formalization of this to the semanticists.
- Finally, the failure of perfective *have* to iterate cannot be handled in just the same way as the last two restrictions, since stative verbs can occur in the perfective. We could stipulate that perfective *have* is an exception to the Past-Participle Lexical Rule. This would entail that it doesn't have a past participle entry, so it couldn't appear as the head of the VP complement to another occurrence of perfective *have*. Alternatively, we could try to find a semantic explanation, for example, that iterating perfective *have* would be redundant. For now, we will not choose between these analyses.

13.3 The NICE Properties

English auxiliary verbs differ from other verbs in (at least) four ways:

(18) a. NEGATION: They can be immediately followed by *not* as a way of negating the sentence.
b. INVERSION: They can precede the subject in questions.
c. CONTRACTION: They have contracted forms created with the suffix *n't*.
d. ELLIPSIS: Their complements can be omitted when the meaning of the missing complement can be reconstructed from the surrounding linguistic context.

[3]This is simplified in a number of respects. In particular, given the kind of semantic analysis we developed for inflected verbs in Chapter 8, the progressive participle (like other inflected forms) will be assigned a semantics with two predications on its RESTR list. The first is the predication that is lexemically specified and whose situation is embedded as an argument of the second predication, which introduces the progressive meaning. The semantic incompatiblity discussed in the text thus really arises from the fact that the situation of the progressive predication can't be the argument of another progressive predication. We will not work out the details of this analysis here, though they are straightforward.

These are sometimes called the 'NICE' properties of auxiliaries. They are illustrated in the following examples.[4]

(19) a. Pat should not leave.
b. *Pat raked not leaves.

(20) a. Has Pat left town?
b. *Left Pat town?

(21) a. They haven't cut the price.
b. *They cutn't the price.
c. *They halven't the price.

(22) a. If anybody is spoiling the children, Pat is.
b. *If anybody keeps spoiling the children, Pat keeps.

Our analysis of these differences will be purely lexical in nature. It will make use of a handful of features (including AUX) and a small set of lexical rules.

13.4 Auxiliary *Do*

Notice that the negative, interrogative, or elliptical counterparts to sentences with no auxiliary verb are usually expressed with the verb *do*:

(23) a. Pat raked leaves.
b. Pat did not rake leaves.

(24) a. Pat left town.
b. Did Pat leave town?

(25) a. They halved the price.
b. They didn't halve the price.

(26) If anybody keeps spoiling the children, Pat does.

So let's add *do* to our list of auxiliary verbs. To do so, we need to examine its properties. For example, what is the FORM of the head of its complement? Are there any other restrictions on the kind of complements it can take? Does it have any restrictions on the FORMS it can have?

The following examples illustrate properties of *do* that will have to be incorporated into the analysis.

(27) a. Pat does not eat garlic.

[4]In earlier stages of the English language, nonauxiliary verbs also exhibited certain of the NICE properties. In fact, this earlier state of affairs still survives today in certain fixed expressions, e.g. *How goes it?* or old sayings, such as *Waste not, want not*.

b. $$\text{*Pat does not} \left\{ \begin{array}{l} \text{eats} \\ \text{eating} \\ \text{eaten} \end{array} \right\} \text{garlic.}$$

(28) a. Pat tried to take logic.
b. *Pat tried to don't take logic.
c. *Pat has done not take logic.
d. *Pat is doing not take logic.

(29) a. Does Pat like watching television?
b. *Does Pat be watching television?
c. *Does Pat have watched television?

These examples show:

- The head of the complement of *do* must be [FORM inf].
- Auxiliary *do* itself only occurs in finite forms.[5]
- The head of the complement of *do* cannot be an auxiliary verb.

That is, *do* behaves just like the modals, but with the added restrictions that (i) its complement cannot be headed by an auxiliary verb and (ii) it makes no contribution to meaning, except to bear the tense information that corresponds to its finite morphology. This can be encoded straightforwardly into the lexical entry for the lexeme for auxiliary *do*:

(30)
$$\left\langle \text{do}, \begin{bmatrix} \textit{auxv-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \left\langle [\ ],\ \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{inf} \\ \text{AUX} & - \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

The semantics specified in (30) correctly guarantees that *do* makes no contribution to the semantics; and the [FORM fin] specification ensures that the only words derived from this root are finite forms. Of course,

[5]The *do* that is found in imperatives like *Do sit down!* is not the same *do*, as evidenced by the fact that it can co-occur with *be*, as in *Do be quiet!* (cf **Do they be quiet?*).

those words have nonempty RESTR values in their semantics, because the lexical rules that generate them add temporal restrictions.

The analysis of *do* as an *auxv-lxm* (and hence as a *srv-lxm*) also predicts that it will allow dummies and idiom chunks as subjects, given the right complements. It is actually tricky to construct such sentences, since the verbs that license dummies or idiom chunk subjects are very often forms of *be*, and hence are [AUX +]. Since *do* doesn't allow [AUX +] complements, this requires an extra step in the construction of the relevant examples. The trick is to put a nonauxiliary raising verb in between, yielding sentences like (31).

(31) a. There did not continue to be riots in the park.
b. Does it continue to annoy people that dogs bark?
c. Close tabs don't seem to have been kept on anybody.

13.5 Analyzing the NICE Properties

Let us work out analyses within our theory for each of the NICE properties. This will involve one lexical rule per property, plus the addition of a few new features.

13.5.1 Negation

The word *not* can appear in a wide variety of contexts, but in this discussion, we will restrict our attention to sentence negation – that is, to cases in which it is the whole clause that is interpreted as being negated. Hence, we will not be dealing with non-sentence negation, that is, with uses of *not* like those in (32).[6]

(32) a. Not many arrows hit the target.
b. I try not to make trouble.
c. Pat must have not been listening.

We also exclude from our analysis the second occurrence of *not* in examples like (33), since this is negating only the VP, not the whole sentence.

(33) Kleptomaniacs can not NOT steal.

If both occurrences of *not* in (33) were instances of sentence negation, they would cancel each other out, and it would mean 'kleptomaniacs can steal'. While (33) clearly has this as an entailment, it actually asserts something stronger, namely, that kleptomaniacs MUST steal. This is the

[6]In a nutshell, our analysis of these is to treat *not* as a modifier that attaches to the left of phrases (other than finite verb phrases). Working this analysis out in detail would require some additional machinery that would take us too far afield, so we will not pursue it here.

interpretation we get if we assume that the first *not* negates the whole sentence but the second one negates only *steal*.

The sentence in (33) shows that there can be only one sentential *not* per clause. To ensure this, we introduce a feature NEG. The negation rule will specify that its input must be [NEG −], and the output is [NEG +]. This will prevent it from applying to its own output, thereby preventing any clause from having multiple sentential negations.[7]

The sort of data we do want to account for includes the following:

(34) a. Pat will not leave.
b. *Pat not will leave.
c. Pat has not left.
d. *Pat not left.
e. Pat would not have left.
f. *Pat not has left.
g. Pat must not have been leaving.

The generalization about where sentential *not* can appear is that it must follow a finite auxiliary verb. We can formalize this by having a lexical rule that inserts *not* as a second argument of a finite auxiliary and requires the output to be [NEG +].

[7]NEG is declared as appropriate only for the part of speech *verb*. And by adding the default constraint [NEG / −] to the type *verb-lxm*, we can ensure that the only verbs that are [NEG +] either are exceptionally so listed or else have undergone a lexical rule that makes them [NEG +].

(35) Negation Lexical Rule

$$\left\langle \boxed{2}\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \\ \text{NEG} & - \\ \text{AUX} & + \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1} \rangle \oplus \boxed{a} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{4} \end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{2}\ ,\ \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{NEG} & + \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1} \rangle \oplus \left\langle \begin{bmatrix} \text{HEAD} & \textit{adv} \\ \text{INDEX} & \boxed{3} \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{not} \\ \text{ARG} & \boxed{4} \end{bmatrix} \right\rangle \end{bmatrix} \right\rangle \oplus \boxed{a} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{3} \end{bmatrix} \end{bmatrix} \right\rangle$$

Note that this is the first lexical rule we have seen that creates new words from words already formed via application of lexical rules to lexemes. Other analyses are possible, but this is the most straightforward way of limiting the application of the rule to finite forms.

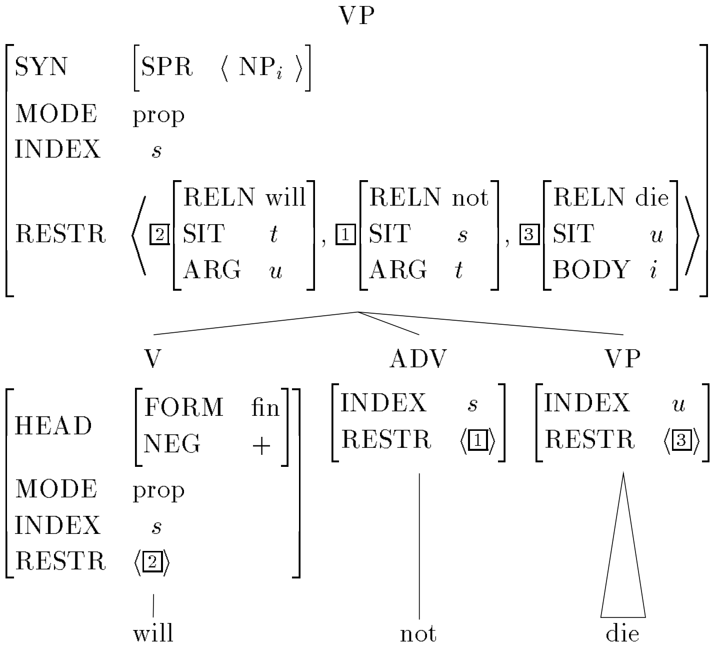
The rule in (35) has the intended effect because the word *not* is treated as an adverb, and it is the only adverb lexically specified as having 'not' as the value of RELN on its RESTRICTION list, as sketched in (36).

(36)

$$\left\langle \text{not}\ ,\ \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \textit{adv} \end{bmatrix} \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{8} \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{not} \\ \text{SIT} & \boxed{8} \\ \text{ARG} & s \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

The effect of the rule in (35), then, is to permit *not* (and only *not*) to appear as an optional second argument of an auxiliary. And when this happens, the index of *not* ($\boxed{3}$ in (35)) is the INDEX of the auxiliary, and the semantic index of the rule input ($\boxed{4}$ in (35)) is the argument of the 'not' relation. This produces a negated semantics for a VP (and hence for a sentence), as shown in (37).

(37)



Problem 2: Negation and Do

How do our rules and lexical entries so far account for the following contrast? Be precise.

(i) *Pat put not the ice cream in the freezer.

(ii) Pat did not put the ice cream in the freezer.

13.5.2 Inversion

In questions, a finite auxiliary verb precedes the subject. All the same restrictions that apply to auxiliaries in declaratives apply when they occur in this inverted order. Thus we have:

(38) a. Can Pat tap-dance?

b. *Can Pat $\left\{\begin{array}{l}\text{tap-danced}\\ \text{tap-dancing}\end{array}\right\}$?

c. Is Pat tap-dancing?

d. *Is Pat $\left\{\begin{array}{l}\text{tap-dance}\\ \text{tap-danced}\end{array}\right\}$?

e. Has Pat tap-danced?

f. *Has Pat $\left\{\begin{array}{l}\text{tap-dance}\\ \text{tap-dancing}\end{array}\right\}$?

g. Could Pat be tap-dancing?

h. *Is Pat coulding tap-dance?

i. Could Pat have tap-danced?

j. *Has Pat could tap-dance?

k. Has Pat been tap-dancing?

l. *Is Pat having tap-danced?

m. Could Pat have been tap-dancing?

n. *Could Pat be having tap-danced?

o. *Could Pat will tap-dance?

p. *Has Pat had tap-danced?

q. *Is Pat being tap-dancing?

These data suggest that we want to maintain the relationship between the auxiliary verb and its complement even when the auxiliary precedes the subject. The immediate problem then is how to get the subject to appear on the right of the (finite) auxiliary instead of on the left. A simple approach is to treat the postauxiliary NP not as a specifier, but rather as its first complement. Recall that the Head-Complement Rule generates complements in the same order in which they are listed in the head's COMPS list.[8] Hence, making the subject NP into the first complement of the lexical entry for the inverted auxiliary puts it just where we want it.

This can be easily achieved by a lexical rule. Since the inverted verb in yes-no questions is the first element in the sentence, the Inversion Lexical Rule must be formulated so that the SPR list of the output is empty and the output's semantic mode is 'ques(tion)', rather than 'prop'.[9]

[8] A more general approach to constituent ordering will ultimately be necessary, especially for languages with much freer word order than English. There are a number of interesting proposals in the literature, but they go beyond the scope of this text.

[9] Here we make the simplifying assumption that inverted sentences are always associated with interrogative semantics. In fact, inverted clauses appear in other kinds of constructions, e.g. the following:

(i) Never have I heard such a beautiful rendition!

(39) Inversion Lexical Rule

$$\left\langle \boxed{1}\,, \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{word} & \\ \text{FORM} & \text{fin} \\ \text{AUX} & + \end{bmatrix} \\ \text{SPR} & \langle \text{ NP } \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{prop} \end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{1}\,, \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{INV} & + \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ques} \end{bmatrix} \end{bmatrix} \right\rangle$$

The outputs of this rule are finite auxiliary verbs that take no specifier. Hence, in any well-formed lexical SD that these outputs give rise to, all members of the ARG-ST list will also appear on the COMPS list, as illustrated in (40).

(40)

$$\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \\ \text{AUX} & + \\ \text{INV} & + \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle \boxed{1}\,, \boxed{2} \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}\text{NP[nom]}\,, \boxed{2}\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{inf} \end{bmatrix} \\ \text{SPR} & \langle \boxed{1} \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

will

Otherwise, because the SPR value is the empty list, the ARP will not be satisfied. And because such a lexical SD has the first ARG-ST member on the COMPS list, that element will be realized as a complement, to

(ii) Had we known that beforehand, we would never have participated.

the right of the lexical head in a phrasal SD constructed in accordance with the Head Complement Rule.

Recall that the lexical rules for finite forms presented in Chapter 8 specify constraints (about case and agreement features) on the first member of the ARG-ST list. Because the first element of the ARG-ST list is the first complement, all words formed from the outputs of this lexical rule will specify the appropriate CASE and AGR constraints not on the SPR value, but rather on the first COMPS member, as shown in (40). The lexical rules for finite verbal forms interact with the Inversion Lexical Rule in (39) to predict contrasts like the following:

(41) a. Can she tap-dance?
b. *Can her tap-dance?
c. Are we winning?
d. *Are us winning?

Similarly, for those auxiliaries that exhibit agreement with their subjects (namely, finite forms of *be*, *have*, and *do*), the agreement in the inverted entries (i.e. the outputs) will be with the first complement. This correctly predicts data like the following:

(42) a. Is the dog barking?
b. $*\left\{\begin{array}{l}\text{Am}\\ \text{Are}\end{array}\right\}$ the dog barking?
c. Have you finished the assignment?
d. *Has you finished the assignment?

Moreover, since as we have seen, auxiliaries are raising verbs, their first argument is identical to the element on the SPR list of their VP argument. Hence, in the output (inverted) auxiliary's entry, the first complement will also function as the second complement's subject. We therefore predict data like the following:

(43) a. Will there be children in the audience?
b. *Will there win the game?
c. Has it annoyed people that dogs bark?
d. Are tabs kept on all linguists by the FBI?
e. *Are tabs taken on all linguists by the FBI?
f. Was advantage taken of the opportunity by students?
g. *Was advantage kept of the opportunity by students?
h. Did it continue to annoy people that nobody listened?
i. *Did it try to annoy people that nobody listened?

In short, this rule creates lexical entries whose first complement has all the properties of a subject, except that it comes after the verb.

Problem 3: Inverted SDs

Draw SDs for the following sentences. (You need not include all features on the nodes, but you should give a complete feature specification for the head of sentence. Otherwise, you can just concentrate on getting the tree geometry right, using standard abbreviations for node labels.)

(i) Did Pat put the ice cream in the freezer?
(ii) Is there a monster in Loch Ness?

Problem 4: Inversion and Do

How does our analysis account for the unacceptability of the following sentence (be precise!):

*Put Pat the ice cream in the freezer?

Problem 5: Negation and Inversion

Our Negation and Inversion Lexical Rules can interact to allow us to generate negative questions. Which of the following sentences will be licensed by our rules so far?

(i) Has Pat not been sleeping?
(ii) Has not Pat been sleeping?

Explain your answer. Do the predictions of the grammar with respect to such sentences accord with your intuitions of well-formedness?

13.5.3 Contraction

Auxiliary verbs with the contracted negative suffix *-n't* exhibit a number of lexical idiosyncrasies. For example, we say *won't*, not **willn't*. Others are *don't, mustn't* and *shan't* (though many speakers don't have any form of *shall* with *-n't* suffixed). (Don't be fooled by spelling: *don't* and *mustn't* are exceptional because of their pronunciation, which is not what would result from simply appending the sound 'nt' to *do* and *must*). There are also exceptions to the rule: **amn't* and, for most speakers, **mayn't*.

We will treat contraction like the inflectional lexical rules we presented earlier, which also allowed for idiosyncratic morphological exceptions; that is, we will posit a morphological function, F_{NEG}, that relates inflected forms of auxiliaries to their negative contracted forms. The rule is then fairly straightforward: it applies to finite forms of auxiliaries, changing their morphology and semantics. The only other modification needed is to add the feature [NEG −] to the input and [NEG +] to the output.[10] The rule, then, is as follows:

(44) Contraction Lexical Rule

$$\left\langle \boxed{2}\, , \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \\ \text{AUX} & + \\ \text{NEG} & - \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{RESTR} & \boxed{a} \end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \mathrm{F}_{NEG}(\boxed{2})\, , \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{NEG} & + \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{not} \\ \text{SIT} & s \\ \text{ARG} & \boxed{1} \end{bmatrix} \right\rangle \oplus \boxed{a} \end{bmatrix} \end{bmatrix} \right\rangle$$

Problem 6: Contraction and Double Negation

As formulated, neither the Negation Lexical Rule nor the Contraction Lexical Rule can apply to the other one's output.

A. Explain why not.
B. Does the mutual exclusivity of these two lexical rules make the right empirical predictions? Provide data and an explanation to support your answer.

Problem 7: First-Person Aren't

In colloquial usage, examples like (i)–(iii) are common, although their uninverted counterparts, (iv)–(vi) are ungrammatical.

(i) Aren't I lucky?

[10] Note that this keeps the rule from applying to its own output, and hence automatically blocks forms like **can'tn't*.

(ii) Aren't I doing a good job?

(iii) Aren't I chosen?

(iv) *I aren't lucky.

(v) *I aren't doing a good job.

(vi) *I aren't chosen.

How could we account for this in our theory? [*Hint: Assume that this* aren't *is a separate lexical entry from the one in examples like You aren't doing a good job. Then provide an explicit lexical entry for the* aren't *in (i)–(iii) and explain why it behaves as it does.*]

13.5.4 Ellipsis

Ellipsis is a discourse phenomenon, in the sense that the interpretation of the missing constituent sometimes depends on something said in an earlier sentence – possibly even by another speaker, as in the following dialogue:[11]

(45) Speaker A: I haven't been reading the newspapers.
Speaker B: Well, I have.

Consequently, we will not try to provide an analysis of the semantic relation between an elliptical sentence and its antecedent. Instead, we will concentrate on the syntactic constraints on ellipsis.

We saw earlier that ellipsis could not immediately follow nonauxiliary verbs. The following example shows that the auxiliary verb immediately before an ellipsis site does not have to be finite.

(46) I haven't been following the debate on taxes, but I should have.

[11]This example also illustrates an argument for the phrase structure we assign to auxiliary constructions (with nested VPs), rather than the alternative with a node AUX containing all auxiliary verbs. On our analysis, what is missing from speaker B's utterance (namely, *been reading the newspapers*) forms a constituent (a VP). But under the AUX alternative, what is missing is part of the AUX, plus the following VP. In examples like (i), we see that all three of the possible ellipses correspond to a constituent in our analysis, but only one of them would be a constituent in the AUX analysis.

(i) Pat couldn't have been doing the reading, but Chris could (have (been (doing the reading)))

In this respect, ellipsis differs from the previous three NICE properties we looked at, in which the auxiliary is always finite. Hence the lexical rule we formulate for ellipsis will not have to stipulate [FORM fin], though it will still require [AUX +].

There is one word, however, that can immediately precede an ellipsis site that we are not analyzing as a verb at all – namely, the complementizer *to* that is used to introduce infinitives.

(47) a. We asked them to open the window, and they tried to.
b. We hoped that the wine would improve with age, but it didn't seem to.

We can handle this if we leave open the part of speech of the input to the Ellipsis Lexical Rule, and say that infinitival *to* is [AUX +]. Then the only [AUX +] elements in the lexicon are auxiliary verbs and the complementizer *to*, so it is just these elements that can precede an elliptical VP.

The following formulation of the rule captures our syntactic observations:

(48) Ellipsis Lexical Rule

$$\left\langle \boxed{3}\,, \begin{bmatrix} \textit{lexeme} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AUX} & + \\ \text{NEG} & - \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1} \rangle \oplus \boxed{\mathit{a}} \end{bmatrix} \right\rangle \Rightarrow \left\langle \boxed{3}\,, \begin{bmatrix} \text{ARG-ST} & \langle \boxed{1} \rangle \end{bmatrix} \right\rangle$$

The outputs of this rule are entries whose ARG-ST no longer contains any of its arguments except the first one. Note that the semantics of such outputs is incomplete, and must be supplemented by appropriate material from the surrounding linguistic context. This analysis permits us to account for the fact that elliptical sentences behave in some ways as if they contained a constituent that is not in fact present. For example, nonreferential subjects are possible in elliptical sentences, so long as the missing complements are understood properly:

(49) a. We hoped it would be obvious that we were unhappy, and it was.
b. The students thought there would be a trick question on the exam, and there was.

The rule as formulated in (48) says nothing about the discourse properties of ellipsis. In particular, it does not specify that ellipsis is only possible in contexts where there is an antecedent phrase that provides the interpretation of the missing complement. It simply specifies that the lexicon includes lexical entries that can give rise to lexical SDs like the following:

(50)
$$\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \\ \text{AUX} & + \end{bmatrix} \\ \text{SPR} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1}\text{NP[nom]} \rangle \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{will} \\ \text{SIT} & s \\ \text{ARG} & t \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$
$$|$$
$$\text{will}$$

In SDs like these, t – the argument of the 'will' relation – is not associated with any predication. Hence the meaning of any clause built from (50) is inherently incomplete.[12]

Problem 8: The Interaction of Ellipsis with Negation and Inversion

A final observation, independent of these last concerns, is that sentential *not* can occur in elliptical clauses:

(i) We wanted to taste the salad, but we could not.
(ii) They were asked to help the cook, but they did not.
(iii) You thought you were clearing the table, but you were not.
(iv) We thought that they had arrived, but they had not.

In addition, inversion is possible in elliptical clauses, as in the following sentences:

(v) [They will become famous.] Will they?
(vi) You thought you were helping them out. Were you?

A. Does our grammar predict that examples like (i)–(iv) are well formed? Explain clearly why or why not.
B. Does our grammar predict that examples like (v)–(vi) are well formed? Explain clearly why or why not.

---

[12] Presenting a fully worked out treatment of VP ellipsis is beyond the scope of this text. There is a rich literature on the subject that we cannot survey here.

13.6 Conclusion

English auxiliaries comprise a richly structured system with numerous idiosyncratic properties. Our theory handles the complexities of the system straightforwardly. Auxiliary verbs are raising verbs that impose special conditions on their second argument. Auxiliary verbs exhibit some exceptional behaviors, such as the restriction of modals to [FORM fin]. And there are several lexical rules that are restricted to auxiliaries, which create specialized versions of the auxiliary verbs to account for the NICE properties.

In the next chapter, we examine some of the dialect variation in the behavior of English auxiliaries and discuss how our analysis can be modified to handle it.

13.7 Further Reading

As noted above, Chomsky (1957) is the seminal work on the English auxiliary system; Lasnik (1995) is an elementary (and updated) presentation of Chomsky's analysis. Among the most influential subsequent work is Ross (1969), McCawley (1971), Akmajian et al. (1979), Steele (1981), Gazdar et al. (1982), and Pollock (1989). The standard reference on negative contraction is Zwicky and Pullum (1983). The analysis presented here is based in part on Warner (1993), Kim (1995) and Kim and Sag (1995).

14

Variation in the English Auxiliary System

14.1 Introduction

English auxiliaries constitute a particularly interesting syntactic system, involving a small set of lexical items that exhibit many intricate interactions and some fascinating idiosyncracies. This system is peculiar to English, though many other languages have elements with intriguingly parallel properties.

English auxiliaries have changed considerably over the last thousand years or so, and their evolution has been well documented, making them a natural domain for studying syntactic change.[1] Change begins with variation, and the auxiliary system is also the locus of some fascinating differences among varieties of English. Variation is interesting in its own right, but studying it also helps us to ascertain which properties of our grammar we should formulate as or deduce from general principles, and which ones we should treat as essentially accidental.

In this chapter, we provide two examples of variation in English auxiliaries. The first example concerns the behavior of *have*, whose syntax is that of an auxiliary verb in some instances but not in others. The second example deals with a much studied phenomenon in the dialect known as African American Vernacular English (AAVE, for short). In both cases, we will explore how the variation might be handled within our theory. Our examples and discussion are intended only as samples of how data on variation that might be relevant to work on syntactic theory. Syntactic variation is a topic worthy of a textbook in its own right, and we make no pretense of doing it justice here.

[1]Discussion of the history of the English auxiliary system would take us too far afield, although it is a fascinating topic.

14.2 Auxiliary Behavior in the Main Verb Have

Our first example of variation in the English auxiliary system is one that occurs in a number of varieties of English, and can even vary for individual speakers, depending on the formality of the context.

In some circumstances, certain uses of *have* as a main verb exhibit auxiliary-like behavior. For example, we have all heard usages like those in (1).

(1) a. Have you any idea of the time?
 b. I haven't a clue.
 c. They said we had a problem, and we have.

This is not the first time we have seen a verb that is not a 'helping verb' – that is, one that is the sole verb in its clause – exhibiting some of the NICE properties. According to our analyses, the lexeme *be* must belong to the type *auxv-lxm*: all finite forms of *be* (e.g. *is*, *were*) undergo the Negation, Inversion, and Contraction Lexical Rules, and all forms of *be* undergo the Ellipsis Lexical Rule.[2]

In our grammar, the feature [AUX +] (associated with all instances of the type *auxv-lxm* and with certain other elements, e.g. the complementizer *to*) is associated with a certain range of properties, notably (i) the NICE properties, and (ii) not being a possible complement to the auxiliary *do*. In the dialects that allow main verb *have* to exhibit NICE properties, we can posit a lexical entry for *have* that takes an NP complement (rather than the VP complement of the auxiliary *have*), but which is still [AUX +]. That is, we posit an entry along the following lines:

[2]There are a few exceptions, which we will not attempt to deal with here. When *be* is used to denote activities over which the subject has clear voluntary control (meaning something close to 'act'), it can co-occur with the auxiliary *do*, as in Bob Dole's statement to supporters during the 1996 presidential campaign:

(i) You're not gonna get that tax break if you don't be quiet.

In addition, as first noted by Akmajian and Wasow (1974), *being* appears to be an exception to the Ellipsis Lexical Rule (for reasons that remain obscure):

(ii) They said we were being followed by a blue car, and we were (*being).

(2)
$$\left\langle \text{have}\ , \begin{bmatrix} \textit{stv-lxm} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{AUX} & +\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \langle\ \text{NP}_i\ ,\ \text{NP}_j\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{possess} \\ \text{SIT} & s \\ \text{POSSESSOR} & i \\ \text{POSSESSED} & j \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

To the best of our knowledge, all dialects that allow examples like (1) also permit their counterparts in (3).

(3) a. Do you have any idea of the time?
 b. I don't have a clue.
 c. They said we had a problem, and we do.

This suggests that the entry in (2) is not quite right. Instead of stipulating [AUX +], it should allow either [AUX +] or [AUX −].[3] This will permit the verb to occur where [AUX +] is required (i.e. in the lexical rules involved in the NICE phenomena) as well as where [AUX −] is required (in the complement of auxiliary *do*). Thus, the dialect allowing the main verb *have* to behave like an auxiliary differs from the standard dialect only in the specification of this one feature.

The situation is actually a bit more complex than this. Not all uses of *have* exhibit the NICE properties, even in the dialects that accept (1). Some examples are given in (4)–(6).

(4) a. They had a fit.
 b. *They had not a fit.
 c. *Had they a fit?

[3]The careful reader will note that we have been slightly evasive about what formal mechanism to use in allowing both values for AUX. The most parsimonious way to do this would be simply to underspecify the entry for this feature. Such an analysis would be consistent with everything in the text to this point. However, it would only work if *verb-lxm* had no default specification for the feature AUX, and this, in turn, would require that every nonauxiliary verb entry in the lexicon (that is, the overwhelming majority of verb entries) be individually marked [AUX −]. It is natural, therefore, to put a default [AUX / −] specification on the type *verb-lxm*, which is overridden by the specification on *auxv-lxm*. If we do this, we need some way for (2) to override the default and still allow both values for AUX. We could do this by modifying (2) to say either [AUX + |−] or ([AUX +]). Both of these options raise some technical questions for the formal theory of defaults in inheritance hierarchies, but these are beyond the scope of this text.

d. *They hadn't a fit.
e. *I said they would have a fit, and they had.

(5) a. You have cancer.
b. *You have not cancer.
c.?*Have you cancer?
d. *You haven't cancer.
e.?*They said you had cancer, and you have.

(6) a. Every day at lunch, Lou had a martini.
b. *Every day at lunch, Lou had not a martini.
c. *Every day at lunch, had Lou a martini?
d. *Every day at lunch, if Fran had a martini, Lou had, too.

There seems to be a semantic difference between those uses of *have* that exhibit NICE properties in the dialect in question and those that do not. Roughly, *have* means 'possess' in the NICE uses, but it assumes more specialized meanings in (4)–(6). To capture the correlation of syntactic behavior with semantics, we need to postulate multiple lexical entries for *have*. In particular, the entry in (2) specifies that the semantic relation is possession. Other main verb entries for *have* specify different relations, and they are all [AUX −].

Although the postulation of multiple entries for *have* might seem a priori undesirable, the fact that it has so many meanings would require separate entries, even if the meanings were not correlated with syntactic differences.

14.3 African American Vernacular English

The next case of variation we will examine concerns a dialect we will refer to as African American Vernacular English (which is also known as Black English or African American English). We will treat AAVE as a homogeneous dialect, just as we have been assuming for simplicity that there is a homogeneous standard American English. There is, in fact, considerable variation within AAVE, but there are also many properties that are quite general to AAVE and legitimize treating it as one dialect.[4]

[4]No two humans speak exactly the same way, or share exactly the same intuitions about every sentence. Indeed, individual speakers change the way they speak over time and under different circumstances. Hence the concepts of 'language' and 'dialect' are idealizations, based on undefined notions of similarity. They are nevertheless indispensible starting points for linguistic analysis. Moreover, providing precise characterizations of similarities and differences across varieties of speech could provide a scientific foundation for some of the intuitions underlying the way people individuate languages.

Linguists place little stock in the language/dialect distinction. One might attempt to characterize two varieties of speech as dialects of the same language if they are

Before delving into the data, we need to digress briefly, to clear up some common misconceptions about AAVE. In the autumn of 1996, as we were writing the first draft of the present chapter, the school board in Oakland, California passed a resolution calling for the use of 'Ebonics' (another name for AAVE, favored particularly by afrocentric activists who wish to deny that AAVE is a variety of English) as a tool in the teaching of standard English to African American children. This event unleashed a storm of public outrage across the country. Much of the criticism was directed at the unfortunate wording of the Oakland resolution, and some of it concerned specific classroom practices; neither of these is relevant to the present text. A great deal of the outcry, however, concerned the linguistic status of AAVE, revealing widespread misunderstanding about the nature of language and grammar, even among many highly educated and sophisticated commentators.

Eldridge Cleaver, the former Black Panther leader, wrote in the *Los Angeles Times*, 'When I was growing up, what is now euphemistically being called Ebonics was accurately called bad English.' This statement – like numerous others that appeared in the press – reveals the powerful influence of prescriptivism. It presupposes that some varieties of English are correct and that others are incorrect. But what is the basis for attributions of correctness or 'badness' to a language variety – or for that matter to a particular utterance? In this text, we have appealed to native speaker intuitions of well-formedness to determine what is grammatical and what is not. This is clearly not the standard of correctness Cleaver had in mind, nor is it the one that prescriptivists employ. Rather, prescriptivism singles out one linguistic variety as the standard, and labels deviations from that standard as incorrect. The choice of the standard is determined by a variety of historical, social, and political factors, and it can be quite different from the language people actually use on a day-to-day basis. There is no linguistic basis for elevating one language variety in this way.

No language or dialect is inherently 'good' or 'bad.' They can only be evaluated with respect to some objective. As linguists, we are interested in languages as natural phenomena. To say that one language is 'better'

mutually intelligible, but even this intuitive characterization is problematic. Thus varieties that we have other reasons to think of as distinct languages (e.g. Swedish and Danish) are to a very large extent mutually intelligible. Moreover the relation of mutual intelligibility is not transitive: given three varieties A, B, and C, mutual intelligibility between A and B and between B and C does not guarantee that A and C are mutually intelligible. Thus one can talk at best about 'complexes' of language varieties (Hockett 1958) among which certain patterns of mutual intelligibility exist. Fortunately, these terminological issues do not need to be resolved in order for linguistic analysis to proceed.

than another *per se* makes no more sense to us than saying one atomic particle is better than another.[5] For our purposes, AAVE is just as legitimate an object of study as any other language variety.

Another widespread and more serious misconception is exemplified in a column by Brent Staples in the *New York Times*, who described AAVE as 'broken English.' Similarly, in a column by *The Washington Post*'s William Raspberry, AAVE is described as 'a language that has....no discernable rules.' Raspberry's piece recounts a fictional conversation with a taxicab driver, who says, 'you can say pretty much what you please [in Ebonics], as long as you're careful to throw in a lot of 'bes' and leave off final consonants.' If such claims were true, it would make linguistic investigation of AAVE trivial and pointless. But they are in fact patently false. Careful investigation of AAVE by linguists over the past three decades has shown that it has as much structure and system to it as any other linguistic variety. The differences between it and other varieties of English are quite systematic. One of those differences will be discussed briefly in this chapter, but see Rickford and Green (in press) for a much more detailed survey.[6]

14.3.1 Missing Forms of Be

Examples like (7), though ungrammatical in standard American English (SAE, for short), are well-formed sentences of AAVE.

(7) a. Chris at home.
  b. We angry with you.
  c. You a genius!
  d. They askin for help.

SAE requires a form of the copula (that is, a form of *be*) in each of these sentences, but, as noted in Chapter 11, many other languages (e.g. Russian and Hungarian) are like AAVE in permitting analogues of (7) without a copula. In fact, Ferguson (1971) noted a number of similarities between the environments in which copulas may be absent across languages, including AAVE.

Labov (1995) presents a number of arguments for an analysis of examples like (7) that involves deletion of a form of *be*. More specifically,

[5] Of course, if the objective for evaluation of language varieties is getting ahead economically, then there can be little doubt that in contemporary American society, AAVE fares poorly (outside of some pockets of the entertainment industry). For this reason, virtually all American educators – including the Oakland School Board – recognize the need to teach standard English in the schools. Unfortunately, this point of agreement seems to have been lost in much of the discussion of 'Ebonics'.

[6] Our data on AAVE are taken largely from published sources, cited below. In addition, we are grateful to John Baugh, Erica Denham, Lisa Green, and Zakiyyah Langford for giving us their judgments on some examples.

he claims that such 'zero copula' sentences involve an extension of SAE contraction: *is* and *are* reduce to *'s* and *'re* in all dialects of English, and AAVE carries the process one step further, deleting the remaining consonants. He concludes that 'the copula is present in the underlying grammar, and is an object of cognition' (p. 46).

This sort of deletion analysis does not fit comfortably with the surface-oriented, constraint-based, strongly lexicalist grammar we have been developing in this text. In Chapter 9, we described this conception of grammar as follows:

> Our grammar....provides a....structure that is directly associated with the string of words that constitute each sentence. The ancillary structure that has to be computed....expresses information that is straightforwardly derivable from properties of the words in the string....There are no operations that destructively modify any representations....We have localized most grammatical and semantic information within lexical entries....[that] correspond directly to the words present in the sentence.

The only way to accommodate Labov's treatment of the zero copula within our theory would be to posit phonological or phonetic processes that are exempt from the conditions just quoted. But such a move would greatly weaken the force of our claims, at least in the absence of some principled method for demarcating the boundaries between syntax and morphology on the one hand, and phonetics and phonology on the other. If deletions can be freely reformulated as a phonetic processes, then a prohibition against syntactic deletion has no substance.

It would be interesting, therefore, to explore how the AAVE zero copula might be accounted for in the theory we have been developing, and to compare such an analysis to a deletion account.

In doing this, however, we do not wish to deny that there may be strong connections between contraction and the AAVE 'zero copula', in terms of their histories or in terms of the functions they serve (such as shortening utterances or signalling an informal style). This does not entail that the best synchronic description of the language must include a deletion rule. Indeed, we will see below that the nondeletion analysis we are led to has distinct advantages over a deletion account.

The most obvious nondeletion analysis would posit a lexical entry with no phonology, which is otherwise just like *is* and *are*:[7]

[7] Actually, (8) is not quite right, because it fails to exclude first-person singular subjects. That is, it allows examples like (i), which are ungrammatical in AAVE

(i) *I hungry.

(8)
$$\left\langle \emptyset\ ,\ \left[\begin{array}{ll} \textit{auxv-lxm} & \\ \text{SYN} & \left[\text{HEAD}\ \left[\text{FORM}\ \ \text{fin}\right]\right] \\ \text{ARG-ST} & \left\langle [\ ]\ ,\ \left[\begin{array}{ll} \text{SYN} & \left[\text{HEAD}\ \left[\text{PRED}\ \ +\right]\right] \\ \text{SEM} & \left[\text{INDEX}\ \ \boxed{2}\right] \end{array}\right] \right\rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \rangle \end{array}\right] \end{array}\right] \right\rangle$$

While a silent variant of *is* and *are* would be straightforward, it clearly violates the spirit of surface-oriented, constraint-based, strong lexicalism. Up to this point, we have avoided positing inaudible lexical entries for 'understood' elements (such as a silent *you* for the subject of imperatives). Analogues of such elements do show up in places in our feature structures (notably in valence features and ARG-ST lists), but their presence is always licensed by a particular grammar rule or word. Hence our grammar fits well with a model of sentence processing that is driven only by the words that are actually audible (or visible): the processing mechanism never needs to guess where in the string there might be silent words. This is a highly desirable design feature that we would not abandon lightly. In addition, as we will see below, there is ample independent evidence against the existence of an inaudible copula in AAVE.

14.3.2 A Phrase Structure Rule Analysis

An alternative analysis of the missing copula in AAVE is to allow the complements of *be* (whether they are VPs, NPs, PPs, or APs) to combine directly with NP subjects to make sentences. In fact, our analysis of *be* already requires that its second argument have a nonempty SPR list. Remember, the SPR of *be* has to be identical to the SPR of its complement, so the complement always must have something on its SPR list.

Hence, unless something is added specifically to exclude them, the following expressions are all generated by our grammar as phrases that are [SPR ⟨ ⟩] and [COMPS ⟨ ⟩], differing in their part of speech types:

To exclude examples like (i), the 'silent copula' analysis would have to be modified in some way. We will return to this restriction on the zero copula construction, providing an account that could be fairly straightforwardly adapted to the silent copula analysis under discussion here.

(9) a. It wild.
    b. You in trouble.
    c. Leslie the boss.
    d. Somebody coming to dinner.
    e. Jean interviewed by a reporter.

These strings are not well-formed stand-alone sentences in SAE, because the initial symbol of our grammar is:

(10)
$$\left[\begin{array}{ll} \textit{phrase} & \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{ll} \textit{verb} & \\ \text{FORM} & \text{fin} \end{array}\right] \\ \text{SPR} & \langle\ \rangle \end{array}\right] \end{array}\right]$$

As noted earlier (Chapter 9), this says that a stand-alone sentence (or what linguists sometimes call a 'root sentence') must be headed by a verb in a finite form. None of the examples in (9) contains a finite verb, so they are clearly ruled out as SAE sentences. It is worth noting that there are constructions (which we will not analyze here) that permit strings similar to those in (9) to appear as subordinate clauses, for example:

(11)
$$\text{With the cat} \left\{\begin{array}{l} \text{away} \\ \text{in the kitchen} \\ \text{a prisoner} \\ \text{sleeping} \\ \text{locked up} \end{array}\right\}\text{, the mice will play.}$$

However, SAE does not permit the strings in (12) as independent sentences.

(12)
$$\text{*The cat} \left\{\begin{array}{l} \text{away} \\ \text{in the kitchen} \\ \text{a prisoner} \\ \text{sleeping} \\ \text{locked up} \end{array}\right\}.$$

Thus we want our grammar to generate strings like those in (9) as well-formed constituents in SAE but make their distribution quite restricted. In particular, they do not occur as root sentences because of the initial symbol (10). Similarly, they do not occur as complements of the complementizer *that* or of the verb *think* because both take complements headed by finite verbs.

Returning now to AAVE, we could try to account for examples like (7) by modifying the initial symbol, allowing a wider range of feature structures to be root sentences. In particular, we could say that AAVE allows another alternative in addition to (10), namely, (13).

(13)
$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{pos} & \\ \text{PRED} & + \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SPR} & \langle\ \rangle \end{bmatrix} \end{bmatrix}$$

However, this analysis is not tenable, for it incorrectly predicts that the missing copula is possible only in root sentences.[8] But examples like (7) and (9) can easily be embedded; sentences like (14) are perfectly normal in AAVE.

(14) a. If you alone, watch out!
b. The man she lookin for ain't here.

Here the strings *you alone* and *she lookin for* are in positions in which SAE would require a clause headed by a finite verb (*you* **are** *alone* and *she* **is** *looking for*), but AAVE permits the copula to be missing. It seems that the grammars of SAE and AAVE differ in that, where the former permits a finite clause headed by *is* or *are*, the latter allows a clause without the copula.

We can capture this informal generalization more precisely by introducing a new phrase structure rule for AAVE, rather than an additional initial symbol. Specifically, we can handle the missing copula in AAVE with a grammar rule that says that a sequence of a nominative NP followed by another phrase can function as a finite clause. The following rule does just this:

[8] Ferguson (1971) notes that some languages allow the copula to be missing only in main clauses, suggesting that there may be languages with initial symbols like (13).

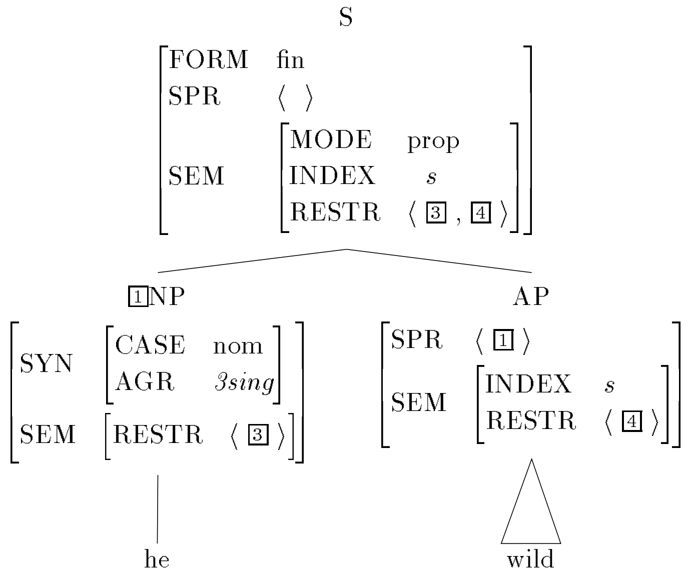
(15) Zero Copula Rule (AAVE)

$$\begin{bmatrix} \textit{phrase} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \rightarrow \begin{array}{c} \boxed{1}\text{NP} \\ \begin{bmatrix} \text{CASE} & \text{nom} \\ \text{AGR} & \textit{non-1sing} \end{bmatrix} \end{array} \begin{bmatrix} \textit{phrase} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{PRED} & + \end{bmatrix} \\ \text{SPR} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix}$$

This rule says that wherever a finite clause is called for, AAVE allows a [PRED +] phrase preceded by its nominative subject. It also says that the subject cannot be first-person singular, that is, *I* (see below). In addition, (15) stipulates the INDEX and MODE values on the left hand side, since the Semantic Inheritance Principle applies only to headed rules.

The Zero Copula Rule yields clauses that occur where finite clauses do, but which appear to be missing a verb. The resulting clauses will look as if they are missing a copula; and since the copula adds nothing semantically (except tense), they will also be interpreted as if they contained a copula. The effect of (15) is thus to license SDs like the following in AAVE:

(16)



We return now to the specification [AGR *non-1sing*] on the NP in the Zero Copula Rule. This was added because the first-person singular pronoun *I* cannot appear as the subject in the zero copula construction in AAVE.

(17) *I { hungry / at home / the winner }.

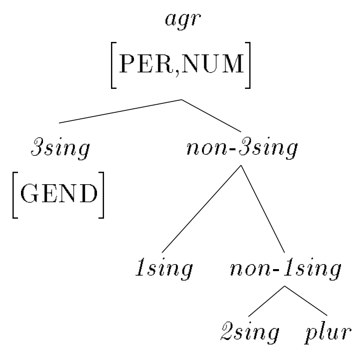
This appears to be a rather singular exception: other varieties of English with the zero copula construction (such as Jamaican Creole) do allow it with first-person singular subjects. It evidently requires a special stipulation on any available analysis of the phenomenon.[9]

The careful reader will have noticed, however *non-1sing* is one of the AGR types we introduced in Chapter 4 (footnote 10). To this point, however, we have distinguished only the two AGR subtypes *3sing* and

[9] On Labov's deletion account, it is one of several counterexamples to the assertion (Labov (1995), p. 39) that 'Where other English dialects do permit contraction of the copula, AAVE permits deletion,' since examples like *I'm hungry* are impeccable in SAE. On the other hand, the deletion account offers some hope of providing a principled account of why the first-person singular exhibits this singular behavior, in terms of phonetic differences between [z] and [r], on the one hand, and [m] on the other. Phonetic differences between these segments might also provide an historical explanation of why, on our account, the synchronic Zero Copula Rule requires a stipulation blocking first-person singular subjects.

non-3sing. In SAE, we would distinguish several subtypes of *non-3sing*, as illustrated in (18).

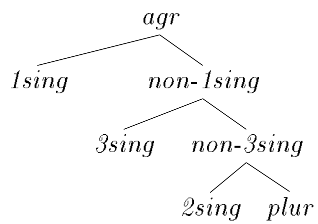
(18)



The type *1sing* is the AGR value for the specifier of the verb *am*, and would also be used for handling the agreement between coindexed first-person singular pronouns. Likewise, in SAE, *non-1sing* is the AGR value for the specifier of *are*; its subject can only be plural or second-person singular, as its two subtypes indicate.

This hierarchy of AGR types would give the wrong results for AAVE. In conjunction with our Zero Copula Rule, it would require the subject of zero copula sentences to be either plural or second-person singular. But, as we have seen (for example in (14b)), third-person singular subjects are possible in AAVE zero copula sentences. This suggests the following slightly different AGR hierarchy in AAVE:

(19)



With the hierarchy in (19), the Zero Copula Rule gives us the right results, since it excludes only the first-person singular. Notice, however, that it has eliminated the high-level distinction between third-person singular and all other AGR types that we had in the SAE hierarchy in (18). This distinction is needed in SAE because almost all verbs take the suffix *-s* in the present tense just in case their subject is third-person singular. Thus, the AAVE hierarchy that we posited in (19) would not be tenable for SAE. But it does work for AAVE, because AAVE verbs (other than *be*) do not mark agreement with their subjects. Present tense AAVE verbs have the same form as the infinitive, irrespective of the person and number of the subject.

(20) a. He see us.
 b. Pat do good work.
 c. Andy make a lot of money.
 d. She have good luck.

This allows the AAVE lexicon to be slightly simpler than the SAE lexicon. Where SAE requires separate entries for present tense verbs with third-person singular subjects, AAVE can simply have one present tense entry. This is illustrated in (21)–(22).

(21) SAE:

$$\left\langle \textit{eats}\ ,\ \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \overset{\text{NP}}{\begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{3sing}\end{bmatrix}}, \text{NP} \right\rangle \end{bmatrix} \right\rangle$$

$$\left\langle \textit{eat}\ ,\ \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \overset{\text{NP}}{\begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{non-3sing}\end{bmatrix}}, \text{NP} \right\rangle \end{bmatrix} \right\rangle$$

(22) AAVE:

$$\left\langle \textit{eat}\ ,\ \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \overset{\text{NP}}{\begin{bmatrix}\text{CASE} & \text{nom}\end{bmatrix}}, \text{NP} \right\rangle \end{bmatrix} \right\rangle$$

Because these forms are not differentiated in AAVE, it needs only one Present Tense Lexical Rule, in place of the two needed in SAE.

Thus, the Zero Copula Rule permits SDs for the zero copula sentences under discussion, without positing any deletion rules or unpronounced words. In order to exclude first-person singular subjects in AAVE zero copula sentences, we needed to revise the AGR type hierarchy we had posited for SAE. This was possible because of a morphological difference

between the two dialects, namely, that only SAE marks the agreement with the subject on most present-tense verbs.

14.3.3 Worksection: Predictions and Responses

Two nondeletion analyses of examples like (7) have been introduced here: one involving a verb that goes unpronounced (see the lexical entry (8) above); and a second that treats the examples as truly verbless (see the rule in (15) above). These analyses make subtly different predictions. The problems in this section explore these differences.

Problem 1: The Zero Copula and Ellipsis

The analyses make different predictions about the behavior of zero copula sentences in elliptical constructions. Explain the differences and explain how the following AAVE data bear on the choice between the analyses.

(i) *They said he wild, and he.
(ii) *They said we on tape, and we.

Problem 2: The Auxiliary Status of the Zero Copula

One response to the argument from the previous problem might be to claim that the silent variant of finite *be* should not be exactly as given in (8), but should be a nonauxiliary (i.e. [AUX −]) subject-raising verb instead. This would prevent it from undergoing the Ellipsis Lexical Rule, and would block the generation of (22). It would also prevent it from undergoing other lexical rules that are limited to [AUX +] verbs, which include the Inversion and Contraction lexical rules.

The evidence from Contraction seems to support such a treatment:

(ii) *We n't gonna lose.

A. Explain how examples like (i) are ruled out by the phrase structure rule analysis of the missing copula.

However, if there is a silent copula that is [AUX −], it should also fail to undergo the Inversion lexical rule. Since the silent copula is inaudible, it is a bit tricky to determine its location. Hence, some ingenuity is required to test whether it inverts. The following data (common to SAE and AAVE) indicate that the material following the question word in what linguists call *wh*-questions must be an inverted clause – that is, a clause whose head verb has undergone the Inversion Lexical Rule.

(iii) Where am I going? vs. *Where I'm going?
(iv) Who were you talking to? vs. *Who you were talking to?

(v) What did they find? vs. *What they found there?
(vi) When can we see it? vs. *When we can see it?

B. With this knowledge about *wh*-questions in mind, use the following data to argue (assuming an analysis that includes a silent copula) that that copula could not be [AUX −]:

(vii) Where he going?
(viii) Who you talking to?

C. Given the conclusion in (B), explain why the example in (i) is problematical for the silent copula analysis.

14.3.4 Some Advantages of the Zero Copula Rule

Methodological considerations led us to our analysis of the AAVE zero copula construction, rather than the sort of deletion account that is standardly assumed. There are, however, some empirical advantages to our treatment.

There are a number of environments in which forms of *be* occur in SAE and the corresponding AAVE sentences also require *be*. A deletion analysis has to explain in these cases why deletion does not occur; likewise, a silent verb analysis must account for differences in the distribution of the audible and inaudible variants of *be*. Labov (1995) gives a list of such environments. We will not go through them all in detail, but we note that our Zero Copula Rule, in conjunction with our analyses of other phenomena in this book (notably, ellipsis and long-distance dependencies) correctly accounts for the obligatoriness of *be* in all of the environments in question.

We will illustrate how our analysis rules out zero copulas in just three environments: negation, emphatics, and elliptical constructions.

Emphasis. When *is* or *are* is emphasized, as in *Allah* **is** *god*, the copula is obligatory. This is obvious on our analysis, since it would be impossible to emphasize what is not there. On a deletion or silent verb analysis, some mechanism is needed to prevent emphasis from falling on the verb (or to prevent deletion of an emphasized verb).

This is another case in which AAVE is like other languages that permit zero copulas. Ferguson (1971, p. 142) points out that, in such languages,

> when emphasis is put on the semantic link, as in definitions and exclamatory pronouncements, a copula equivalent is used, either a special verb (e.g. 'stands', 'is found') or a pronoun (e.g. 'he', 'they'), or a verb 'to be' which is normally used in other tenses or in existential clauses.

Ellipsis. Constructions that allow the complement to *be* to be missing are incompatible with the zero copula construction. We saw one such construction in Chapter 13, where we provided an analysis that accounts for examples like (23):

(23) a. Pat isn't fond of dogs, but Chris is.
 b. The children were making noise because the grownups were.

We introduced a lexical rule that allowed [AUX +] elements to occur without their normally obligatory complements in appropriate contexts.

This sort of ellipsis is possible in AAVE, but not when the clause in question is a zero copula:

(24) a. Sandy ain't in the car, but Terry is.
 b. *Sandy ain't in the car, but Terry.

Another type of ellipsis occurs in comparative sentences like the following:

(25) She is more intelligent than he is.

Again, the copula is obligatory in AAVE:

(26) *She (is) more intelligent than he.

In both kinds of elliptical constructions, a deletion analysis must block deletion of a form of *be* immediately preceding an ellipsis site. Likewise, a silent verb analysis needs to provide some mechanism to keep the inaudible variant of *be* from occurring just before ellipsis. Our analysis, however, requires no such mechanism. The Zero Copula Rule licenses a construction with a subject and a predicate. The elliptical examples we have been discussing have no predicate. Hence, they could not be licensed by the Zero Copula Rule.

Notice that the comparative construction does not always lack a predicate. In examples like (27), the clause following *than* has both a subject and a VP headed by a finite form of *be*.

(27) The table is longer than it is wide.

In (27), *it is wide* is a finite clause (that is, S[FORM fin]). Hence, our analysis predicts that the Zero Copula Rule should be applicable, licensing (28) in AAVE:

(28) The table (is) longer than it wide.

Our consultants confirm that (28) is indeed acceptable in AAVE.

***Wh*-Questions.** (29a) is grammatical, but its zero copula counterpart, (29b), is ungrammatical.

(29) a. I wonder where he is.
b. *I wonder where he.

This construction is an instance of the topic of the next chapter, what we are calling 'long-distance dependencies'. The word *where* in these examples is the complement of *is*, although it is not in the usual position of a complement (following the head). In our analysis of such constructions, the information that the complement appears in a non-canonical position is encoded on the head verb. But our treatment of the zero copula construction employs a non-headed rule: there is no head verb. Lacking a crucial element needed to license the placement of the complement (*where*) at the front of its clause, an example like (29b) cannot be generated.

Summing up, our Zero Copula Rule (15) correctly requires a form of *be* to be present in a variety of environments where deletion or silent verb analyses might allow them. We hasten to add that sufficiently sophisticated versions of these other analyses might provide principled accounts of the same data. Labov's contraction-based account is one example, because most of the environments that require a form of *be* in AAVE also disallow contracted forms of *be* in SAE.

Our analysis has the further advantage of bringing out the commonalities between AAVE and other zero copula languages. In general, the data from these other languages do not support plausible phonological or phonetic approaches like Labov's for English. Because of this, one might accept Labov's account as part of an account of the historical evolution of the zero copula construction in AAVE. However, we are inclined to say that the construction has now been reanalyzed in syntactic terms, fitting into a well established cross-linguistic pattern. This would help to explain why the correlation between where contraction occurs in SAE and where *be* may be absent in AAVE is only partial.

Problem 3: AAVE Invariant *Be*

The use of *be* in environments where SAE would require a finite form is one of the best known features of AAVE. (This is what Raspberry was ridiculing in the column quoted earlier in the chapter). This so-called 'invariant *be*' conveys a special meaning, usually characterized as habitual. Thus, for example, (i) means roughly that the students are usually or always in the hall when the bell rings.

(i) The students be in the hall when the bell ring. (from Green, 1993)

The goal of this problem is to determine how this use of *be* should be analyzed in our theory. Specifically, provide answers to the following three questions, and give arguments for your answers:

A. Should the 'invariant *be*' be analyzed as a distinct lexical entry, or can it be assimilated to one of the entries for *be* we have already posited? [*Hint: Consider the semantics.*]
B. Is the 'invariant *be*' a verb, and, if so, is it finite?
C. Is the 'invariant *be*' an auxiliary – that is, is it [AUX +]?

The following data should be helpful in answering B and C.

(ii) *The students be not in the hall when the bell ring.
(iii) *Be the students in the hall when the bell ring?
(iv) *The students ben't in the hall when the bell ring.
(v) *Bob be eating when the news come on, and Sue be, too.
(vi) Bob be eating when the news come on, and Sue do, too.

14.4 Conclusion

There is much more that could be said about variation within the English auxiliary system. Our superficial look at two cases of linguistic variation was meant only to demonstrate that the theory of grammar developed here can accommodate such variation naturally. In the case of the main verb *have*, careful analysis revealed a close link between its variable syntactic and semantic properties. In the case of AAVE, we were able to provide a grammar for the zero copula construction, without positing silent lexical entries or deletion rules. Moreover, this led us to notice the difference in the agreement properties of AAVE and SAE verbs, which allows the lexicon of AAVE to be somewhat simpler than that of SAE. Finally, we saw that our analysis of the AAVE zero copula construction captures its commonalities with verbless sentences in other languages.

14.5 Further Reading

Much of the pioneering work on AAVE was done by William Labov and his collaborators and students. Among the most important works are Labov, et al. (1968), Labov (1969, 1972), Baugh (1983), and Rickford and Green (in press). Labov (1995) is a clear presentation of a different analysis of some of the same phenomena discussed in this chapter. Labov's analysis is examined in detail in Wasow and Sag (forthcoming). An early discussion of the dialect variation with respect to the main verb *have* can be found in Chomsky (1975), which was written in 1955.

15

Long-Distance Dependencies

15.1 Introduction

One of the principal tasks of a theory of grammar is to provide mechanisms that allow economical formulations of the sorts of co-occurrence restrictions that exist in natural languages. In earlier chapters, we developed techniques for analyzing such aspects of syntax as differences in the valence of particular verbs, agreement between subject and verb, agreement between determiner and head noun, and restrictions on the distribution of dummy NPs. All of these co-occurrence restrictions are quite local, in the sense that they involve limitations on what can occur together as elements of a single clause. We extended this locality slightly with our analysis of raising, which in effect permits the co-occurrence restrictions of one verb to be transmitted to a higher verb.

The present chapter introduces a new type of construction in which the locality of co-occurrence restrictions appears to be violated in a more radical way. In these cases, two elements (say, an NP and a verb) appear far from one another in a sentence, despite the existence of a syntactic dependency (such as case marking or agreement) between them. Handling these 'long distance dependencies' (or LDDs, as we will call them) will require several changes to our theory:

- a new feature,
- a reformulation of one of our principles,
- a new principle,
- a new phrase structure rule, and
- a new lexical rule.

15.2 Some Data

Our current grammar correctly rules out examples like the following:

(1) a. *They handed to the baby.

b. *They handed the toy.
c. *You have talked to.
d. *The children discover.

Because the lexical entry for *hand* specifies that its COMPS list has both an object NP and a PP, (1a–b) are ruled out through the interaction of the lexicon, the headed grammar rules, the Argument Realization Principle, and the Valence Principle. Similarly, (1c–d) are ruled out because both the preposition *to* and the verb *discover* require an object NP, which is absent from these examples.

So it's interesting to find that there are grammatical sentences that contain exactly the ungrammatical strings of words in (1). For example, there are questions containing *wh*-words ('*wh*-questions') such as following:

(2) a. What did they hand to the baby?
b. Who(m) did they hand the toy?
c. Who(m) should you have talked to?
d. What will the children discover?

There are also NPs modified by RELATIVE CLAUSES which contain the same ungrammatical strings:

(3) a. The toy which they handed to the baby...
b. The baby that they handed the toy to...
c. The people who(m) you have talked to...
d. The presents that the children discover...

And finally there is a kind of sentence that is used for a certain sort of emphasis that is usually called a 'topicalized' sentence. In this kind of sentence, a topicalized element can be followed by one of those same ungrammatical word sequences in (1):[1]

[1]When examples like (4) are first presented, some students claim that they find them unacceptable, but examination of actual usage indicates that topicalization is quite common, e.g. in examples like the following (from a cartoon):

(i) Me, you bring an empty food dish; him, you bring a leash.

The name 'topicalization' is actually rather misleading. To be sure, the fronted element refers to an entity whose role in the discourse is distinguished in some way, but that entity need not correspond to the 'topic of discussion' in any straightforward way, as (i) indicates.

To illustrate these points, consider a context like the following, where an example like (4b) seems quite natural:

(v) A: How did they deal with all the screaming kids?
B: They promised to take the twins to a movie; they tossed new baseball gloves at Pat and Chris; and the baby, they handed a toy.

(4) a. That toy, they handed to the baby.
b. The baby, they handed a toy.
c. That kind of person, you have talked to (many times).
d. Presents that come from grandma, the children (always) discover.

In each of the examples in (2)–(4), there is a dependency between an 'extra' phrase or 'filler' at the beginning of a clause and a 'gap' somewhere within the clause.

In short, we see that elements which cannot normally be missing from a clause are allowed to be missing if there is an appropriate filler in the right place. Likewise, if there is a filler, then there must be a gap somewhere within the sentence that follows the filler:

(5) a. *What did Kim hand the toys to the baby?
b. *The dolls that Kim handed the toys to the baby....
c. *The dolls, Kim handed the toys to the baby.

In such constructions, the filler can be separated from the gap by extra clauses, as indicated in (6)–(8). To help readers identify the location of the gaps, we have marked them with an underlined space.

(6) a. What did you say they handed __ to the baby?
b. Who(m) did he claim that they handed the toy to __?
c. Who(m) do you think you have talked to __?
d. What will he predict that the children discover __?

(7) a. The toy which we believe they handed __ to the baby...
b. The baby that I think they handed the toy to __...
c. The person who(m) everyone thinks you have talked to __...
d. The presents that it annoys me that the children discover __...

(8) a. That toy, I think they handed __ to the baby.
b. This baby, I know that they handed a toy to __.
c. That kind of person, you know you have talked to __.
d. Presents that come from grandma, I know that the children (always) discover __.

In fact, there can be multiple extra clauses intervening:

(9) What did you think Pat claimed I said they handed __ to the baby?

15.3 Formulating the Problem

We want to be able to build clauses with elements missing within them. But somehow we have to keep track of the fact that something is missing. Furthermore, as the following contrasts show, we need to keep track of just what is missing:

(10) a. This, you can rely on.
b. *This, you can rely.
c. *On this, you can rely on.
d. On this, you can rely.
e. *On this, you can trust.

(11) a. Him, you can rely on.
b. *He, you can rely on.

(12) a. The twins, I can't tell the difference between.
b. *That couple, I can't tell the difference between.

We can think of this as an information problem. We have to make sure that the phrases within the sentence keep track of what's missing from them as they are built. This has to be done just right, so that sentences missing a phrase of type X (no matter how deeply embedded the X-type gap may be) combine with a filler of type X, and that fillers are allowed only when there is a gap for them to fill (cf. (5)).

15.4 The Feature GAP

Suppose we use a feature, GAP, to encode the fact that a phrase is missing a certain kind of element. There are examples of clauses where more than one phrase is missing[2], although a detailed analysis of them is beyond the scope of this text:

(13) a. Problems this involved, my friends on the East Coast are difficult to talk to __ about __.
b. ?That outrageous announcer on the radio, I couldn't figure out which picture of __ to print __.

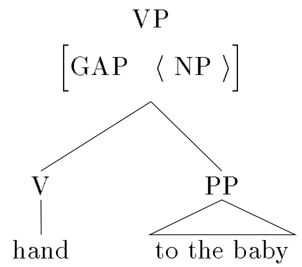
Note that the two gaps in each of these sentences have distinct fillers. In (13a), for example, the filler for the first gap is *my friends on the East Coast*, and the filler for the second one is *problems this involved*. Such examples are rare in English and sound a bit awkward, but there are other languages (e.g. Polish) that allow multiple gaps more freely.

Given the existence of sentences with multiple gaps, we need a mechanism that can keep track of many missing elements. This suggests that the value of GAP is a list of feature structures, like the values of COMPS, SPR, and ARG-ST.

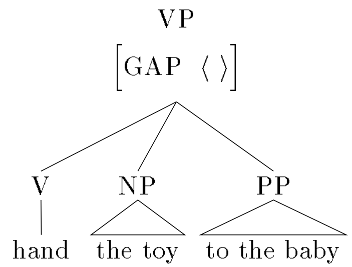
The intuitive significance of a phrase specified as, say, [GAP ⟨ NP ⟩] is that it is missing exactly one NP. The trick will be to make GAP have the right values in the right places. What we want is to allow a transitive verb or preposition to build a VP or PP without ever combining with

[2] Or, as linguists sometimes say (though it is somewhat of an oxymoron): 'where more than one gap appears'.

an object NP. Furthermore, we want to ensure that it is only when an NP is missing that the relevant phrase is specified as [GAP ⟨ NP ⟩], as illustrated in (14).

(14)


When nothing is missing, we want the relevant phrase to be [GAP ⟨ ⟩], as in (15).

(15)


We will deal with this latest kind of 'missing element' as an instance of something that is present in argument structure but absent from the valence features. We could accomplish this by means of a lexical rule, but a more general solution is to modify the Argument Realization Principle. Our current version of the principle says that a word structure tree is well formed only if the valence lists (SPR and COMPS) add up to the argument structure (ARG-ST). We now want to allow for the possibility that some element or elements of ARG-ST are on neither the SPR list nor the COMPS list, but on the GAP list instead.

To make this modification precise, we will introduce a kind of subtraction operation on lists, which we will mark with the symbol $\ominus$. Intuitively, if A and B are lists, then A $\ominus$ B is a list that results from removing the elements of B from A. A couple of caveats are in order here. First, we want A $\ominus$ B to be defined only when the elements of B all occur in A, and in the same order. So there are many pairs of lists for which this kind of list subtraction is undefined. This is unlike our form of list addition ($\oplus$), which is defined for any pair of lists. Second, when A $\ominus$ B is defined, it need not be unique. For example, if A = ⟨NP, PP, NP⟩ and B = ⟨ NP ⟩, then there are two possible values for A $\ominus$ B, namely

⟨NP, PP⟩ and ⟨PP, NP⟩. We will interpret an equation like A $\ominus$ B = C to mean that there is some value for A $\ominus$ B that is identical to C.

With this new tool in hand, we can restate the Argument Realization Principle as indicated in following revised definition of lexical satisfaction:

(16) Lexical Satisfaction
A word structure:

$$\begin{array}{c} F \\ | \\ \omega \end{array}$$

satisfies a lexical entry $\langle \omega, \delta \rangle$ just in case:

1. F satisfies δ,
2. Argument Realization Principle
   F satisfies the following feature structure description:

$$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{SPR} & \boxed{1} \\ \text{COMPS} & \boxed{2} \ominus \boxed{3} \\ \text{GAP} & \boxed{3} \end{bmatrix} \\ \text{ARG-ST} & \boxed{1} \oplus \boxed{2} \end{bmatrix}$$

   and
3. Case Constraint
   Any NP in a noninitial position of F's ARG-ST list is [CASE acc].

Intuitively, clause 2 in (16) (the revised ARP) guarantees that any argument that could appear on a word's COMPS list can appear on its GAP list instead. (We will deal with gaps that correspond to subjects, rather than complements, in section 15.5.) Further, (16) guarantees that whenever an argument is missing, any co-occurrence restrictions the word imposes on that argument will be registered on the element that appears on the GAP list.

Because the result of list subtraction (as we have defined it, namely, $\ominus$) is not always unique, when we specify the ARG-ST in a verb's lexical entry without also specifying its SPR, COMPS, and GAP values, we are actually providing an underspecified lexical entry that can be satisfied by multiple word structures. Consider, for example, the lexical entry for the lexeme *hand*, as specified in (17).

(17)
$$\left\langle \text{hand}\ , \begin{bmatrix} \textit{ptv-lxm} & \\ \text{ARG-ST} & \left\langle [\ ]_i\ , [\ ]_k\ , \begin{bmatrix} \text{FORM} & \text{to} \\ \text{P-OBJ} & \text{NP}_j \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \text{s} \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{hand} \\ \text{SIT} & s \\ \text{HANDER} & i \\ \text{HANDED-TO} & j \\ \text{HANDED-ITEM} & k \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

This can undergo the Non-3rd-Singular Verb Lexical Rule presented in Chapter 8, yielding the following lexical entry:

(18)
$$\left\langle \text{hand}\ , \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{bmatrix} \text{CASE} & \text{nom} \\ \text{AGR} & \textit{non-3sing} \end{bmatrix}, \text{NP[acc]}, \begin{bmatrix} \text{FORM} & \text{to} \\ \text{P-OBJ} & \text{NP} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \ldots \end{bmatrix} \end{bmatrix} \right\rangle$$

There are a number of word structures that this lexical entry can give rise to. They differ in their specifications for the features SPR, COMPS, and GAP. In particular, each of the following lexical SDs (omitting features not relevant to the present context) illustrates a distinct way that a word structure can satisfy the ARP:

(19)
$$\begin{array}{c}\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix} \\ \text{SPR} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{2}\text{NP[acc]} , \boxed{3}\text{PP[to]} \rangle \\ \text{GAP} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{array}{c}\boxed{1}\text{NP} \\ \begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{non-3sing}\end{bmatrix}\end{array}, \boxed{2} , \boxed{3} \right\rangle \end{bmatrix} \\ | \\ \text{hand}\end{array}$$

(20)
$$\begin{array}{c}\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix} \\ \text{SPR} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{3}\text{PP[to]} \rangle \\ \text{GAP} & \langle \boxed{2}\text{NP[acc]} \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{array}{c}\boxed{1}\text{NP} \\ \begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{non-3sing}\end{bmatrix}\end{array}, \boxed{2} , \boxed{3} \right\rangle \end{bmatrix} \\ | \\ \text{hand}\end{array}$$

(21)
$$\begin{array}{c}\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix} \\ \text{SPR} & \langle \boxed{1} \rangle \\ \text{COMPS} & \langle \boxed{2}\text{NP[acc]} \rangle \\ \text{GAP} & \langle \boxed{3}\text{PP[to]} \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{array}{c}\boxed{1}\text{NP} \\ \begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{non-3sing}\end{bmatrix}\end{array}, \boxed{2} , \boxed{3} \right\rangle \end{bmatrix} \\ | \\ \text{hand}\end{array}$$

All of these are legitimate lexical SDs, and they serve as the bases for distinct phrase structure trees: (19) describes *hand* in sentences like (22a); (20) is the way *hand* appears in sentences like (22b); and (21) is the basis for our description of sentences like (22c).[3]

(22) a. You handed the toy to the baby.
  b. What did you hand to the baby?
  c. To whom did you hand the toy?

The prepositional lexeme in (23) will now give rise to the lexical SDs in (24) and (25) (again omitting what is not directly relevant).

(23)
$$\left\langle \text{to} , \begin{bmatrix} \textit{mkp-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{prep} & \\ \text{FORM} & \text{to}\end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}\text{NP[acc]} \right\rangle \end{bmatrix} \right\rangle$$

[3]The ARP also allows for a word structure in which both the NP and PP complements are in the GAP list, rather than the COMPS list. As noted above, however, consideration of examples with multiple gaps (which are relatively rare in English) goes beyond the scope of this text.

(24)
$$\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{prep} & \\ \text{FORM} & \text{to} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle \boxed{2}\text{NP[acc]} \rangle \\ \text{GAP} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{2} \rangle \end{bmatrix}$$

to

(25)
$$\begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{prep} & \\ \text{FORM} & \text{to} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \\ \text{GAP} & \langle \boxed{2}\text{NP[acc]} \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{2} \rangle \end{bmatrix}$$

to

This last lexical SD is the one that allows for sentences like (26).

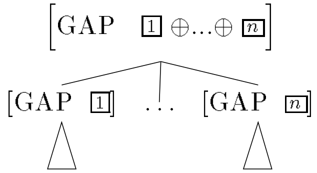
(26) Which baby did you hand the toy to?

The GAP feature tells us which of a word's arguments is missing. The Argument Realization Principle, as we have reformulated it, permits us to instantiate gaps freely (other than elements that must be on the SPR list). Now we need some way of passing the information in the GAP value up from words like those just illustrated so that the phrases that they head will register the fact that something is missing. In fact, we need to pass up[4] the GAP information more generally, as we'll see in a moment, so we will adopt the more general principle in (27).

[4]The metaphor of passing information between nodes should not be taken too literally. What the principle in (27) does is similar to what the Head Feature Principle and Valence Principle do, namely, enforce a particular relationship between certain feature values in mothers and daughters in phrase structure trees. That is, it is simply part of our complex definition of well-formedness for phrase structure trees.

(27) The GAP Principle

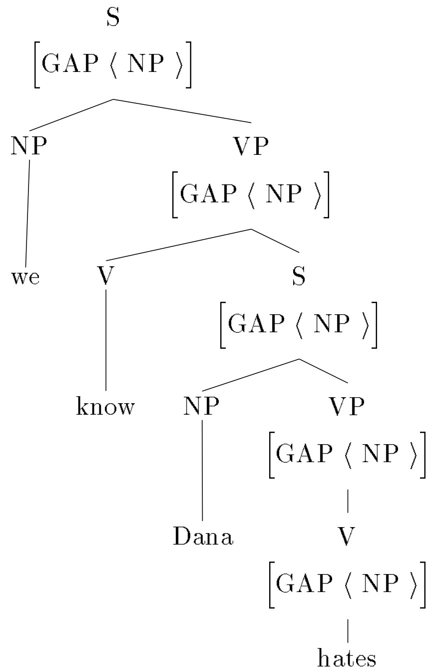
A well-formed phrase structure licensed by a headed rule other than the Head Filler Rule must satisfy the following SD:



In other words, in a headed structure, the GAP values of all the daughters must add up to be the GAP value of the mother, unless the rule sanctioning the structure is the Head-Filler Rule (to which we turn directly).

The notion of lists 'adding up to' something is the same one we have employed before, namely the operation that we denote with the symbol '⊕'. In most cases, most of the lists that are added up in this way are in fact empty, so that the addition is quite trivial. The purpose of this principle, once again, is to make sure that any information represented in the GAP value of a node will also be represented in that node's mother, but most constituents don't contain gaps. The effect of (27), then, given our lexical entries (and the word structures they sanction in virtue of our revision of the ARP), is illustrated in (28).

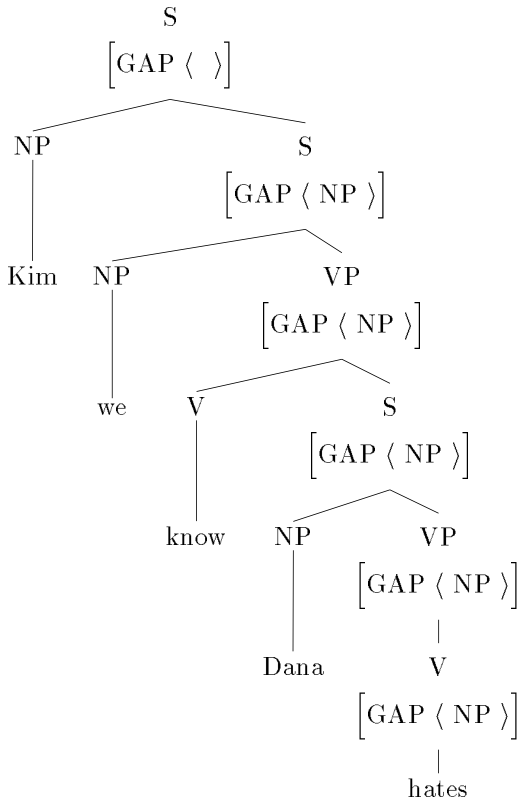
(28)



Note that we are suppressing empty GAP specifications on three nodes in (28). But it is true everywhere in (28) that the GAP values of the daughters add up to the mother's GAP value: $((\langle\,\rangle \oplus \langle NP\rangle) = \langle NP\rangle = (\langle NP\rangle \oplus \langle\,\rangle))$.

Of course, *we know Dana hates* by itself is not a well-formed sentence. It must be combined with an NP to fill the gap corresponding to the object of *hates*. This requires a structure along the following lines:

(29)



We have not yet accounted for the disappearance of the NP from the GAP value at the topmost node of (29). Intuitively, what is going on here is that the filler NP (*Kim*) is introduced, thus discharging the obligation encoded in the GAP value. To formalize this intuition, we introduce a new grammar rule.

(30) Head-Filler Rule

$$\begin{bmatrix} \textit{phrase} & \\ \text{GAP} & \langle\,\rangle \end{bmatrix} \rightarrow \boxed{1}\begin{bmatrix} \textit{phrase} & \\ \text{GAP} & \langle\,\rangle \end{bmatrix} \quad \mathbf{H}\begin{bmatrix} \textit{phrase} & \\ \text{FORM} & \text{fin} \\ \text{SPR} & \langle\,\rangle \\ \text{GAP} & \langle \boxed{1} \rangle \end{bmatrix}$$

The GAP Principle (like the Valence Principle) allows the gap information to be propagated upward through tree structures. But because the Head-Filler Rule is not subject to the GAP Principle, it in effect terminates the upward propagation of a nonempty GAP specification.

Rule (30) introduces the filler as its first daughter, specifying that it is identical to the value of the GAP feature in the second daughter, as shown in the highest local tree in (29). The mechanisms introduced to handle fillers and gaps guarantee that whenever a node of a tree structure is licensed by the Head Filler Rule, somewhere inside the finite S (the head daughter) there is exactly one word with a nonempty GAP list. The Head-Filler Rule is the only way we have of licensing the removal of elements from a GAP list. More precisely, this is our only way to license a node that is [GAP ⟨ ⟩] itself but which dominates another node that has something on its GAP list. Consequently, the analysis presented introduces a filler if and only if there is a gap for it to fill.

We need one more modification in our grammar to ensure that all gaps ultimately get filled. We do this by revising our initial symbol to include a specification that it must have an empty GAP list. That is, our initial symbol is now the following:

(31)
$$\begin{bmatrix} \textit{phrase} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \\ \text{GAP} & \langle\ \rangle \end{bmatrix} \end{bmatrix}$$

Problem 1: An SD with a Gap
Draw an SD for (8b). You should provide about the same level of formal detail as in (29).

Problem 2: Blocking Filled Gaps
Examples (i) and (ii) are well formed, but example (iii) is ungrammatical.

(i) Pat thinks that I rely on some sort of trick.
(ii) This mnemonic, Pat thinks that I rely on.
(iii) *This mnemonic, Pat thinks that I rely on some sort of trick.

Explain in detail why the mechanisms that license (i) and (ii) do not also permit (iii).

15.5 Subject Gaps

We have covered only the basic cases of long-distance dependencies. There are many additional complexities. For example, we have not discussed cases in which the gaps are not complements, but rather subjects or modifiers. In addition, we have not discussed the distribution of *wh*-words (such as *who, what, which*, etc.) in questions and relative clauses, nor the obligatory inverted order of subject and auxiliary verb in many *wh*-questions. There is a rich literature investigating these and many other questions associated with LDDs, but such matters are beyond the scope of this text. In this section we sketch the basics of an account of what is known as subject extraction – that is LDDs in which the gaps are in subject position.

Our present account does not yet deal with examples like (32).

(32) a. Which candidates do you think like raw oysters?
b. That candidate, I think likes raw oysters.

This is because it is a general property of verbs (analyzed in terms of a constraint inherited from the type *verb-lxm*) that they must have a singleton SPR list, rather than an empty one. That is, the ARP requires that the first member of a word's ARG-ST list (the verb's subject, in the present context) must also be on its SPR list. It follows that any elements that appear on a verb's GAP list must correspond to noninitial members of the ARG-ST list. Consequently, there is no way for a subject argument of a verb such as *likes* to appear on the GAP list. Hence we have no account (yet) of examples like (32).

Subject extraction is subject to special constraints in many languages. Hence it is not unreasonable for us to treat it in terms of a special rule, in this case, the following lexical rule:

(33) Subject Extraction Lexical Rule

$$\left\langle \boxed{0}, \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ [\ ]\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{0}, \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{SPR} & \langle\ \rangle \\ \text{GAP} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}, \ldots \right\rangle \end{bmatrix} \right\rangle$$

This rule maps any lexical entry for a finite verb form into a lexical entry with an empty SPR list and a GAP list containing an element identified with the first argument – the subject of the verb. Lexical entries that are outputs of this rule, like (34), give rise to lexical SDs like (35).

(34)
$$\left\langle \text{likes}\ ,\ \left[\begin{array}{ll} \textit{word} & \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{ll}\textit{verb} & \\ \text{FORM} & \text{fin}\end{array}\right] \\ \text{SPR} & \langle\ \rangle \\ \text{GAP} & \left\langle \boxed{1}\left[\begin{array}{ll}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{3sing}\end{array}\right]\right\rangle \end{array}\right] \\ \text{ARG-ST} & \langle\ \boxed{1}\ ,\ \text{NP[acc]}\ \rangle \\ \text{SEM} & [\ldots] \end{array}\right] \right\rangle$$

(35)
$$\begin{array}{c} \left[\begin{array}{ll} \textit{word} & \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{ll}\textit{verb} & \\ \text{FORM} & \text{fin}\end{array}\right] \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \boxed{2}\text{NP[acc]}\ \rangle \\ \text{GAP} & \left\langle \boxed{1}\left[\begin{array}{ll}\text{AGR} & \textit{3sing}\end{array}\right]\right\rangle \end{array}\right] \\ \text{ARG-ST} & \langle\ \boxed{1}\ ,\ \boxed{2}\ \rangle \end{array}\right] \\ | \\ \text{likes} \end{array}$$

Note that the ARP is satisfied in (35): the SPR list is empty, and the rest of the ARG-ST list (i.e. the whole ARG-ST list) is in the appropriate relation with the list values of COMPS and GAP.

Problem 3: Subject Gaps

This problem is to make sure you understand how our analysis accounts for examples like (32).

(a) Sketch the lexical entry for *likes* that is the input to the Subject Extraction Lexical Rule.

(b) Sketch the entire SD for the sentence in (32b). Be sure to explain how our grammar ensures that all relevant feature specifications are as they are in your sketch.

(c) Does our analysis correctly predict the contrast between (32b) and (i)?
(i) *Those candidates, I think likes raw oysters.
Explain why or why not.

Problem 4: Irish Complementizers

Consider the following example that shows the typical word order pattern of Modern Irish (data from McCloskey (1979)):

(i) *Shíl mé goN mbeadh sé* ann
thought I COMP would-be he there
'I thought that he would be there.' [M 2a]

Irish is a VSO language, one which we might describe in terms of a Head-Specifier-Complement Rule that introduces both kinds of dependents as sisters of the lexical head.

A. Formulate such a rule and show the structure for sentence (i).

Now consider some further Irish data:

(ii) *Dúirt mé gurL shíl mé goN mbeadh sé ann*
said I goN+past thought I COMP would-be he there
'I said that I thought that he would be there.' [M 3a]

(iii) *an fear aL shíl mé aL bheadh ann*
the man COMP thought I COMP would-be __ there
'the man that I thought would be there' [M 2b]

(iv) *an fear aL dúirt mé aL shíl mé aL*
the man COMP said I COMP thought I COMP
bheadh ann
would-be __ there
'the man that I said I thought would be there' [M 3a]

(v) *an fear aL shíl goN mbeadh sé ann*
[the man]$_j$ COMP thought __ COMP would-be he$_j$ there
'[the man]$_j$ that thought he$_j$ would be there' [M 4a]

(vi) *an fear aL dúirt sé aL shíl goN*
the man COMP said he COMP thought __ COMP
mbeadh sé ann
would-be he there
'the man that he said thought he would be there' [M 4c]

The complementizers *goN* and *aL* are in complementary distribution.

That is, wherever *goN* is possible in these examples, *aL* is not, and vice versa.[5] Assume that both these elements are heads of CPs similar to those headed by *that* complementizers in English. If we then make the further assumption that LDDs in Irish work much as they do in English, we have all the tools we need to analyze the contrasts in (i)–(vi).

B. Provide lexical entries for these two complementizers.
C. Show how your analysis successfully explains the distributional differences between the two complementizers.

15.6 The Coordinate Structure Constraint

One of the most discussed topics related to LDDs concerns restrictions on possible pairings of fillers and gaps. Although the position of filler and gap may be arbitrarily far apart, there are certain configurations that do not permit LDDs. Such configurations are known as 'islands' (a term due to Ross (1967)), and a major goal of syntactic research over the past three decades has been to understand where and why islands occur. In this section, we will look at one type of island and show how our grammar correctly predicts its existence and its properties.

The following examples illustrate what Ross called the 'Coordinate Structure Constraint':

(36) a. *Here is the student that [the principal suspended [__ and Sandy]].
b. *Here is the student that [the principal suspended [Sandy and __]].

(37) a. *Here is the student that [the principal suspended __ and Sandy defended him].
b. *Here is the student that [the student council passed new rules and the principal suspended __].

(38) a. *Apple bagels, I can assure you that [Leslie likes __ and Sandy hates cream cheese].
b. *Apple bagels, I can assure you that [Leslie likes cream cheese and Sandy hates __].

Translating Ross's transformation-based formulation of the constraint into the language of fillers and gaps that we have been using, it can be stated as follows:

[5] For the purposes of this problem, you should ignore the difference between *gurL* and *goN*.

(39) Coordinate Structure Constraint (CSC)
In a coordinate structure,
(a) no conjunct can be a gap,
(b) nor can a gap be contained in a conjunct if its filler is outside of that conjunct.

Ross also noticed a systematic class of exceptions to this constraint, illustrated by (40).

(40) a. This is the dancer that [we bought [a portrait of __ and two photos of __]].
b. Here is the student that [the principal suspended __ and the teacher defended __].
c. Apple bagels, I can assure you that [Leslie likes __ and Sandy hates __].

To handle these, he appended an additional clause to the constraint, which we can formulate as follows:

(41) 'Across-the-Board' Exception (addendum to CSC):
. . . unless each conjunct has a gap paired with the same filler.

As presented, the Coordinate Structure Constraint seems quite arbitrary, and the Across-the-Board Exception is just an added complication. The descriptive generalizations of (39) and (41) ideally should not have to be stipulated. It would be preferable if they emerged as consequences of independently motivated aspects of the analyses of LDDs and coordination. And in fact, our accounts of LDDs and coordination interact to make precisely the right predictions in this domain, as we will now show.

Recall the grammar rule for coordination:

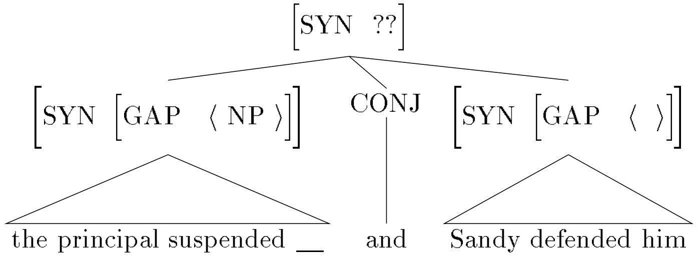
$$\begin{bmatrix}\text{SYN} & \boxed{0}\\ \text{IND} & s_0\end{bmatrix} \rightarrow$$

$$\begin{bmatrix}\text{SYN} & \boxed{0}\\ \text{IND} & s_1\end{bmatrix} \ldots \begin{bmatrix}\text{SYN} & \boxed{0}\\ \text{IND} & s_{n-1}\end{bmatrix} \overset{\text{CONJ}}{\begin{bmatrix}\text{IND} & s_0\\ \text{RESTR} & \left\langle\begin{bmatrix}\text{ARGS}\ \langle s_1 \ldots s_n\rangle\end{bmatrix}\right\rangle\end{bmatrix}} \begin{bmatrix}\text{SYN} & \boxed{0}\\ \text{IND} & s_n\end{bmatrix}$$

Intuitively, this allows any number of elements with the same SYN value to be conjoined. But GAP is part of SYN, so two phrases with different GAP values will have different SYN values. Consequently, two conjuncts in a coordinate structure cannot differ in their GAP value. If one has an empty GAP list and the other has a nonempty GAP list (as in (36)–

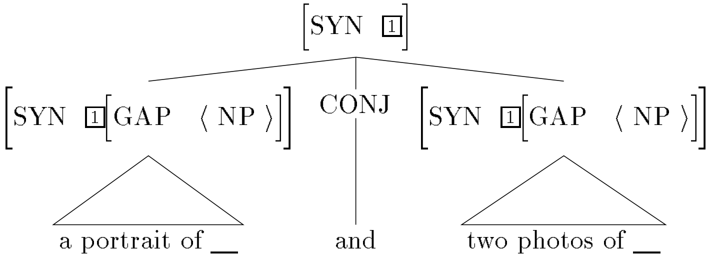
(38)), then the structure is not licensed. The SYN values that should unify cannot, as shown in (42):

(42)



On the other hand, it is possible for conjuncts to have nonempty GAP lists if they are all nonempty and all share the same value. This is what is illustrated in (40), whose structure is as shown in (43):

(43)



In short, both the CSC and the Across-the-Board exception to it fall out of our analysis as straightforward consequences.

We close this discussion with one final observation about LDDs and coordinate structures. There is an exception to (41), illustrated by (44):

(44)*Which rock legend would it be ridiculous to compare [[__] and [__]]?

Our statements of the generalizations in (39) and (41), like Ross's original formulations of them, would in fact permit (44), whose deviance should have a syntactic (rather than a semantic) explanation, it would appear, because the meaning of this putative sentence could certainly be expressed as (45):

(45) Which rock legend would it be ridiculous to compare __ with himself?

But our analysis correctly rules out any sentences in which a gap constitutes a full conjunct. This is because nonempty GAP values in the lexicon are licensed by the Argument Realization Principle. Hence our notion of a gap is an argument that fails to be realized in the syntax, not a phonetically empty phrase (or 'trace', as such phrases are often

called). The difference is subtle, but the predictions are quite striking: our traceless analysis of gaps provides an immediate account of the deviance of (44) – and also of the examples in (36) – (38). The Coordinate Structure Constraint and its exceptions are thus explained in the analysis we have developed. Many alternative approaches – particularly those involving movement transformations to account for LDDs – have had to incorporate ad hoc stipulations to deal with this range of facts, or else have not accounted for them at all.

15.7 Conclusion

Deducing the Coordinate Structure Constraint and its exceptions from our analyses of coordination and LDDs is an elegant result,[6] providing significant support for our general approach to syntax.

We will not examine other island constraints in this text. As with the Coordinate Structure Constraint, linguists have not been content to catalog the environments in which filler-gap pairings are impossible. Rather, a great deal of effort has gone into the search for explanations of syntactic islands, either in terms of the interaction of independently motivated elements of the theory (as in the example given above), or in terms of such factors as the architecture of the human language-processing mechanisms. This is a fertile area of research, in which definitive answers have not yet been found.

15.8 Further Reading

Ross (1967) is probably the most influential work to date on the topic of long-distance dependencies. Chomsky (1973, 1977, 1986b) developed one of the most influential approaches to analyzing these constructions, using transformations. Nontransformational treatments are presented by Zaenen (1983) and Gazdar (1981). The treatment presented here is unusual in not positing an empty category (a trace) in the position of the gap. Arguments for such a traceless analysis are discussed by Sag and Fodor (1994).

[6] Essentially this account was first developed by Gazdar (1981), within the theory of Generalized Phrase Structure Grammar.

16

From Rule to Sign

16.1 Taking Stock

Let us examine the road we have travelled in the preceding chapters. We began with the inadequacy of simple context-free grammars, given their inability to express the notion of headedness, their inability to express cross-categorial generalizations, and the redundancy inherent in their descriptions of natural languages like English. We set out to modify CFGs – first by introducing the notion of feature structure, to model not only syntactic categories but also a variety of other constructs that became necessary as we developed our analyses (lexemes, words, agr-cats, synsem-strucs, etc.). Central to our theory of feature structures has been the notion of a linguistic type, which we used both to declare which features are appropriate for particular kinds of linguistic entities and to classify linguistic entities (and the constraints they obey) in a hierarchical fashion.

After examining and analyzing a host of grammatical phenomena, however, we find that our system has not strayed very far from its CFG origins. We continue to specify well-formed tree structures in essentially the CFG fashion: we specify a lexicon plus a set of grammar rules, and we combine the information from these two sources in terms of a third, namely, the set of conditions that constitute our definition of well-formed tree structures. The lexicon is more elaborate than it would be in a simple CFG, with its hierarchical type structure and its lexical rules. Likewise, we have enriched the definition of phrasal satisfaction (part of our well-formedness definitions) to incorporate various general principles, such as the Head Feature Principle. The grammar rules, on the other hand, have become rather simple and schematic. Nevertheless, we have continued to divide the work of the grammar among these three components, each with its own formal character.

If we now step back from this picture of grammar, we can see things from a new perspective. For example, we can now ask why phrases have no place in the hierarchy of linguistic entities. Surely they are linguistic entities just as much as words, lexemes, and synsem-strucs are. Yet they have an altogether different status in our current grammar: they are defined indirectly, in terms of the system of rules and principles that together characterize the well-formed phrase structure trees. As we shall see in this chapter, it is possible to reformulate our theory so that the grammar of phrases is not radically different from that of other linguistic objects. This reformulation (which represents the practice of much current research) has the formal advantage of providing a more uniform treatment of the lexicon and grammar rules, the descriptive advantage of allowing generalizations about phrases to be better expressed, and the explanatory advantage of fitting better with what we know about human sentence-processing, as discussed in Chapter 9.

16.2 Words and Signs

The renowned Swiss linguist Ferdinand de Saussure (1857-1913) conceived of language as a system of what he called 'signs'. A sign in Saussure's sense is nothing more than a conventional association of form with meaning.[1] The sign-based conception of language is attractive in that it lets us put all linguistic expressions – words and phrases alike – on an equal footing. Phrases like *love*, *Kim loves Sandy*, *Go away*, *to continue to like anchovies*, and so forth can all be viewed as associations of sound and meaning that are in accord with the constraints of English grammar, while *l'amour*, *Kim aime Sandy*, *Allez-vous en*, and *continuer d'aimer les anchois* are phrasal signs of French – different forms associated with the same meanings – and likewise for the corrsponding phrasal signs of Inuit, Tongan, or any other natural language.

Moreover, if we could reformulate all of our grammar as a set of constraints on signs, so that the English language would be just the set of signs that satisfied the constraints of English grammar, then we would have a picture of grammar that was completely true to the constraint-based architecture that we motivated in Chapter 9 on psychological grounds. On the sign-based conception of grammar (where, as we will see, lexical rules can be eliminated), the well-formed structures are just those that satisfy all the constraints of the theory. The well-formed structures must satisfy all the relevant type constraints, but they need not satisfy those constraints in any fixed order.

How, then, can we relate the grammar we have developed to the

[1] Or, as Saussure would have it, an association of a mental representation of sound with a mental representation of meaning.

Saussurean conception? To begin with, our current notion of a lexical entry is very much like a sign, in that lexical entries specify a form and a meaning. Our lexical entries are richer than signs, though, in that they also specify syntactic information. Note that there has been a terminological tension throughout the preceding chapters about the term 'word'. We introduced the type *word* (a subtype of *synsem-struc*) and sometimes when we use the term 'word', that is what we mean. But on other occasions, we have used the term 'word' to refer to a lexical entry (i.e. a pair consisting of a form and a feature structure) whose feature structure is of type *word*, e.g. (1).

(1)
$$\left\langle \text{Kim}\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \textit{3sing} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & s \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

In our current grammar this word is the result of applying the Singular Noun Lexical Rule to the lexical entry whose first member is *Kim* and whose second member is a description of type *pn-lxm*.

It would be a small but significant move to revise our notion of *word* along Saussurean lines, thereby eliminating the terminological tension mentioned above. Suppose that we posited a type, *word*, whose features were PHON(OLOGY) and SEM(ANTICS). We could then model the word *Kim* as follows:

(2)
$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \text{Kim} \rangle \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & s \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

This would be true to Saussure's conception, but it contains none of the SYNTAX or ARG-ST information that has been central to our analyses of a variety of complex grammatical phenomena. Indeed, Saussure is often faulted for failing to address syntactic issues.

But it requires only a small modification to include the syntactic information that is missing from (2). We could introduce a SYNTAX attribute parallel to SEMANTICS; alternatively we could make PHON and SYNSEM the only features appropriate for instances of the type *word*, making its SYNSEM values the synsem-strucs that have served us well in the analyses of the preceding chapters. The result would look something like (3).

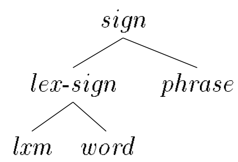
(3)
$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \text{Kim} \rangle \\ \text{SYNSEM} & \begin{bmatrix} \textit{synsem-struc} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{AGR} & \textit{3sing} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle \ \rangle \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{ref} \\ \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & s \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

This is in essence the format in which the lexical analyses presented in this text have appeared in much of the published literature on sign-based grammar.

Notice that the PHON value in (3) is presented as a list. This not only provides a uniform representation for words (recall our analysis of *kick the bucket* in Chapter 11), but also allows us to generalize the notion of sign to include phrases, where the PHON value will usually be a list of more than one form. Because feature structures like (3) are descriptions, they often omit certain grammatical specifications. And such descriptions are satisfied by a family of fully specified word structures – those objects of type *word* that are consistent with all the information that is specified. (See the discussion of satisfying descriptions in Chapter 3.)

Adopting a sign-based conception of grammar doesn't change our lexical analyses in any fundamental way; in fact, it enables us to improve them, as we will see. With the introduction of the notion of sign, though, we will want to revise our terminology a bit. For example, the type *lexical-item*, whose two immediate subtypes are *word* and *lexeme* (see Chapter 8 and the summary at the beginning of Chapter 9), is probably better recast as *lexical-sign* (*lex-sign*). The change is primarily terminological – constraint inheritance works just as before: an individual lexeme description (what we used to call a 'lexical entry for a lexeme') inherits constraints from the types that it is an instance of (with the possibility of overriding default constraints). The only substantive difference is that phonological information is now in the feature structures that participate in the inheritance.

The picture we have at the highest level of the grammar, then, is of signs subdivided according to the following type hierarchy.

(4)


All signs are specified for the features PHON and SYNSEM; this will allow us to better reflect the common properties of words and phrases (while still drawing a type distinction between them). As we shall see below, phrases have additional features that are inappropriate for lexical signs.

In the next section, we explore the consequences of the sign-based architecture for the structure of the lexicon. In section 16.4, we sketch a sign-based conception of phrase, which will simplify certain aspects of our grammar and allow us to express cross-classifying generalizations about phrasal constructions.

16.3 The Organization of the Lexicon

There are two distinct advantages to treating words as signs: (i) it allows us to express generalizations that cut across words and lexemes; and (ii) it provides a new, more elegant constraint-based alternative to lexical rules.

16.3.1 Multiple Inheritance Hierarchies

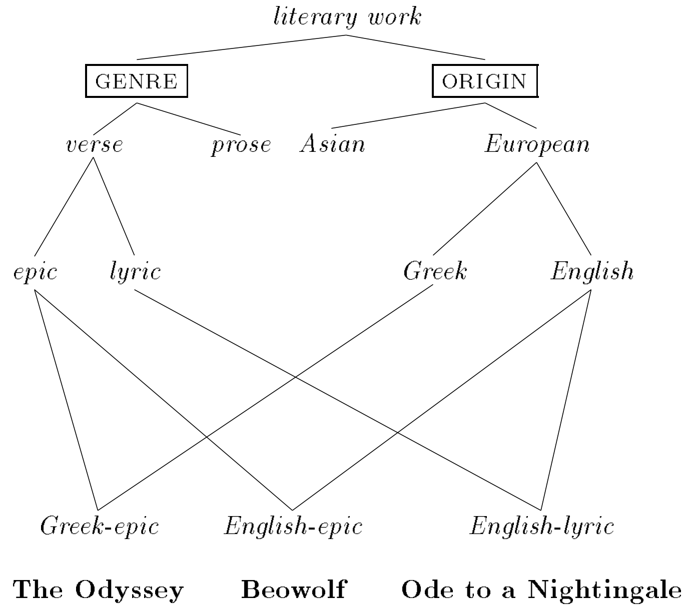
Recall that in Chapter 12, we introduced a distinction between raising and control elements. As we noted there, however, the distinction cuts across part-of-speech distinctions, for example, the distinction between verbs and adjectives. In fact, cross-cutting regularities are not at all uncommon in human languages, and our theory of grammar should be able to express such generalizations.

But in fact, the theory of lexical types we presented in Chapter 8 doesn't fare well in expressing cross-cutting generalizations. Because the hierarchy of lexemes is a tree, we posit distinct types (e.g. *adj-lxm* vs. *verb-lxm*) whenever a distinction must be made. But this means that if these types each have a subtype with a common property – for example, the type of subject-raising verb (*continue*) versus that of the subject-raising adjective (*likely*) – then we must state the constraint on subject-raising twice – once on each of the distinct types. Our 'single-mother' inheritance hierarchies thus fail to express certain generalizations that we find in natural language.

There is a solution to this problem. Suppose that we allow a type to be subdivided in two (or more) independent ways. That is, suppose we allow independent partitions of certain types into subtypes so that each maximal (leaf) type must have a supertype in each partition. Intuitively, the partitions correspond to distinct informational dimensions. For example, we can distinguish types based on part-of-speech distinctions from types based on distinctions of argument structure, thus allowing the contrast of, say, verb versus adjective to be independent of the contrast of intransitive versus transitive versus subject-raising, and so on.

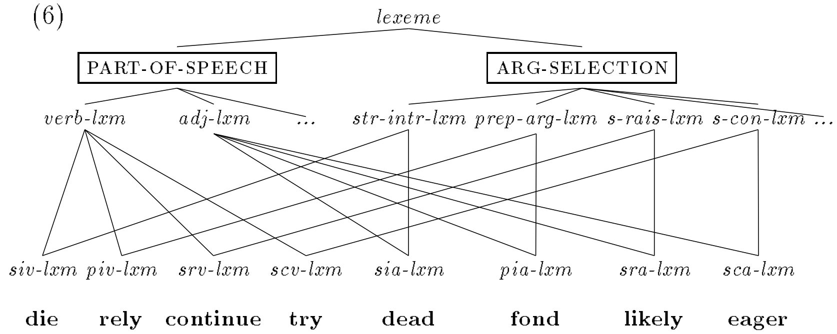
This kind of classification is called a 'multiple inheritance hierarchy'. Such hierarchies are commonly used to organize multiple dimensions of information about objects in particular knowledge domains. Literary works, for example, might be organized in terms of types that form two independent hierarchical dimensions of classification, as shown in (5).

(5)



In (6), we illustrate one way our lexeme hierachy could be revised using multiple inheritance to express the cross-cutting generalizations our current hierarchy fails to capture.

(6)



Several comments about this hierarchy are in order. First, we are using some new abbreviations for type names, so we have spelled out all of the names in (7).

(7) a. *str-intr-lxm*: *strict-intransitive-lexeme*
b. *prep-arg-lxm*: *PP-argument-lexeme*
c. *s-rais-lxm*: *subject-raising-lexeme*
d. *s-con-lxm*: *subject-control-lexeme*

e. *siv*: *strict-intransitive-verb-lexeme*
f. *piv*: *PP-intransitive-verb-lexeme*
g. *srv*: *subject-raising-verb-lexeme*
h. *scv*: *subject-control-verb-lexeme*
i. *sia*: *strict-intransitive-adjective-lexeme*
j. *pia*: *PP-intransitive-adjective-lexeme*
k. *sra*: *subject-raising-adjective-lexeme*
l. *sca*: *subject-control-adjective-lexeme*

Second, the ARG-SELECTION types (*str-intr-lxm*, *prep-arg-lxm*, etc.) should be constrained so as to express the generalizations across ARG-ST values that are common to the particular verbal and adjectival subtypes. These constraints can be stated as in (8).[2]

(8) a. $$\textit{str-intran-lxm}: \left[\text{SS} \left[\text{ARG-ST} \quad \langle\, [\;] \,\rangle\right]\right]$$

b. $$\textit{prep-arg-lxm}: \left[\text{SS} \left[\text{ARG-ST} \quad \langle\, [\;]\, ,\, \text{PP} \,\rangle\right]\right]$$

c. $$\textit{s-rais-lxm}: \left[\text{SS} \left[\text{ARG-ST} \left\langle \boxed{1}\, , \begin{bmatrix}\textit{phrase} & \\ \text{SPR} & \langle\, \boxed{1} \,\rangle\end{bmatrix} \right\rangle\right]\right]$$

d. $$\textit{s-con-lxm}: \left[\text{SS} \left[\text{ARG-ST} \left\langle \text{NP}_i\, , \begin{bmatrix}\textit{phrase} & \\ \text{SPR} & \langle\, \text{NP}_i \,\rangle\end{bmatrix} \right\rangle\right]\right]$$

The PART-OF-SPEECH types can remain subject to the earlier constraints, namely:

(9) a. $$\textit{verb-lxm}: \left[\text{SS} \begin{bmatrix}\text{SYN} & \begin{bmatrix}\text{HEAD} & \textit{verb} \\ \text{SPR} & \langle\, [\;] \,\rangle\end{bmatrix} \\ \text{ARG-ST} & /\ \langle\, \text{NP}\, , \ldots \,\rangle \\ \text{SEM} & \left[\text{MODE} \quad \text{prop}\right]\end{bmatrix}\right]$$

b. $$\textit{adj-lxm}: \left[\text{SS} \begin{bmatrix}\text{SYN} & \begin{bmatrix}\text{HEAD} & \textit{adj} \\ \text{SPR} & \langle\, [\;] \,\rangle\end{bmatrix} \\ \text{ARG-ST} & /\ \langle\, \text{NP}\, , \ldots \,\rangle \\ \text{SEM} & \left[\text{MODE} \quad \text{prop}\right]\end{bmatrix}\right]$$

Given the similarity of these constraints, of course, we could further

[2]Here and throughout, we use ‘SS’ to abbreviate ‘SYNSEM’.

revise the system so that the ARG-ST and SEM specifications are associated with a common supertype.

Our purpose here is not to make a definitive proposal for the analysis of the English lexeme hierarchy,[3] but rather to show that multiple inheritance hiearchies can be used to factor cross-cutting generalizations of words into succinct constraints that are associated with cross-classifying types.

16.3.2 Lexical Rules as Word Types

Let us now consider how lexical rules can be eliminated in favor of a hierachical system of types, given a sign-based architecture. In this text, we have presented the function of lexical rules as expanding the set of lexical entries. That is, we have treated them as mappings from lexical descriptions to lexical descriptions. We have seen three kinds of lexical rules: derivational rules that map lexemes to lexemes (e.g. the Extraposition Lexical Rule), inflectional rules mapping lexemes to words (e.g. the 3rd Singular Verb Lexical Rule), and other rules mapping words to words (e.g. the Negation Lexical Rule).

The work of all three kinds of lexical rule can be handled by types. Here we will focus on inflectional rules. Suppose that we declare a feature STEM as appropriate for the type *word*. If the value of STEM is of type *lexeme*, then we have a feature structure where a lexeme fits inside of a word. This is one way to build the word/lexeme relation into a single feature structure. We might further add the default constraints that the SYNSEM and PHON values of a word are identical to those of its STEM value. These constraints, illustrated in (10), will have the same effect as our convention that lexical rules preserve information that is not explicitly contradicted.

(10) $$\textit{word}: \begin{bmatrix}\text{PHON} & /\ \boxed{1} \\ \text{SYNSEM} & /\ \boxed{2} \\ \text{STEM} & \begin{bmatrix}\textit{lxm} & \\ \text{PHON} & /\ \boxed{1} \\ \text{SYNSEM} & /\ \boxed{2}\end{bmatrix}\end{bmatrix}$$

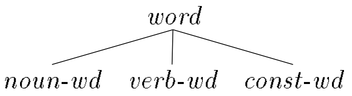
Each lexeme-to-word (inflectional) lexical rule will then correspond to a distinct subtype of word, with appropriate constraints added. For example, the Constant Lexeme Lexical Rule can be replaced by a subtype of *word*, constrained as shown in (11).

[3]Such a proposal might also involve separating the distinction between constant and inflecting lexemes into a separate dimension.

(11) *const-wd*: $\begin{bmatrix}\text{STEM} & \textit{const-lxm}\end{bmatrix}$

Note that the PHON and SYNSEM identifications are inherited from (10) by default.

If we replace lexical rules with a hierarchy of subtypes of *word*, we can not only express the same generalizations that our lexical rules used to express, but we can also group lexical rules into families, establishing intermediate types to express further generalizations, that is, those properties that families of lexical rules have in common. Suppose for example that we posit (for English) the three basic subtypes of *word* shown in (12) and associate them with the constraints shown in (13).[4]

(12)


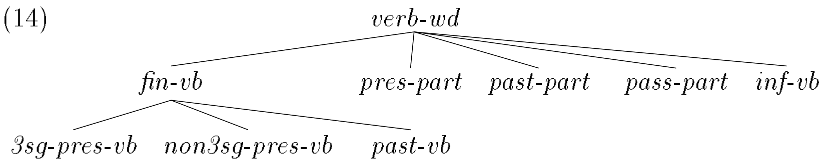
(13) a. *noun-wd*: $\begin{bmatrix}\text{STEM} & \textit{noun-lxm}\end{bmatrix}$

b. *verb-wd*: $\begin{bmatrix}\text{STEM} & \textit{verb-lxm}\end{bmatrix}$

c. *const-wd*: $\begin{bmatrix}\text{STEM} & \textit{const-lxm}\end{bmatrix}$

Note that these constraints interact with the default identities imposed on the type *word* by (10). For example, the HEAD value of a *verb-wd* will be of type *verb*.

More interestingly, we can establish the following hierarchy of the subtypes of *verb-wd*:

(14)


This enables us to pull out a common property of all finite verbal forms and express it as a single constraint on the intermediate level type *fin-vb*:

(15) *fin-vb*: $\begin{bmatrix}\text{SYNSEM} & \begin{bmatrix}\text{SYN} & \begin{bmatrix}\text{SPR} & \langle\, [\text{CASE} \;\; \text{nom}] \,\rangle\end{bmatrix}\end{bmatrix}\end{bmatrix}$

All remaining effects of the relevant lexical rules now become constraints on the subtypes in (14). The default constraint in (10) guarantees that whatever constraints are lexemically specified and not specifically contradicted by constraints on the word type will be inherited by the appropriate word.

[4] The lexeme types assumed here are just those we made use of in Chapter 8.

For example, the type *3sg-pres-vb* will be constrained as shown in (16):[5]

(16)
$$\textit{3sg-pres-vb}: \begin{bmatrix}\text{PHON} & \text{F}_{3SG}(\boxed{a}) \\ \text{STEM} & \begin{bmatrix}\text{PHON} & \boxed{a} \\ \text{SS} & \begin{bmatrix}\text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{b}\end{bmatrix}\end{bmatrix}\end{bmatrix} \\ \text{SS} & \begin{bmatrix}\text{ARG-ST} & \left\langle \begin{bmatrix}\text{AGR} & \textit{3sing}\end{bmatrix}, \ldots \right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{2} \\ \text{RESTR} & \boxed{b} \oplus \left\langle \begin{bmatrix}\text{RELN} & \text{t-overlap} \\ \text{ARG1} & \boxed{2} \\ \text{ARG2} & \text{now}\end{bmatrix} \right\rangle\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

Hence, through inheritance of constraints on superordinate types, words such as *walks* will have a feature structure like the one in (17).

[5] The careful reader will notice that we have slightly modified our conception of morphological functions like F_{3SG}. Instead of mapping forms onto forms, they now map lists of forms onto lists of forms. In cases where the input list has more than one member, the relevant morphological change affects just the first member of the list; see Chapter 11, footnote 13.

$$
(17)\quad \begin{bmatrix}
\text{PHON} & \langle \textit{walks}\rangle\ (=F_{3SG}(\boxed{a})) \\
\text{STEM} & \begin{bmatrix} \text{PHON} & \boxed{a}\langle\textit{walk}\rangle \\ \text{SS} & \begin{bmatrix} \text{SYN} & \boxed{0} \\ \text{ARG-ST} & \boxed{b} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \boxed{1}\begin{bmatrix}\text{RELN} & \text{walk}\\ \text{SIT} & s \\ \text{WALKER} & i\end{bmatrix}\right\rangle \end{bmatrix}\end{bmatrix}\end{bmatrix} \\
\text{SS} & \begin{bmatrix} \text{SYN} & \boxed{0}\begin{bmatrix}\text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \\ \text{AUX} & - \\ \text{PRED} & -\end{bmatrix} \\ \text{SPR} & \langle\ \text{NP}\ \rangle\end{bmatrix} \\ \text{ARG-ST} & \boxed{b}\left\langle\begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{3sing}\end{bmatrix}\right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & s \\ \text{RESTR} & \left\langle \boxed{1}, \begin{bmatrix}\text{RELN} & \text{t-overlap} \\ \text{ARG1} & s \\ \text{ARG2} & \text{now}\end{bmatrix}\right\rangle\end{bmatrix}\end{bmatrix}
\end{bmatrix}
$$

Note that the ARG-ST and SYN values of the word *walks* are unified with those of its STEM value. This is a consequence of the default unification in (10): the constraints in (16) specifically alter the SEM value, but the other parts of SYNSEM remain unified.[6]

What we have just done is to eliminate a construct from our theory: lexical rules that map lexical descriptions to other lexical descriptions. In place of these mappings, we have pressed into service the independently necessary notion of type hierarchy, which, as we have seen, allows us to express certain generalizations about words (common properties of lexical rules) that the earlier grammar relying on lexical rules was not able to express.

This new conception of lexical rules also makes possible a reformulation of the Argument Realization Principle. This now becomes a non-defeasible constraint associated with the type *word*:

[6]For a precise discussion of the approach to default unification that we make use of here, see Lascarides and Copestake (1998).

$$
(18)\quad \textit{word}:\ \begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{SPR} & \boxed{a} \\ \text{COMPS} & \boxed{b} \ominus \boxed{c} \\ \text{GAP} & \boxed{c} \end{bmatrix} \\ \text{ARG-ST} & \boxed{a} \oplus \boxed{b} \end{bmatrix} \end{bmatrix}
$$

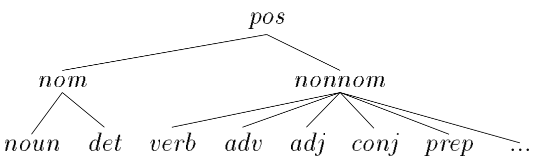
As a consequence of this constraint, the word *walks* obeys further specifications, as shown in (19).

$$
(19)\quad \begin{bmatrix}
\text{PHON} & \langle \textit{walks}\rangle\ (=F_{3SG}(\boxed{a})) \\
\text{STEM} & \begin{bmatrix} \text{PHON} & \boxed{a}\langle\textit{walk}\rangle \\ \text{SS} & \begin{bmatrix} \text{SYN} & \boxed{0} \\ \text{ARG-ST} & \boxed{b} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \boxed{1}\begin{bmatrix}\text{RELN} & \text{walk}\\ \text{SIT} & s \\ \text{WALKER} & i\end{bmatrix}\right\rangle \end{bmatrix}\end{bmatrix}\end{bmatrix} \\
\text{SS} & \begin{bmatrix} \text{SYN} & \boxed{0}\begin{bmatrix}\text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \\ \text{AUX} & - \\ \text{PRED} & -\end{bmatrix} \\ \text{SPR} & \langle\ \boxed{2}\ \rangle \\ \text{COMPS} & \langle\ \rangle\end{bmatrix} \\ \text{ARG-ST} & \boxed{b}\left\langle \boxed{2}\text{NP}\begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{3sing}\end{bmatrix}\right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & s \\ \text{RESTR} & \left\langle \boxed{1}, \begin{bmatrix}\text{RELN} & \text{t-overlap} \\ \text{ARG1} & s \\ \text{ARG2} & \text{now}\end{bmatrix}\right\rangle\end{bmatrix}\end{bmatrix}
\end{bmatrix}
$$

The final constraint we will discuss here in connection with lexical signs is the Case Constraint, which was formulated in Chapter 8 as (20), a constraint on word structures.

(20) Case Constraint:
Any NP in a noninitial position of a word's ARG-ST list is [CASE acc].

Making this constraint more precise in terms of a sign-based architecture is an interesting challenge, as we have no direct way of expressing quantification (i.e. 'any NP [on a list]'). In approaching this problem, let us first propose a minor change to the hierarchy of part of speech types, so as to treat all nonnominal types as instances of a common type:

(21)


The introduction of the type *nonnom(inal)* will simplify the statement of constraints we consider in a moment.

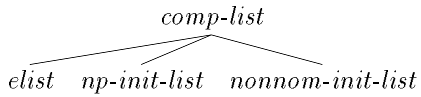
To create a kind of list that can contain diverse kinds of synsem-strucs, except a nominative NP, we first need to consider more precisely what lists are. As noted briefly in Chapter 8, note 7, a list is commonly treated as a feature structure with the two features FIRST and REST. The empty list is a special (atomic) type of list that we will call *elist*. Thus in these terms, the lists that we have been writing as ⟨ NP ⟩, ⟨ NP , PP ⟩, and ⟨ NP , NP , PP ⟩ would be represented as (22a,b,c), respectively.

(22) a. $\begin{bmatrix} \text{FIRST} & \text{NP} \\ \text{REST} & \textit{elist} \end{bmatrix}$

b. $\begin{bmatrix} \text{FIRST} & \text{NP} \\ \text{REST} & \begin{bmatrix} \text{FIRST} & \text{PP} \\ \text{REST} & \textit{elist} \end{bmatrix} \end{bmatrix}$

c. $\begin{bmatrix} \text{FIRST} & \text{NP} \\ \text{REST} & \begin{bmatrix} \text{FIRST} & \text{NP} \\ \text{REST} & \begin{bmatrix} \text{FIRST} & \text{PP} \\ \text{REST} & \textit{elist} \end{bmatrix} \end{bmatrix} \end{bmatrix}$

If we conceive of lists in this way, we can contemplate the idea of special types of list that are subject to specific constraints. In particular, suppose we hypothesize a type called *comp(lement)-list*, which is intuitively the kind of list that completes an ARG-ST list, and so is the kind of list that is an ARG-ST list's REST value. We could then divide comp-lists into three subtypes as follows:

(23)


Intuitively, *np-init-list* is the type of a list beginning with an NP (synsem-struc), and *nonnom-init-list* is the type of a list beginning with a synsem-struc whose HEAD value is (any subtype of) *nonnom*.

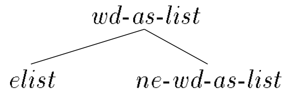
Part of the work previously done by the Case Constraint can now be accomplished by the following type constraints:

(24) a. *np-init-list*: $\begin{bmatrix} \text{FIRST} & \text{NP[CASE acc]} \\ \text{REST} & \textit{comp-list} \end{bmatrix}$

b. *nonnom-init-list*: $\begin{bmatrix} \text{FIRST} & \begin{bmatrix} \text{SYN} & [\text{HEAD} \;\; \textit{nonnom}] \end{bmatrix} \\ \text{REST} & \textit{comp-list} \end{bmatrix}$

From these type constraints, it follows that any NP on a *comp-list* must be [CASE acc].

Once we have a type like *comp-list*, we can specify what kinds of lists can be the value of a word's ARG-ST feature by defining subtypes of a new type, *word-argument-structure-list* (*wd-as-list*). This is illustrated in (25).[7]

(25)


The new type *nonempty-word-argument-structure-list* (*ne-wd-as-list*) is now constrained as in (26):

(26) *ne-wd-as-list*: $\begin{bmatrix} \text{REST} & \textit{comp-list} \end{bmatrix}$

And because of this constraint, we can achieve the effect of the Case Constraint simply by specifying that a word's ARG-ST value must be of type *wd-as-list*, as in (27).

(27) *word*: $\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{ARG-ST} & \textit{wd-as-list} \end{bmatrix} \end{bmatrix}$

A word's ARG-ST value, then, must either be empty or be a nonempty list of synsem-strucs whose noninitial NPs (if any) are all [CASE acc].

Note that this analysis leaves an initial NP on a word's ARG-ST list unspecified for CASE, unless some other type is subject to a further constraint on that NP. The constraint stated in (15), which requires that

[7] Note that some types, like *elist*, have many supertypes.

the first argument of all finite verb forms by [CASE nom], is an example of such a type constraint.

We have now revised our treatment of both the Argument Realization Principle and the Case Constraint, both of which were formerly clauses in the definition of lexical satisfaction. The current formulation, by contrast, utilizes only type constraints, providing a purely constraint-based account of the grammar of lexical signs.

Problem 1
Explain why the first argument of nonfinite verb forms must be unspecified for CASE, rather than specified as [CASE acc]. [*Hint: Consider raising constructions.*]

16.4 Phrasal Signs

Thus far, we have recast our notions of word and lexeme in Saussurean terms by modelling his notion of 'sign' in terms of feature structures. There is ample reason to do the same for phrases. Reflect, for a moment, on the theory of phrases we have developed. All phrases share one property: they each have at least one daughter. In addition, there are different types of phrases: headed and nonheaded. Moreover, the headed phrases have many subvarieties (e.g. head-specifier phrase, head-complement phrase), as do the nonheaded phrases (e.g. imperative clause and coordinate phrase). This is just the sort of classification and subclassification which, in the lexicon, led us to posit a hierarchy of types.

Further, the current architecture of our grammar treats grammar rules as a special kind of theoretical entity, and provides no way to capture properties that are shared by some, but not all, grammar rules. A bifurcation of grammar rules into headed and nonheaded rules is referred to in our definition of phrasal satisfaction, but in our current system, this distinction is simply stipulated in prose. We have not made use of the formal machinery introduced to handle analogous classifications in the lexicon. In short, the representational differences between grammar rules and lexical entries in the earlier chapters obscure the fundamental similarities among lexemes, words and phrases.

Capturing these similarities is desirable not just for the sake of making the theory formally more uniform; it also has analytic advantages. Some generalizations hold of certain kinds of phrases and not others. For example the Head Feature Principle obviously applies only to those phrases that have a head daughter, whereas the Semantic Compositionality Principle holds of all phrases. In addition, our formulations of principles like the Valence Principle and the Gap Principle specifically excluded certain grammar rules from their domain. We had no technical machinery for doing this, other than naming particular rules that were to be excluded in the appropriate clauses of the definition of phrasal satisfaction. However, if phrases are treated as feature structures assigned to particular types and if those types constitute a type hierarchy, then we could state monotonic constraints that hold at different levels (e.g. that apply to all phrases, or else just to headed phrases), or we could use default constraints to express generalizations that hold over most, but not all kinds of phrases. Thus adopting the sign-based architecture for phrases allows us to exploit mechanisms we already employ in our grammar. We can define lexical and phrasal signs in a uniform way, eliminating the entire ancillary apparatus that we have introduced to define phrasal satisfaction.

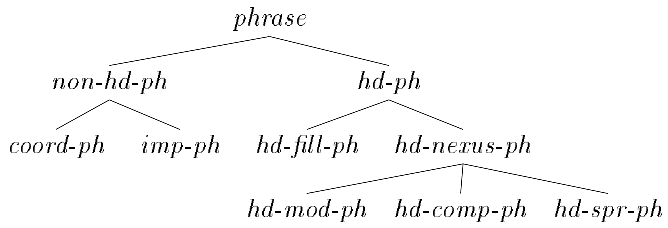
What exactly do we mean by the 'sign-based architecture for phrases'? What we are after is a way of modelling a phrase like *Kim walks* as a kind of sign, that is, a feature structure which, like the lexical signs we have just presented, specificies values for the features PHON and SYNSEM. This is illustrated in (28).

(28)
$$\begin{bmatrix} \textit{phrase} & \\ \text{PHON} & \langle \text{Kim}, \text{walks} \rangle \\ \text{SS} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & t \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & s \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{walk} \\ \text{SIT} & t \\ \text{WALKER} & i \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{t-overlap} \\ \text{SIT} & u \\ \text{ARG1} & t \\ \text{ARG2} & \text{now} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

This unfamiliar representation explicitly embodies the Saussurean idea that the grammar of English defines a conventional association between the string of forms ⟨*Kim, walks*⟩ and its meaning, which we have treated in terms of the proposition 'there is a walking situation t in which someone named *Kim* is walking, where t temporally overlaps the time of utterance'.

Our sign-based grammar must now specify which feature structures like (28) are well-formed English phrases and which are not. But to do so, we no longer need to formulate a definition of phrasal satisfaction. Rather, we need only specify our inventory of phrasal types as follows.[8]

(29)



Each of the six phrasal types at the bottom of this hierarchy (i.e. those with no subtypes) corresponds to one of our old grammar rules. The types *hd-ph* and *non-hd-ph* correspond to our old classification of rules as headed or nonheaded. The one truly novel element in this hierarchy is the type *hd-nexus-ph*, which includes as subtypes all the headed phrases except for the head-filler phrases. As we will see shortly, what the three subtypes of *hd-nexus-ph* have in common is that they are all subject to the GAP Principle.

Before proceeding, we need to specify (just as we have done for all types we have considered in earlier chapters) which features are appropriate for which types. This can be done as summarized in (30).

[8] Here we abbreviate as indicated:

non-hd-ph	*non-headed-phrase*	*hd-ph*	*headed-phrase*
coord-ph	*coordinate-phrase*	*imp-ph*	*imperative-phrase*
hd-fill-ph	*head-filler-phrase*	*hd-nexus-ph*	*head-nexus-phrase*
hd-comp-ph	*head-complement-phrase*	*hd-spr-ph*	*head-specifier-phrase*
hd-mod-ph	*head-modifier-phrase*		

(30)

TYPE	FEATURES/VALUE TYPES	IST
sign	$\begin{bmatrix}\text{PHON} & \text{list}(\textit{form}) \\ \text{SYNSEM} & \textit{synsem-struc}\end{bmatrix}$	
phrase	$\begin{bmatrix}\text{NHD-DTRS} & \text{list}(\textit{sign})\end{bmatrix}$	*sign*
hd-ph	$\begin{bmatrix}\text{HD-DTR} & \textit{sign}\end{bmatrix}$	*phrase*

According to the table in (30), the features PHON[9] and SYNSEM are appropriate for all signs, the feature NON-HEAD-DAUGHTERS (NHD-DTRS) is appropriate for all phrases, and HEAD-DAUGHTER (HD-DTR) is appropriate only for headed phrases.

This organization of types and features uses the features HD-DTR and NHD-DTRS for the embedding of one phrase within another. In so doing, we eliminate the need for a separate definition of phrasal satisfaction. But the feature structures will look even less familiar than the last one we considered. For example, the sentence *Kim walks* will be modelled by the feature structure described in (31):

[9] We have introduced the type *form* to classify all the possible shapes of lexemes or words. We will not explore the structure of PHON values in any further detail here.

(31)

$$\begin{bmatrix} \textit{hd-spr-ph} & \\ \text{PHON} & \langle \text{ Kim , walks } \rangle \\ \text{SS} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{prop} \\ \text{INDEX} & t \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & s \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{walk} \\ \text{SIT} & t \\ \text{WALKER} & i \end{bmatrix}, \begin{bmatrix} \text{RELN} & \text{t-overlap} \\ \text{SIT} & u \\ \text{ARG1} & t \\ \text{ARG2} & \text{now} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \textit{hd-comp-ph} & \\ \text{PHON} & \langle \text{ walks } \rangle \\ \text{SYNSEM} & [\ldots] \\ \text{HD-DTR} & \begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \text{ walks } \rangle \\ \text{SYNSEM} & [\ldots] \end{bmatrix} \\ \text{NHD-DTRS} & \langle\ \rangle \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{bmatrix} \textit{hd-comp-ph} & \\ \text{PHON} & \langle \text{ Kim } \rangle \\ \text{SYNSEM} & [\ldots] \\ \text{HD-DTR} & \begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle \text{ Kim } \rangle \\ \text{SYNSEM} & [\ldots] \end{bmatrix} \\ \text{NHD-DTRS} & \langle\ \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

What has changed is that the embedding of one phrase (or phrase description) within another now grows from left to right, rather than top-down as in familiar tree descriptions. But a moment's reflection reveals that the same information is conveyed. The incomplete decription in (31) is true to the analyis in the text – the head of the S is the VP *walks*, whose head (and only) daughter is the V *walks*, and the subject of the S is the NP *Kim*, whose head (and only) daughter is the N *Kim*.

So how will our grammar be recast in this sign-based architecture? One aspect that will be revised is linear order. Recall that in Chapter 4 we hinted that our treatment of the ordering of constituents might not be adequate. Aside from that brief allusion, however, we have simply assumed that the sequencing of elements followed stipulations in the grammar rules or in the valence features of heads. The sign-based architecture allows us to factor linear precedence rules into a new kind of constraint that specifies the PHON values of larger phrases in terms of the PHON values of their immediate constituents. In simple cases, the PHON values of the daughters are simply added together to yield the PHON value of the mother. This is illustrated in (32), which shows the PHON values in the analysis of *Kim loves Sandy.*[10]

(32)

$$\begin{bmatrix} \textit{phrase} & \\ \text{PHON} & \boxed{\text{a}} \oplus \boxed{\text{b}} \\ \text{HD-DTR} & \begin{bmatrix} \text{PHON} & \boxed{\text{b}} = \boxed{\text{c}} \oplus \boxed{\text{d}} \\ \text{HD-DTR} & \begin{bmatrix} \text{PHON} & \boxed{\text{c}}\langle \text{loves} \rangle \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{bmatrix} \text{PHON} & \boxed{\text{d}}\langle \text{Sandy} \rangle \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{bmatrix} \text{PHON} & \boxed{\text{a}} \\ \text{HD-DTR} & \begin{bmatrix} \text{PHON} & \boxed{\text{a}}\langle \text{Kim} \rangle \end{bmatrix} \\ \text{NHD-DTRS} & \langle\ \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

Recall that each grammar rule specifies certain constraints on the mother and daughter nodes. These constraints now become constraints on the various types of phrase – analogous to the constraints on lexical types. The Head-Complement Rule, Head-Specifier Rule and Head-Modifier

[10] It is possible formally to combine the PHON values of daughters using more complex operations than simple list addition. A number of languages exhibit complex word-order patterns suggesting that some such device is desirable. However, consideration of such matters is beyond the scope of this text.

Rule, for example, correspond to the following constraints on phrasal types:

(33) a.

$$hd\text{-}comp\text{-}ph: \left[\begin{array}{ll} \text{SYNSEM} & \left[\text{SYN} \left[\text{COMPS} \ \langle\ \rangle\right]\right] \\ \text{HD-DTR} & \left[\begin{array}{l} word \\ \text{SS} \left[\text{SYN} \left[\text{COMPS} \ \langle \boxed{1},\ldots,\boxed{n} \rangle\right]\right] \end{array}\right] \\ \text{NHD-DTRS} & \left\langle \left[\text{SS} \ \boxed{1}\right], \ldots, \left[\text{SS} \ \boxed{n}\right] \right\rangle \end{array}\right]$$

b.

$$hd\text{-}spr\text{-}ph: \left[\begin{array}{ll} \text{SYNSEM} & \left[\text{SYN} \left[\text{SPR} \ \langle\ \rangle\right]\right] \\ \text{HD-DTR} & \left[\begin{array}{l} phrase \\ \text{SS} \left[\text{SYN} \left[\text{SPR} \ \langle \boxed{1} \rangle\right]\right] \end{array}\right] \\ \text{NHD-DTRS} & \left\langle \left[\text{SS} \ \boxed{1}\right] \right\rangle \end{array}\right]$$

c.

$$hd\text{-}mod\text{-}ph: \left[\begin{array}{ll} \text{SYNSEM} & \left[\text{SYN} \left[\text{SPR} \ \langle\ \rangle\right]\right] \\ \text{HD-DTR} & \left[\text{SS} \ \boxed{1}\right] \\ \text{NHD-DTRS} & \left\langle \left[\begin{array}{l} phrase \\ \text{SS} \left[\text{SYN} \left[\text{HEAD} \left[\text{MOD} \ \boxed{1}\right]\right]\right] \end{array}\right] \right\rangle \end{array}\right]$$

These constraints correspond directly to the constraints we wrote into our grammar rules. But because (i) the features HD-DTR and NHD-DTRS introduce in their values feature structures of type *phrase* and (ii) these phrases themselves have HD-DTR and NHD-DTRS specifications, we effectively introduce recursion directly through the type system. The phrases that appear as daughters will themselves have daughters (obeying the appropriate constraints). Hence there is no limit on how many instances of each type of phrase can occur in a single phrase. This is exactly the effect we got in CFG by allowing recursive rules (or recursive instantiations of schematic rules) and requiring that every local subtree in a well-formed phrase structure satisfy some lexical entry or some grammar rule. But now that phrases are feature structures, the recursion is an automatic consequence of our type constraints.

In addition, by making one daughter select for the SYNSEM value of another daughter (via COMPS, SPR, or MOD), we get the kind of locality restriction that CFG-like systems exhibit: because HD-DTR and NHD-DTRS are not features of synsem-strucs (i.e. are specified at the same level as SYNSEM), only local information can be selected for. That is, the values of COMPS, SPR, and MOD can only include SYNSEM values and hence will never be able to mention the HD-DTR or NHD-DTRS of complements, specifiers, or modifiers. Consequently, under our current assumptions, we would be hard-pressed to write a grammar for a language where, for example, some verb selected for a complement that was an S whose VP head daughter contained an accusative NP. CFGs allow selection between sisters; our CFG-like system extended this notion of locality, allowing a kind of 'aunt' selection since the SPR value is passed up and discharged at a higher level of structure. The CFG-like system and its sign-based variant can describe a nonlocal dependency only if some further and otherwise unmotivated feature is introduced to carry the information about the accusative NP up to the VP and to the S it heads. Once the relevant information is encoded on the S node, it would become locally selectable. The predication of locality in this sense is exactly right: there are no human languages (as far as we know) where a verb selects for an S complement whose VP head daughter must contain an accusative NP.

What about our theory of headed phrases? The Head Feature Principle and the Valence Principle now become constraints on the type *hd-ph*. The new formulation of the HFP is given in (34).

(34) Head Feature Principle

$$hd\text{-}ph: \left[\begin{array}{ll} \text{SYNSEM} & \left[\text{SYN} \left[\text{HEAD} \ \boxed{1}\right]\right] \\ \text{HD-DTR} & \left[\text{SS} \left[\text{SYN} \left[\text{HEAD} \ \boxed{1}\right]\right]\right] \end{array}\right]$$

This constraint applies to all instances of the type *hd-ph*, that is, to instances of all four kinds of headed phrase.

The Valence Principle is now formulated as in (35).

(35) Valence Principle

$$
\textit{hd-ph}:\ \begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{COMPS} & / \ \boxed{1} \\ \text{SPR} & / \ \boxed{2} \end{bmatrix} \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \text{SS} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{COMPS} & / \ \boxed{1} \\ \text{SPR} & / \ \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}
$$

Note that this is a defeasible constraint (i.e. one that can be overridden), saying that a headed phrase's SPR and COMPS values are by default the same as those of the head daughter. The Valence Principle applies so long as no constraint on a subtype (e.g. *hd-spr-ph* or *hd-comp-ph*) specifically contradicts it.

The Semantic Inheritance Principle can be similarly reformulated to apply only to headed phrases:

(36) Semantic Inheritance Principle

$$
\textit{hd-ph}:\ \begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{SEM} & \begin{bmatrix} \text{MODE} & \boxed{1} \\ \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \text{SEM} & \begin{bmatrix} \text{MODE} & \boxed{1} \\ \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}
$$

Its effect remains exactly the same.

These three principles are now cast as type constraints, rather than as clauses in a definition of phrasal satisfaction. Because phrases are feature structures in our new conception of grammar, we achieve exactly the same result as before, but now our method of expressing lexical and phrasal constraints is uniform. The theory has gained considerable elegance and simplicity.

Consider now the GAP Principle, which we reformulate as the following nondefeasible constraint on the type *hd-nexus-ph*:

(37) GAP Principle

$$
\textit{hd-nexus-ph}:\ \begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{GAP} & \boxed{\text{a}} \oplus \boxed{\text{b-1}} \oplus \ldots \oplus \boxed{\text{b-n}} \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \text{SS} & \begin{bmatrix} \text{GAP} & \boxed{\text{a}} \end{bmatrix} \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{array}{l} [\text{SS}\ [\text{GAP}\ \boxed{\text{b-1}}]]\ , \\ \ldots\ , \\ [\text{SS}\ [\text{GAP}\ \boxed{\text{b-n}}]] \end{array} \right\rangle \end{bmatrix}
$$

Because head-filler phrases are not a kind (subtype) of *hd-nexus-ph*, they do not obey this constraint. Rather, they are constrained as follows:

(38)

$$
\textit{hd-fill-ph}:\ \begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{GAP} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \textit{phrase} & \\ \text{SS} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \\ \text{GAP} & \langle \boxed{1} \rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{bmatrix} \text{SS} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix}
$$

This type constraint corresponds to the feature specifications that we wrote into the Head-Filler Rule in Chapter 15. The two constraints just given guarantee that the topicalization construction is treated correctly. The head daughter of a head-filler phrase must have an empty SPR list, an empty COMPS list, and a nonempty GAP list. Hence it can be a head-specifier phrase, which in turn can have a head-complement phrase as its head daughter, as shown in (39).

(39)
$$\begin{bmatrix} \textit{hd-fill-ph} \\ \text{PHON} & \langle \text{ Lee , Kim , likes } \rangle \\ \text{SS} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \end{bmatrix} \\ \text{GAP} & \langle\ \rangle \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \textit{hd-spr-ph} \\ \text{PHON} & \langle \text{ Kim, likes } \rangle \\ \text{SS} & \begin{bmatrix} \text{GAP} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \textit{hd-comp-ph} \\ \text{PHON} & \langle \text{ likes } \rangle \\ \text{SS} & \begin{bmatrix} \text{GAP} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{HD-DTR} & \begin{bmatrix} \textit{word} \\ \text{PHON} & \langle \text{ likes } \rangle \end{bmatrix} \\ \text{NHD-DTRS} & \langle\ \rangle \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{bmatrix} \text{PHON} & \langle \text{ Kim } \rangle \\ \text{SS} & \begin{bmatrix} \text{GAP} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{bmatrix} \textit{phrase} \\ \text{PHON} & \langle \text{ Lee } \rangle \\ \text{SS} & \boxed{1} \\ & \ldots \end{bmatrix} \right\rangle \end{bmatrix}$$

Our rules for unheaded constructions lend themselves to a similar reanalysis in terms of type constraints. The Imperative Rule corresponds to the type constraint in (40).

(40)
$$\textit{imp-ph}: \begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{dir} \\ \text{INDEX} & s \end{bmatrix} \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{bmatrix} \textit{phrase} \\ \text{SS} & \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{FORM} & \text{inf} \end{bmatrix} \\ \text{SPR} & \left\langle \text{NP}\begin{bmatrix} \text{PER 2nd} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \end{bmatrix} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

This constraint correctly requires imperative phrases to contain a nonhead daughter that is an infinitival VP whose unexpressed subject is second person.

Finally, the Coordination Rule, modified in Chapter 5, can also be recast in terms of a type constraint.

(41) *coord-ph*:
$$\begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \text{SYN} & \boxed{0} \\ \text{SEM} & \begin{bmatrix} \text{IND} & s_0 \end{bmatrix} \end{bmatrix} \\ \text{NHD-DTRS} & \left\langle \begin{bmatrix} \text{SYN} & \boxed{0} \\ \text{SEM} & [\text{IND} \ \ s_1] \end{bmatrix}, \ldots \begin{bmatrix} \text{SYN} & \boxed{0} \\ \text{SEM} & [\text{IND} \ \ s_{n-1}] \end{bmatrix}, \right. \\ & \left. \begin{bmatrix} \text{HEAD} & \textit{conj} \\ \text{IND} & s_0 \\ \text{RESTR} & \left\langle [\text{ARGS} \ \ \langle s_1 \ldots s_n \rangle\ ] \right\rangle \end{bmatrix}, \begin{bmatrix} \text{SYN} & \boxed{0} \\ \text{SEM} & [\text{IND} \ \ s_n] \end{bmatrix} \right\rangle \end{bmatrix}$$

So we see that both nonheaded and headed phrases can be treated in terms of types and type constraints. The distinction between the two types of phrase is drawn precisely to restrict the domain of application of certain constraints, for example, the Head Feature Principle and the Valence Principle, so that they apply only to headed phrases. Other principles are stated as constraints on the type *phrase*, and hence apply to headed and nonheaded phrases alike.[11]

[11] Given the absence of any feature DAUGHTERS corresponding to all daughters

Of course, we still must distinguish those phrases that can stand alone as complete (nonelliptical) utterances from all other kinds of phrases. That is, we still need something that corresponds to our earlier notion of an 'initial symbol' definition. Here we can posit a type called *root* and assume that all stand-alone phrases must be instances of it. Having declared such a type, we could constrain it as follows:

(42)
$$root: \begin{bmatrix} phrase \\ \text{SYNSEM} \begin{bmatrix} \text{SYN} \begin{bmatrix} \text{HEAD} & \begin{bmatrix} verb \\ \text{FORM} \quad \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \\ \text{GAP} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

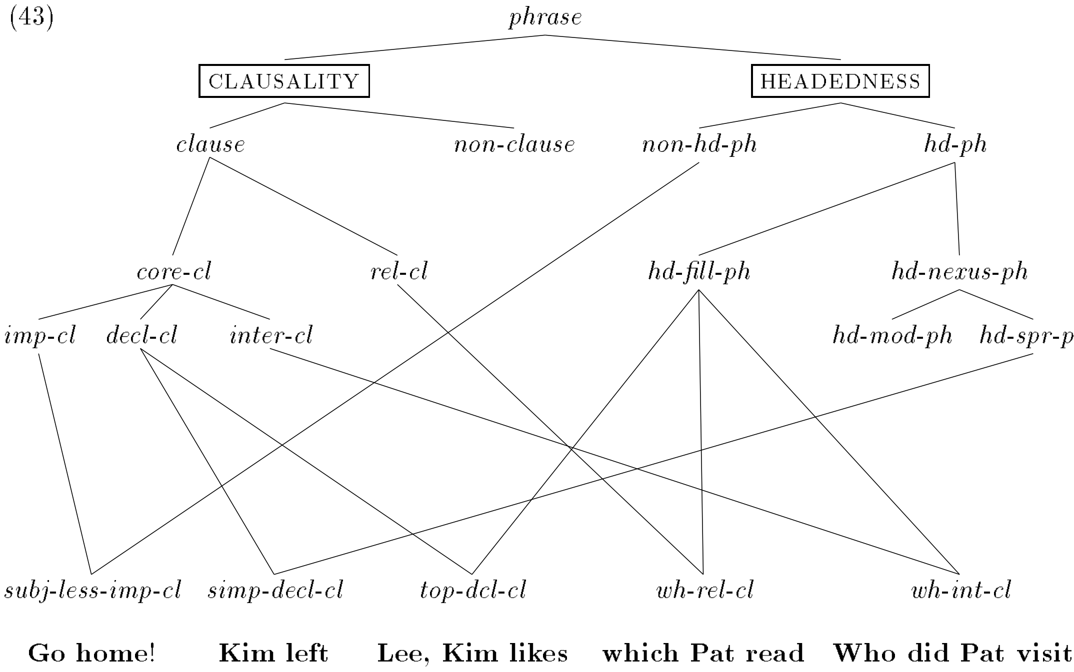
Finally, we must consider a further advantage of the sign-based architecture: it enables the expression of new generalizations about diverse types of phrases. Recall that in Chapter 15, we noted that topicalization was not the only example of a filler-gap dependency. Relative clauses (e.g. (*the person*) *who Sandy thought that Pat visited*) and *wh*-questions (e.g. *Who did Sandy think that Pat visited?*) are two other kinds of clauses that involve filler-gap dependencies. To put it differently, these are two subvarieties of head-filler construction. As further investigation of clauses and other kinds of constructions reveals, this same pattern of cross-cutting generalizations holds true throughout the grammar.[12] There are many kinds of constructions in a language, yet they fall into groups that have many common properties.

To deal with this fundamental fact about languages, we can again exploit the notion of multiple inheritance. For example, consider the idea that phrases are partitioned into two dimensions: CLAUSALITY and HEADEDNESS. This could lead to the following (incomplete) hierarchy of phrases:

irrespective of their status as head, certain principles, e.g. the Semantic Compositionality Principle, either become somewhat cumbersome, or else must be narrowed so as to apply only to headed phrases.

[12]See Fillmore and Kay (forthcoming), Sag (1997), Ginzburg and Sag (forthcoming).

(43)



Here we again use a number of new abbreviations:

(44) a. *subj-less-imp-cl*: *subjectless-imperative clause*
b. *simp-decl-cl*: *simple-declarative-clause*
c. *top-decl-cl*: *topicalized-declarative-clause*
d. *wh-rel-cl*: *wh-relative-clause*
e. *wh-int-cl*: *wh-interrogative-clause*

Once more, we appeal to the superordinate types to serve as the locus of constraints that cut across the various subtypes. The constraints on the type *hd-fill-ph*, for example, will cut across topicalization and the various *wh*-constructions, though each kind of head-filler construction will have properties of its own (e.g. the inversion that is characteristic of the main clause *wh*-questions). Working out the details of this factorization of grammatical constraints in terms of superordinate types is the object of ongoing inquiry in a variety of constraint-based grammatical frameworks, including HPSG, Construction Grammar, and Word (Dependency) Grammar (see Appendix B).

This completes our sketch of how we can modify our framework to embrace Saussure's conception of language as a system of signs. With the revisions to the theoretical architecture that we have outlined – modelling both words and phrases as kinds of signs and using feature structures to model both these notions – a grammar becomes nothing more than a set of descriptions of typed objects. The language defined by the grammar is the set of fully resolved models – that is, the objects that satisfy the descriptions.

This view of grammar comports well with the psycholinguistic results discussed in Chapter 9, for the constructs of the grammar are now no longer clauses in a recursive definition of linguistic structures. Every construct in our theory is now a flexible unordered constraint, including lexical entries, grammar rules, and syntactic and semantic principles. We have retained the surface-oriented and strongly lexicalist character of our theory, which we argued for earlier. And our grammar is now even more strongly constraint-based than it was. We have removed the ordering among the lexical rules, the grammar rules, and the general principles that was implicit in their distinct formal statuses. Formulating all the essential components of our theory as constraints on (descriptions of) signs renders the theory compatible with a wide range of procedural implementations. Evidence like that cited in Chapter 9 suggests that distinct tasks or contexts might employ the same linguistic knowledge in divergent processes and orders. Hence the formal homogeneity introduced by means of the sign-based architecture has empirical advantages, in addition to its conceptual simplicity.

16.5 Conclusion

This final chapter has suggested a major reconceptualization of the grammatical theory developed in the preceding fifteen chapters. We have not worked out all of the details here, but we have presented enough to indicate that recasting various theoretical constructs as signs would have a number of advantages, including the following:

- *Parsimony* Eliminating the diversity in the kinds of formal machinery used for lexical entries, grammar rules, phrase structures, and general principles of well-formedness makes the theory simpler and more elegant.
- *Constructions* By replacing phrase structure rules with an inheritance hierarchy of phrase types, we can capture generalizations across different kinds of constructions that we had to treat as accidental in our earlier theory. Indeed, the phrase types may provide a formal explication of the traditional notion of a 'grammatical construction' (see Goldberg (1995) and Sag (1997) for two recent discussions of this notion).
- *Interfaces* By including phonological, syntactic, and semantic information within the same data structures (feature structures), we clear the way for stating constraints that express the relationships among these. We have explored some of the syntax-semantics interface constraints in earlier chapters; the new architecture allows similar interactions between the phonology and the syntax and semantics, as is required in order to account for the interpretational effect of pitch accent, for example the distinct semantic/pragmatic effects of *KIM loves Sandy*, *Kim loves SANDY*, and *Kim LOVES Sandy*.
  A natural extension would be to include in our feature structures some information about the pragmatics – that is, about appropriate contexts of use; and the sign-based architecture would allow us to state constraints on the interactions of pragmatics with semantics, syntax, and phonology.
- *Process Independence* By providing purely declarative descriptions of the relationships among different pieces of information, our grammar can be used in comprehension models, production models, or many kinds of computational applications.

Investigation of sign-based grammars is a robust area of current research. Our remarks in this chapter have only scratched the surface. Indeed, the same could be said on a more general level: syntactic theory is a multifaceted field of study that is rapidly changing; our introduction to it has been necessarily very partial and somewhat simplified.

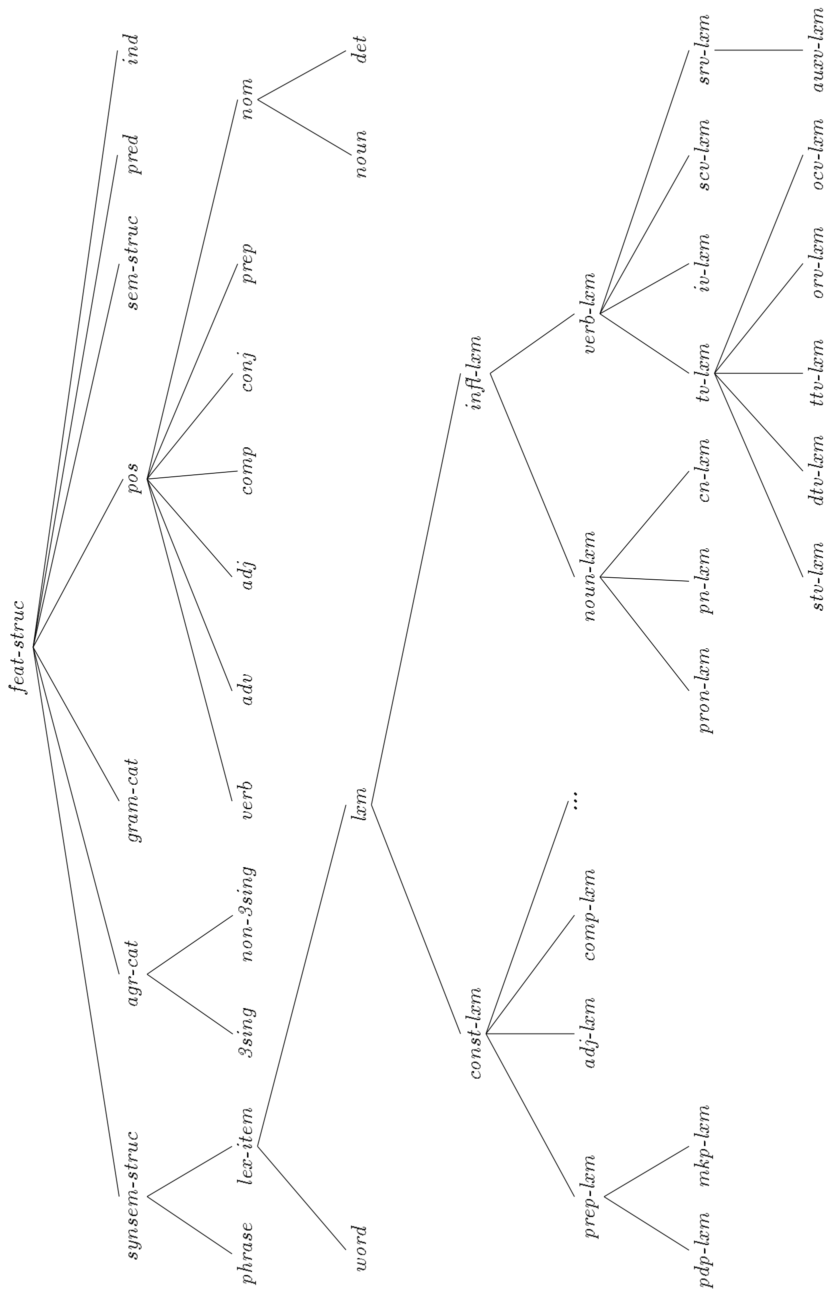
It is impossible to predict with any confidence how the field of syntax will develop in the future. No doubt many of the specific analyses put forward in this text will eventually need to be revised – as has been the case with most specific analyses in the generative tradition over the past several decades. But each reanalysis deepens our understanding of the phenomena under investigation and lays the groundwork for more refined accounts.

Moreover, working through and comparing analyses of specific phenomena in considerable detail illustrates how syntactic theorizing is done, and hence how progress in the field comes about. Our primary goals in this text have been to introduce the reader to modes of argumentation and to teach the value of explicit formalization of hypotheses, the need to take semantics seriously in syntactic analysis, and the value of paying attention to processing considerations. If we have achieved these goals, then we have accomplished what we set out to do.

Appendix A: Summary of the Grammar

The Type Hierarchy

The types that are used in the grammar we have developed in Chapters 3–15 are presented here in two distinct formats (as in the interim summary in Chapter 9). The first is a tree diagram indicating the hierarchical organization of all relevant types. The second is a list of particular types, with an indication of which features are appropriate for each, what type of value is appropriate for each such feature, and each type's immediate supertype (IST).



SOME GENERAL TYPES		
TYPE	FEATURES/CONSTRAINTS	IST
feat-struc		
synsem-struc	$\begin{bmatrix} \text{SYN} & \textit{gram-cat} \\ \text{SEM} & \textit{sem-struc} \end{bmatrix}$	*feat-struc*
phrase		*synsem-struc*
lex-item	$\begin{bmatrix} \text{ARG-ST} & \text{list}(\textit{synsem-struc}) \end{bmatrix}$	*synsem-struc*
word		*lex-item*
lexeme	$\begin{bmatrix} \text{SEM} & \begin{bmatrix} \text{MODE} & / \text{ none} \end{bmatrix} \end{bmatrix}$	*lex-item*

LEXEME TYPES		
TYPE	CONSTRAINTS	ISA
infl-lxm, *const-lxm*		*lexeme*
prep-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \textit{prep} \end{bmatrix} \end{bmatrix}$	*const-lxm*
pdp-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MOD} & \left\{ \begin{matrix} \text{NOM,} \\ \text{VP,} \\ \text{none} \end{matrix} \right\} \\ \text{P-OBJ} & \text{none} \end{bmatrix} \\ \text{SPR} & \langle\ [\ ]\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \text{ NP , NP } \rangle \end{bmatrix}$	*prep-lxm*
mkp-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MOD} & \text{none} \\ \text{P-OBJ} & \boxed{1} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1} \rangle \end{bmatrix}$	*prep-lxm*

LEXEME TYPES

adj-lxm, *conj-lxm*, *det-lxm*, ...	$\begin{bmatrix} \ldots \end{bmatrix}$	*const-lxm*
comp-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{comp} & \\ \text{FORM} & \boxed{2} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \ldots, \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \boxed{2} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix}$	*const-lxm*
noun-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{noun} & \\ \text{FORM} & /\ \text{none} \\ \text{AGR} & \begin{bmatrix} \text{PER} & /\ \text{3rd} \end{bmatrix} \\ \text{ANA} & /\ - \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & /\ \langle\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{MODE} & /\ \text{ref} \end{bmatrix} \end{bmatrix}$	*infl-lxm*
pron-lxm	$\begin{bmatrix} \ldots \end{bmatrix}$	*noun-lxm*
pn-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{NUM} & /\ \text{sg} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$	*noun-lxm*
cn-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AGR} & \boxed{1} \end{bmatrix} \\ \text{SPR} & \langle [\ ] \rangle \end{bmatrix} \\ \text{ARG-ST} & /\ \left\langle \begin{matrix} \text{DetP} \\ \begin{bmatrix} \text{AGR} & \boxed{1} \end{bmatrix} \end{matrix} \right\rangle \end{bmatrix}$	*noun-lxm*

LEXEME TYPES

TYPE	CONSTRAINTS	ISA
verb-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{AUX} & /\ - \\ \text{NEG} & /\ - \end{bmatrix} \\ \text{SPR} & \langle [\ ] \rangle \end{bmatrix} \\ \text{ARG-ST} & /\ \langle \text{NP}, \ldots \rangle \\ \text{SEM} & [\text{MODE} \ \ \text{prop}] \end{bmatrix}$	*infl-lxm*
iv-lxm	$\begin{bmatrix} \text{ARG-ST} & \langle [\ ] \rangle \end{bmatrix}$	*verb-lxm*
piv-lxm	$\begin{bmatrix} \text{ARG-ST} & \langle [\ ] , \text{PP} \rangle \end{bmatrix}$	*iv-lxm*
tv-lxm	$\begin{bmatrix} \text{ARG-ST} & \langle [\ ] , \text{NP} , \ldots \rangle \end{bmatrix}$	*verb-lxm*
stv-lxm	$\begin{bmatrix} \text{ARG-ST} & \langle [\ ] , [\ ] \rangle \end{bmatrix}$	*tv-lxm*
dtv-lxm	$\begin{bmatrix} \text{ARG-ST} & \langle [\ ] , [\ ] , \text{NP} \rangle \end{bmatrix}$	*tv-lxm*
ptv-lxm	$\begin{bmatrix} \text{ARG-ST} & \langle [\ ] , [\ ] , \text{PP} \rangle \end{bmatrix}$	*tv-lxm*
srv-lxm	$\begin{bmatrix} \text{ARG-ST} & \left\langle \boxed{1} , \begin{bmatrix} \text{SPR} & \langle \boxed{1} \rangle \end{bmatrix} \right\rangle \end{bmatrix}$	*verb-lxm*
scv-lxm	$\begin{bmatrix} \text{ARG-ST} & \left\langle \text{NP}_i , \begin{bmatrix} \text{SPR} & \langle \text{NP}_i \rangle \end{bmatrix} \right\rangle \end{bmatrix}$	*verb-lxm*
orv-lxm	$\begin{bmatrix} \text{ARG-ST} & \left\langle \text{NP} , \boxed{1} , \begin{bmatrix} \text{SPR} & \langle \boxed{1} \rangle \end{bmatrix} \right\rangle \end{bmatrix}$	*tv-lxm*
ocv-lxm	$\begin{bmatrix} \text{ARG-ST} & \left\langle \text{NP} , \text{NP}_i , \begin{bmatrix} \text{SPR} & \langle \text{NP}_i \rangle \end{bmatrix} \right\rangle \end{bmatrix}$	*tv-lxm*
auxv-lxm	$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AUX} & + \end{bmatrix} \end{bmatrix} \end{bmatrix}$	*srv-lxm*

OTHER GRAMMATICAL TYPES		
TYPE	FEATURES/CONSTRAINTS	ISA
gram-cat	$\begin{bmatrix}\text{HEAD} & pos \\ \text{COMPS} & \text{list}(synsem\text{-}struc) \\ \text{SPR} & \text{list}(synsem\text{-}struc) \\ \text{GAP} & \text{list}(synsem\text{-}struc)\end{bmatrix}$	*feat-struc*
pos	$\begin{bmatrix}\text{FORM} & \{\text{fin, to,...}\} \\ \text{PRED} & \{+, -\}\end{bmatrix}$	*feat-struc*
verb	$\begin{bmatrix}\text{AUX} & \{+, -\} \\ \text{NEG} & \{+, -\}\end{bmatrix}$	*pos*
prep	$\begin{bmatrix}\text{P-OBJ} & \{synsem\text{-}struc, \text{none}\} \\ \text{MOD} & \{\text{NOM, VP, none,...}\}\end{bmatrix}$	*pos*
nominal	$\begin{bmatrix}\text{AGR} & agr\text{-}cat\end{bmatrix}$	*pos*
noun	$\begin{bmatrix}\text{CASE} & \{\text{nom, acc}\} \\ \text{ANA} & \{+, -\}\end{bmatrix}$	*nominal*
det	$\begin{bmatrix}\text{COUNT} & \{+, -\}\end{bmatrix}$	*nominal*
adv	$\begin{bmatrix}\text{MOD} & \{\text{VP, none,...}\}\end{bmatrix}$	*pos*
adj	$\begin{bmatrix}\text{MOD} & \{\text{NOM, none}\}\end{bmatrix}$	*pos*
conj		*pos*

OTHER GRAMMATICAL TYPES		
TYPE	FEATURES/CONSTRAINTS	ISA
agr-cat	$\begin{bmatrix}\text{PER} & \{\text{1st, 2nd, 3rd}\} \\ \text{NUM} & \{\text{sg, pl}\}\end{bmatrix}$	*feat-struc*
3sing	$\begin{bmatrix}\text{PER} & \text{3rd} \\ \text{NUM} & \text{sg} \\ \text{GEND} & \{\text{masc, fem, neut}\}\end{bmatrix}$	*agr-cat*
non-3sing		*agr-cat*
sem-struc	$\begin{bmatrix}\text{MODE} & \{\text{prop, ques, dir, ref}\} \\ \text{INDEX} & \{index\text{ , none}\} \\ \text{RESTR} & \text{list}(predication)\end{bmatrix}$	*feat-struc*
predication	$\begin{bmatrix}\text{RELN} & \{\text{love,walk,...}\} \\ \ldots & \end{bmatrix}$	*feat-struc*
index		*feat-struc*

The Basic Lexicon

Here are some sample lexical entries that are part of the basic lexicon. '...' means 'this is something we haven't dealt with but a complete grammar would have to'.

Nouns

(45)

$$\left\langle \text{she}\ ,\ \begin{bmatrix} pron\text{-}lxm & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{CASE} & \text{nom} \\ \text{AGR} & \begin{bmatrix}\text{NUM} & \text{sg} \\ \text{GEND} & \text{fem}\end{bmatrix}\end{bmatrix}\end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{female} \\ \text{SIT} & s \\ \text{INSTANCE} & i\end{bmatrix} \right\rangle\end{bmatrix}\end{bmatrix} \right\rangle$$

(46)
$$\left\langle \text{him}\ , \begin{bmatrix} \textit{pron-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{CASE} & \text{acc} \\ \text{AGR} & \begin{bmatrix} \text{NUM} & \text{sg} \\ \text{GEND} & \text{masc} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{male} \\ \text{SIT} & s \\ \text{INSTANCE} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(47)
$$\left\langle \text{themselves}\ , \begin{bmatrix} \textit{pron-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{CASE} & \text{acc} \\ \text{ANA} & + \\ \text{AGR} & \begin{bmatrix} \text{NUM} & \text{pl} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{group} \\ \text{SIT} & s \\ \text{INSTANCE} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(48)
$$\left\langle \text{Kim}\ , \begin{bmatrix} \textit{pn-lxm} & \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{name} \\ \text{SIT} & s \\ \text{NAME} & \text{Kim} \\ \text{NAMED} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(49)
$$\left\langle \text{book}\ , \begin{bmatrix} \textit{cn-lxm} & \\ \text{ARG-ST} & \langle\ [\text{COUNT}\ +]\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & i \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{book} \\ \text{SIT} & s \\ \text{INSTANCE} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(50)
$$\left\langle \text{there}\ , \begin{bmatrix} \textit{pron-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{there} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{none} \\ \text{INDEX} & \text{none} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(51)
$$\left\langle \text{it}, \begin{bmatrix} \textit{pron-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{it} \\ \text{AGR} & \begin{bmatrix} \text{NUM} & \text{sg} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{none} \\ \text{INDEX} & \text{none} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(52)
$$\left\langle \text{tabs}\ , \begin{bmatrix} \textit{cn-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{tabs} \\ \text{AGR} & \begin{bmatrix} \text{NUM} & \text{pl} \end{bmatrix} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{none} \\ \text{INDEX} & \text{none} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(53)
$$\left\langle \text{advantage}\ , \begin{bmatrix} \textit{cn-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{advantage} \\ \text{AGR} & \begin{bmatrix} \text{NUM} & \text{sg} \end{bmatrix} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{MODE} & \text{none} \\ \text{INDEX} & \text{none} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

Verbs

(54)

$$\left\langle \text{die} , \begin{bmatrix} \textit{siv-lxm} & \\ \text{ARG-ST} & \langle\, [\ ]_i \,\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{die} \\ \text{SIT} & s \\ \text{CORPSE} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(55)

$$\left\langle \text{love} , \begin{bmatrix} \textit{stv-lxm} & \\ \text{ARG-ST} & \langle\, [\ ]_i \,,\, [\ ]_j \,\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{love} \\ \text{SIT} & s \\ \text{LOVER} & i \\ \text{LOVED} & j \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(56)

$$\left\langle \text{give} , \begin{bmatrix} \textit{dtv-lxm} & \\ \text{ARG-ST} & \langle\, [\ ]_i \,,\, [\ ]_j \,,\, [\ ]_k \,\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{give} \\ \text{SIT} & s \\ \text{GIVER} & i \\ \text{GIVEN} & j \\ \text{GIFT} & k \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(57)

$$\left\langle \text{give} , \begin{bmatrix} \textit{ptv-lxm} & \\ \text{ARG-ST} & \langle\, [\ ]_i \,,\, [\ ]_k \,,\, [\text{P-OBJ} \ \ \text{NP}_j] \,\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{give} \\ \text{SIT} & s \\ \text{GIVER} & i \\ \text{GIVEN} & j \\ \text{GIFT} & k \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(58)

$$\left\langle \text{annoy} , \begin{bmatrix} \textit{stv-lxm} & \\ \text{ARG-ST} & \left\langle \begin{bmatrix} \text{HEAD} & \textit{comp} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{1} \end{bmatrix} \end{bmatrix} , [\ ]_i \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{annoy} \\ \text{SIT} & s \\ \text{ANNOYED} & i \\ \text{ANNOYANCE} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(59)

$$\left\langle \text{keep} , \begin{bmatrix} \textit{ptv-lxm} & \\ \text{ARG-ST} & \left\langle \text{NP}_i \,,\, \overset{\text{NP}}{\begin{bmatrix} \text{FORM} & \text{tabs} \end{bmatrix}} , \overset{\text{PP}}{\begin{bmatrix} \text{FORM} & \text{on} \\ \text{P-OBJ} & \text{NP}_j \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{observe} \\ \text{SIT} & s \\ \text{OBSERVER} & i \\ \text{OBSERVED} & j \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(60)

$$\left\langle \text{take} , \begin{bmatrix} \textit{ptv-lxm} & \\ \text{ARG-ST} & \left\langle \text{NP}_i \,,\, \overset{\text{NP}}{\begin{bmatrix} \text{FORM} & \text{advantage} \end{bmatrix}} , \overset{\text{PP}}{\begin{bmatrix} \text{FORM} & \text{of} \\ \text{P-OBJ} & \text{NP}_j \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \text{s} \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{exploit} \\ \text{SIT} & s \\ \text{EXPLOITER} & i \\ \text{EXPLOITED} & j \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(61)

$$\left\langle \langle \text{kick, the, bucket} \rangle , \begin{bmatrix} \textit{iv-lxm} & \\ \text{ARG-ST} & \langle \text{NP}_i \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \text{s} \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{die} \\ \text{CORPSE} & i \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(62)

$$\left\langle \text{continue} , \begin{bmatrix} \textit{srv-lxm} & \\ \text{ARG-ST} & \left\langle [\;\;] , \overset{\text{CP}}{\begin{bmatrix} \text{FORM} & \text{inf} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{continue} \\ \text{SIT} & s \\ \text{ARG} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(63)

$$\left\langle \text{try} , \begin{bmatrix} \textit{scv-lxm} & \\ \text{ARG-ST} & \left\langle [\;\;]_i , \overset{\text{CP}}{\begin{bmatrix} \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{try} \\ \text{SIT} & s \\ \text{TRIER} & i \\ \text{ARG} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(64) a.

$$\left\langle \text{expect} , \begin{bmatrix} \textit{orv-lxm} & \\ \text{ARG-ST} & \left\langle [\;\;]_j , [\;\;] , \overset{\text{CP}}{\begin{bmatrix} \text{FORM} & \text{inf} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{expect} \\ \text{SIT} & s \\ \text{EXPECTER} & j \\ \text{ARG} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

b.

$$\left\langle \text{persuade} , \begin{bmatrix} \textit{ocv-lxm} & \\ \text{ARG-ST} & \left\langle [\;\;]_j , [\;\;]_i , \overset{\text{CP}}{\begin{bmatrix} \text{FORM} & \text{inf} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix}} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{persuade} \\ \text{SIT} & s \\ \text{PERSUADER} & j \\ \text{PERSUADEE} & i \\ \text{ARG} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(65)

$$\left\langle \text{can}\ ,\ \begin{bmatrix} \textit{auxv-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \left\langle [\ ]\ ,\ \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{inf} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{can} \\ \text{SIT} & s \\ \text{ARG} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(66)

$$\left\langle \text{do}\ ,\ \begin{bmatrix} \textit{auxv-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{FORM} & \text{fin} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \left\langle [\ ]\ ,\ \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{inf} \\ \text{AUX} & - \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(67)

$$\left\langle \text{have}\ ,\ \begin{bmatrix} \textit{auxv-lxm} & \\ \text{ARG-ST} & \left\langle [\ ]\ ,\ \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{psp} \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{3} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{have} \\ \text{SIT} & s \\ \text{ARG} & \boxed{3} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(68)

$$\left\langle \text{be}\ ,\ \begin{bmatrix} \textit{auxv-lxm} & \\ \text{ARG-ST} & \left\langle [\ ]\ ,\ \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{PRED} & + \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{2} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

(69)

$$\left\langle \text{be}\ ,\ \begin{bmatrix} \textit{orv-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AUX} & + \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{bmatrix} \text{FORM there} \end{bmatrix},\ [\,]\ ,\ \begin{bmatrix} \text{PRED} & + \\ \text{COMPS} & \langle\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{4} \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{4} \\ \text{RESTR} & \langle\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle$$

Miscellaneous

(70)

$$\left\langle \text{the}\ ,\ \begin{bmatrix} \textit{det-lxm} & \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & [...] \end{bmatrix} \right\rangle$$

(71)

$$\left\langle \text{few}\ ,\ \begin{bmatrix} \textit{det-lxm} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{COUNT} & + \\ \text{AGR} & \begin{bmatrix} \textit{non-3sing} & \\ \text{NUM} & \text{pl} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & [...] \end{bmatrix} \right\rangle$$

(72)

$$\left\langle \text{'s}\ ,\ \begin{bmatrix} \textit{det-lxm} & \\ \text{ARG-ST} & \langle\ \text{NP}\ \rangle \\ \text{SEM} & [...] \end{bmatrix} \right\rangle$$

(73)

$$\left\langle \text{to}\ ,\ \begin{bmatrix} \textit{mkp-lxm} \\ \dots \end{bmatrix} \right\rangle$$

(74)
$$\left\langle \text{and}\ ,\ \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{conj-lxm}} \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{INDEX} & s \\ \text{RESTR} & \left\langle \left[\begin{array}{ll} \text{RELN} & \text{and} \\ \text{SIT} & s \end{array}\right] \right\rangle \end{array}\right] \end{array}\right] \right\rangle$$

(75)
$$\left\langle \text{that}\ ,\ \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{comp-lxm}} \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\text{FORM}\quad \text{fin}\right] \\ \text{SPR} & \langle\ \rangle \end{array}\right] \\ \text{ARG-ST} & \langle\ [\text{SPR}\ \langle\ \rangle]\ \rangle \end{array}\right] \right\rangle$$

(76)
$$\left\langle \text{to}\ ,\ \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{comp-lxm}} \\ \text{SYN} & \left[\begin{array}{ll} \text{HEAD} & \left[\text{FORM}\quad \text{inf}\right] \\ \text{SPR} & \langle\ [\ ]\ \rangle \end{array}\right] \\ \text{ARG-ST} & \left\langle \boxed{1}\ ,\ \left[\text{SPR}\ \langle\ \boxed{1}\ \rangle\right] \right\rangle \end{array}\right] \right\rangle$$

(77)
$$\left\langle \text{not}\ ,\ \left[\begin{array}{ll} \text{SYN} & \left[\text{HEAD}\quad \textit{adv}\right] \\ \text{ARG-ST} & \langle\ \rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{INDEX} & \boxed{8} \\ \text{RESTR} & \left\langle \left[\begin{array}{ll} \text{RELN} & \text{not} \\ \text{SIT} & \boxed{8} \\ \text{ARG} & \text{s} \end{array}\right] \right\rangle \end{array}\right] \end{array}\right] \right\rangle$$

The Grammar Rules

- Head-Complement Rule

$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{COMPS} & \langle\ \rangle \end{array}\right] \rightarrow \text{H}\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{word}} \\ \text{COMPS} & \left\langle \boxed{1}, \ldots, \boxed{n} \right\rangle \end{array}\right]\ \boxed{1}\ \ldots\ \boxed{n}$$

- Head-Specifier Rule

$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{SPR} & \langle\ \rangle \end{array}\right] \rightarrow\ \boxed{1}\quad \text{H}\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{SPR} & \langle\ \boxed{1}\ \rangle \end{array}\right]$$

- Head-Modifier Rule

$$[\textit{phrase}] \rightarrow \text{H}\boxed{1}[\textit{phrase}]\quad \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{MOD} & \boxed{1} \end{array}\right]$$

- Coordination Rule

$$\left[\begin{array}{ll} \text{SYN} & \boxed{0} \\ \text{IND} & s_0 \end{array}\right] \rightarrow$$

$$\left[\begin{array}{ll} \text{SYN} & \boxed{0} \\ \text{IND} & s_1 \end{array}\right] \ldots \left[\begin{array}{ll} \text{SYN} & \boxed{0} \\ \text{IND} & s_{n-1} \end{array}\right] \left[\begin{array}{ll} \text{HEAD} & \textit{conj} \\ \text{IND} & s_0 \\ \text{RESTR} & \left\langle \left[\text{ARGS}\ \langle s_1 \ldots s_n \rangle\right] \right\rangle \end{array}\right] \left[\begin{array}{ll} \text{SYN} & \boxed{0} \\ \text{IND} & s_n \end{array}\right]$$

- Imperative Rule

$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{HEAD} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{verb}} \\ \text{FORM} & \text{fin} \end{array}\right] \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \\ \text{SEM} & \left[\begin{array}{ll} \text{MODE} & \text{dir} \\ \text{INDEX} & s \end{array}\right] \end{array}\right] \rightarrow \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{HEAD} & \left[\begin{array}{ll} \multicolumn{2}{l}{\textit{verb}} \\ \text{FORM} & \text{inf} \end{array}\right] \\ \text{SPR} & \left\langle \text{NP}\left[\text{PER}\quad \text{2nd}\right] \right\rangle \\ \text{SEM} & \left[\text{INDEX}\quad s\right] \end{array}\right]$$

- Head-Filler Rule:

$$\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{GAP} & \langle\ \rangle \end{array}\right] \rightarrow\ \boxed{1}\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{GAP} & \langle\ \rangle \end{array}\right]\quad \text{H}\left[\begin{array}{ll} \multicolumn{2}{l}{\textit{phrase}} \\ \text{FORM} & \text{fin} \\ \text{SPR} & \langle\ \rangle \\ \text{GAP} & \langle\ \boxed{1}\ \rangle \end{array}\right]$$

Well-Formedness Definitions

In the following definitions, we take for granted the notions of resolved feature structure and tree structure, as described in Chapter 6 (See also the earlier summary in Chapter 9).

(78) Well-Formed Tree Structure

Φ is a well-formed tree structure just in case every local subtree in Φ satisfies some lexical entry η or some grammar rule ρ.

(79) Lexical Satisfaction

A word structure:

$$\begin{array}{c} F \\ | \\ \omega \end{array}$$

satisfies a lexical entry $\langle \omega, \delta \rangle$ just in case:

1. F is of type *word* and F satisfies δ,
2. Argument Realization Principle
   F satisfies the following feature structure description:

$$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{SPR} & \boxed{a} \\ \text{COMPS} & \boxed{b} \ominus \boxed{c} \\ \text{GAP} & \boxed{c} \end{bmatrix} \\ \text{ARG-ST} & \boxed{a} \oplus \boxed{b} \end{bmatrix}$$

and

3. Case Constraint
   Any NP in a noninitial position of F's ARG-ST list is [CASE acc].

(80) Phrasal Satisfaction

A local subtree $\Phi =$

$$\begin{array}{ccc} & \phi_0 & \\ \swarrow & & \searrow \\ \phi_1 & \ldots & \phi_n \end{array}$$

satisfies a grammar rule $\rho = \delta_0 \rightarrow \delta_1 \ldots \delta_n$ just in case:[1]

1. The sequence $\langle \phi_0, \phi_1, ...\phi_n \rangle$ satisfies the description $\langle \delta_0, \delta_1, \ldots \delta_n \rangle$
2. Φ satisfies the Semantic Compositionality Principle, the Binding Theory, and the Anaphoric Agreement Principle,
3. if ρ is a headed rule, then Φ satisfies the Head Feature Principle and the Semantic Inheritance Principle,
4. if ρ is a headed rule other than the Head-Complement Rule, then Φ satisfies Part A of the Valence Principle,
5. if ρ is a headed rule other than the Head-Specifier Rule, then Φ satisfies Part B of the Valence Principle, and
6. if ρ is a headed rule other than the Head-Filler Rule, then Φ satisfies the GAP Principle.

(81) Semantic Compositionality Principle

$$\begin{array}{ccc} & \begin{bmatrix} \text{RESTR} & \boxed{a} \oplus \ldots \oplus \boxed{n} \end{bmatrix} & \\ \swarrow & | & \searrow \\ [\text{RESTR} \ \boxed{a}] & \ldots & [\text{RESTR} \ \boxed{n}] \end{array}$$

(82) The Binding Theory

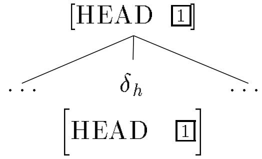
Principle A: An [ANA +] synsem-struc must be outranked by a coindexed synsem-struc.
Principle B: An [ANA −] synsem-struc must not be outranked by a coindexed synsem-struc.

(83) Anaphoric Agreement Principle

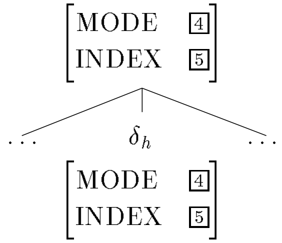
Coindexed elements agree (i.e. share a single AGR value).

[4]Note that clause (1) here must speak of a sequence of resolved feature structures satisfying a sequence description. This is because of identities that must hold across members of the sequence, e.g. those required by the rules themselves or by the principles given below.

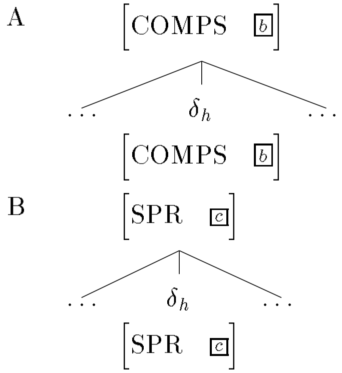
(84) Head Feature Principle



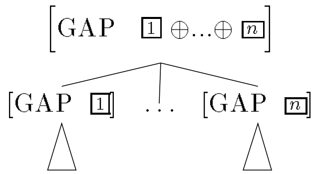
(85) Semantic Inheritance Principle



(86) Valence Principle



(87) The GAP Principle



(88) Initial Symbol Definition

A CFG must include a statement of which category (or categories) can start a tree derivation. The analogue of this 'initial symbol' definition in our grammar is a constraint guaranteeing that for a phrase to stand alone, its synsem-struc must satisfy the following description:

$$\begin{bmatrix} \textit{phrase} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ \rangle \\ \text{COMPS} & \langle\ \rangle \\ \text{GAP} & \langle\ \rangle \end{bmatrix} \end{bmatrix}$$

Lexical Rules

(89) Singular Noun Lexical Rule

$$\left\langle \boxed{1}\,,\ \begin{bmatrix} \textit{noun-lxm} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{1}\,,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{NUM} & \text{sg} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \right\rangle$$

(90) Plural Noun Lexical Rule

$$\left\langle \boxed{1}\,,\ \begin{bmatrix} \textit{noun-lxm} & \\ \text{ARG-ST} & \langle\ [\text{COUNT} +]\ \rangle \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \text{F}_{NPL}(\boxed{1})\,,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{NUM} & \text{pl} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \right\rangle$$

(91) 3rd-Singular Verb Lexical Rule

$$\left\langle \boxed{3}, \begin{bmatrix} \textit{verb-lxm} & \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a}\end{bmatrix}\end{bmatrix}\right\rangle \Rightarrow$$

$$\left\langle \text{F}_{3SG}(\boxed{3}), \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{3sing}\end{bmatrix}, \ldots \right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{2} \\ \text{RESTR} & \boxed{a} \oplus \left\langle \begin{bmatrix}\text{RELN} & \text{t-overlap}\\ \text{ARG1} & \boxed{2} \\ \text{ARG2} & \text{now}\end{bmatrix}\right\rangle\end{bmatrix}\end{bmatrix}\right\rangle$$

(92) Non-3rd-Singular Verb Lexical Rule

$$\left\langle \boxed{3}, \begin{bmatrix} \textit{verb-lxm} & \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a}\end{bmatrix}\end{bmatrix}\right\rangle \Rightarrow$$

$$\left\langle \boxed{3}, \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{bmatrix}\text{CASE} & \text{nom}\\ \text{AGR} & \textit{non-3sing}\end{bmatrix}, \ldots \right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{2} \\ \text{RESTR} & \boxed{a} \oplus \left\langle \begin{bmatrix}\text{RELN} & \text{t-overlap}\\ \text{ARG1} & \boxed{2} \\ \text{ARG2} & \text{now}\end{bmatrix}\right\rangle\end{bmatrix}\end{bmatrix}\right\rangle$$

(93) Past-Tense Verb Lexical Rule

$$\left\langle \boxed{2}, \begin{bmatrix} \textit{lexeme} & \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a}\end{bmatrix}\end{bmatrix}\right\rangle \Rightarrow$$

$$\left\langle \text{F}_{PAST}(\boxed{2}), \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{fin}\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{bmatrix}\text{CASE} & \text{nom}\end{bmatrix}, \ldots \right\rangle \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{3} \\ \text{RESTR} & \boxed{a} \oplus \left\langle \begin{bmatrix}\text{RELN} & \text{t-precede}\\ \text{ARG1} & \boxed{3} \\ \text{ARG2} & \text{now}\end{bmatrix}\right\rangle\end{bmatrix}\end{bmatrix}\right\rangle$$

(94) Present Participle Lexical Rule

$$\left\langle \boxed{3}, \begin{bmatrix} \textit{verb-lxm} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{PRED} & -\end{bmatrix}\end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a}\end{bmatrix}\end{bmatrix}\right\rangle \Rightarrow$$

$$\left\langle \text{F}_{PRP}(\boxed{3}), \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{prp}\\ \text{PRED} & +\end{bmatrix}\end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a} \oplus \ldots\end{bmatrix}\end{bmatrix}\right\rangle$$

(95) Past Participle Lexical Rule

$$\left\langle \boxed{2}, \begin{bmatrix} \textit{verb-lxm} & \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a}\end{bmatrix}\end{bmatrix}\right\rangle \Rightarrow$$

$$\left\langle \text{F}_{PSP}(\boxed{2}), \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{psp}\end{bmatrix}\end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a} \oplus \ldots\end{bmatrix}\end{bmatrix}\right\rangle$$

(96) Infinitival Lexical Rule

$$\left\langle \boxed{2}\ ,\ \begin{bmatrix} \textit{verb-lxm} & \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a}\end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{2}\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{inf}\end{bmatrix}\end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{RESTR} & \boxed{a} \oplus \ldots\end{bmatrix} \end{bmatrix} \right\rangle$$

(97) Passive Lexical Rule

$$\left\langle \boxed{1}\ ,\ \begin{bmatrix} \textit{tv-lxm} & \\ \text{ARG-ST} & \langle\ \text{NP}_i\ \rangle \oplus \boxed{\text{a}} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \text{F}_{PSP}(\boxed{1})\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{FORM} & \text{pass}\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \boxed{\text{a}} \oplus \left\langle \left(\text{PP}\begin{bmatrix}\text{FORM} & \text{by} \\ \text{P-OBJ} & \text{NP}_i\end{bmatrix}\right) \right\rangle \end{bmatrix} \right\rangle$$

(98) Extraposition Lexical Rule:

$$\left\langle \boxed{1}\ ,\ \begin{bmatrix} \textit{lxm} & \\ \text{ARG-ST} & \boxed{\text{a}}\left\langle \begin{bmatrix}\text{HEAD} & \textit{comp}\end{bmatrix} \right\rangle \oplus \boxed{\text{b}} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{1}\ ,\ \begin{bmatrix} \textit{derived-lxm} & \\ \text{ARG-ST} & \langle\ \text{NP}\begin{bmatrix}\text{FORM} & \text{it}\end{bmatrix} \rangle \oplus \boxed{\text{b}} \oplus \boxed{\text{a}} \end{bmatrix} \right\rangle$$

(99) Negation Lexical Rule

$$\left\langle \boxed{2}\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{FORM} & \text{fin} \\ \text{NEG} & - \\ \text{AUX} & + \end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \langle\boxed{1}\rangle \oplus \boxed{\text{a}} \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{4}\end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{2}\ ,\ \begin{bmatrix} \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{NEG} & +\end{bmatrix}\end{bmatrix} \\ \text{ARG-ST} & \langle\boxed{1}\rangle \oplus \left\langle \begin{bmatrix}\text{HEAD} & \textit{adv} \\ \text{INDEX} & \boxed{3} \\ \text{RESTR} & \left\langle \begin{bmatrix}\text{RELN} & \text{not} \\ \text{ARG} & \boxed{4}\end{bmatrix} \right\rangle \end{bmatrix} \right\rangle \oplus \boxed{\text{a}} \\ \text{SEM} & \begin{bmatrix}\text{INDEX} & \boxed{3}\end{bmatrix} \end{bmatrix} \right\rangle$$

(100) Inversion Lexical Rule

$$\left\langle \boxed{1}\ ,\ \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\textit{word} & \\ \text{FORM} & \text{fin} \\ \text{AUX} & + \end{bmatrix} \\ \text{SPR} & \langle\ \text{NP}\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{MODE} & \text{prop}\end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{1}\ ,\ \begin{bmatrix} \text{SYN} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{INV} & +\end{bmatrix} \\ \text{SPR} & \langle\ \rangle \end{bmatrix} \\ \text{SEM} & \begin{bmatrix}\text{MODE} & \text{ques}\end{bmatrix} \end{bmatrix} \right\rangle$$

(101) Contraction Lexical Rule

$$\left\langle \boxed{2}\,, \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \\ \text{AUX} & + \\ \text{NEG} & - \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{RESTR} & \boxed{a} \end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \text{F}_{NEG}(\boxed{2})\,, \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{NEG} & + \end{bmatrix} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \\ \text{RESTR} & \left\langle \begin{bmatrix} \text{RELN} & \text{not} \\ \text{SIT} & s \\ \text{ARG} & \boxed{1} \end{bmatrix} \right\rangle \oplus \boxed{a} \end{bmatrix} \end{bmatrix} \right\rangle$$

(102) Ellipsis Lexical Rule

$$\left\langle \boxed{3}\,, \begin{bmatrix} \textit{lexeme} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{AUX} & + \\ \text{NEG} & - \end{bmatrix} \end{bmatrix} \\ \text{ARG-ST} & \langle \boxed{1} \rangle \oplus \boxed{a} \end{bmatrix} \right\rangle \Rightarrow \left\langle \boxed{3}\,, \begin{bmatrix} \text{ARG-ST} & \langle \boxed{1} \rangle \end{bmatrix} \right\rangle$$

(103) Subject Extraction Lexical Rule

$$\left\langle \boxed{0}, \begin{bmatrix} \textit{word} & \\ \text{SYN} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{FORM} & \text{fin} \end{bmatrix} \\ \text{SPR} & \langle\ [\ ]\ \rangle \end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \boxed{0}, \begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{SPR} & \langle\ \rangle \\ \text{GAP} & \langle \boxed{1} \rangle \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1}, \ldots \right\rangle \end{bmatrix} \right\rangle$$

(104) Constant Lexeme Lexical Rule

$$\langle \boxed{1}\,, [\textit{const-lxm}] \rangle \Rightarrow \langle \boxed{1}\,, [\textit{word}] \rangle$$

(105) Agent Nominalization Lexical Rule

$$\left\langle \boxed{2}\,, \begin{bmatrix} \textit{verb-lxm} & \\ \text{ARG-ST} & \langle\ \text{NP}_i\ (,\ \boxed{1}\text{NP})\ \rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & s \end{bmatrix} \end{bmatrix} \right\rangle \Rightarrow$$

$$\left\langle \text{F}_{-er}(\boxed{2})\,, \begin{bmatrix} \textit{cn-lxm} & \\ \text{ARG-ST} & \left\langle \text{DetP}\ (,\ \overset{\text{PP}}{\begin{bmatrix} \text{P-OBJ} & \boxed{1} \\ \text{FORM} & \text{of} \end{bmatrix}}) \right\rangle \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & i \end{bmatrix} \end{bmatrix} \right\rangle$$

Appendix B
Generative Grammar: an historical overview

As noted in Chapter 2, the theory of grammar developed in this text is most closely related to the framework known as 'Head-driven Phrase Structure Grammar', or HPSG. HPSG is one of a number of frameworks for syntactic analysis that have been developed within the Chomskyan paradigm, broadly conceived. The intellectual tradition it represents is eclectic in its orientation, synthesizing ideas from several approaches to the study of language. To clarify these connections, we provide here a brief history of generative grammar, including a survey of its major branches,[1] with notes on their relevant contribution or influence to the ideas presented within this text.

The basic concept of generative grammar is simply a system of rules that defines in a formally precise way (i.e. 'generates') a set of sequences (strings over some vocabulary of words or 'formatives') that represent the well-formed sentences of a given language. Thus both of the systems considered in Chapter 2 (the regular expression (finite-state) and context-free phrase structure grammars) are generative grammars, as is the grammar summarized in Appendix A.

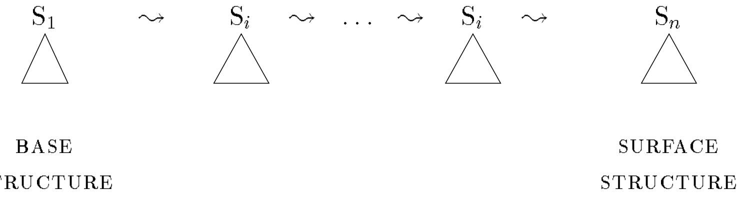
Generative syntax began in the 1950s when Noam Chomsky and others he influenced developed and formalized a theory of grammar based on the notion of 'transformation'.[2] The architecture of a transformational generative grammar defines sentence well-formedness indirectly:

[1]The dates given in parentheses are roughly the periods during which a substantial number of researchers have been or are still active in developing the theory.

[2]A somewhat different though related concept of transformation can be found in the work of Zellig Harris, beginning in the 1950s. A number of relevant papers are collected in Harris 1970.

first, base (or 'underlying' or 'kernel') structures are generated via a system of phrase structure rules;[3] and then transformational rules apply successively to map these phrase structures into other phrase structures. The sentences of the language, then, are just those that can be derived by applying transformational rules to the base structures according to a particular regime, e.g. a regime of ordered transformations, at least some of which are obligatory. A transformational derivation thus involves a sequence of phrase structures (or structural descriptions), the first of which is a base structure and the last of which is a phrase structure (usually called a 'surface structure') whose word string corresponds to a sentence of the language:

(106)



Transformational generative grammar (which has dominated the mainstream of syntactic theory from the 1960s through the 1990s) has changed significantly over the years, in ways we sketch below. Yet, despite considerable evolution within this framework, the notion of transformational derivation has been present in one guise or another in virtually every formulation of transformational grammar.[4] Similarly, other commonalities remain in the practice of transformational grammarians, such as the treatment of sublexical entities (e.g. inflectional affixes) as independent syntactic elements, that is, as syntactic primitives on a par with words.[5]

In contrast to the transformational tradition, there is another approach to generative grammar, equally committed (if not more so) to the original goal of developing precisely formulated grammars. This tradition has two distinctive properties:

[3] In some versions of this approach, lexical insertion into the structures generated by the CFG is accomplished by a separate specialized mechanism.

[4] There are exceptions, though, e.g. Koster 1987 and Brody 1995. Chomsky has always maintained that it is 'not easy' to provide empirical (or theory-independent) evidence that would lead one to prefer a transformational theory over simpler alternatives. Despite this repeated claim (Chomsky (1981: 90f; 1995: 223f)), Chomsky has included transformational operations in every version of grammatical theory he has developed since the 1950s.

[5] Hence Chomsky's introduction of the term (syntactic) 'formative' to encompass stems, noninflecting words, and inflectional affixes.

(i) **Constraint-Based Architecture**: Grammars are based on the notion of constraint satisfaction, rather than transformational derivation.

(ii) **Strict Lexicalism**: Words, formed in accordance with an independent lexical theory (or 'module'), are the atoms of the syntax. Their internal structure is invisible to syntactic constraints.

These two design properties together form the basis of the 'constraint-based lexicalist' (CBL) approach to generative grammar. In CBL approaches, surface structures are generated directly, though ancillary kinds of syntactic representation may be cogenerated (see below).

The principle of strict lexicalism has its origin in the pioneering work of Chomsky (1970), who challenged previous attempts to derive nominalizations (e.g. *the enemy's destruction of the city*) from clauses (e.g. *the enemy destroyed the city*) via syntactic transformations. In the mid- and late 1970s, many other alternatives to transformational analyses were developed. There are two particularly significant developments in this period. The first is Bresnan's 'Realistic' Transformational Grammar (widely circulated in unpublished form; a version was published as Bresnan (1978)), which for the first time provided a cogent treatment of numerous phenomena (e.g. passivization) in lexical rather than transformational terms. Bresnan's dramatic first step inspired a number of people, notably Brame (1979) and Gazdar (1981) [first drafted in 1980], to take the further step of purging transformations from syntactic theory altogether. Second, the emergence of the framework of Montague Grammar provided new techniques for characterizing meanings directly in terms of surface structure, thereby eventually eliminating any semantic motivation for syntactic transformations. In many versions of transformational grammar, active and passive sentences were derived from a common underlying structure, leading to the (controversial) suggestion that many aspects of meaning are preserved by transformational derivations. With the advent of more sophisticated methods of semantic analysis, distinct surface structures could be assigned formally distinct but equivalent semantic interpretations, thus accounting for the semantics in a principled fashion without appeal to transformations.

'Realistic' Transformational Grammar and Montague Grammar together set the stage for the emergence of fully nontransformational generative frameworks in the late 1970s and early 1980s. Most notable among these are Lexical-Functional Grammar, Generalized Phrase Structure Grammar, Categorial Grammar, and Dependency Grammar, each of which we summarize below. The subsequent history of CBL generative grammar witnessed not only considerable development in each of these frameworks, but also the introduction of such new approaches as Construction Grammar. Of immediate relevance also is the evolution of Generalized Phrase Structure Grammar, through the integration of ideas from various other frameworks, into the framework of HPSG, from which are directly drawn many analyses and the general orientation of the present text.

The remainder of this appendix briefly sketches a number of the most influential theories of grammar developed over the past forty years. We do not pretend that this is a comprehensive listing of approaches to syntactic description that have been explored in that period; our main purpose here is to situate the theory developed in this text in a wider intellectual landscape, indicating the many conceptual strands that have contributed to our approach. At the same time, we hope to convey a general sense of the historical development of generative grammar and its various schools.

Transformational Grammar

Early Transformational Grammar (1955–1964) An early version of transformational generative grammar was presented in Chomsky's 1957 book, *Syntactic Structures*. The analyses presented there and in other transformational works of the period included explicit formal statements of rules intended to license all and only the well-formed sentences of the language under discussion (usually English). This emphasis on the precise formulation of hypotheses is perhaps the greatest influence of early transformational grammar on the approach presented here.

As noted above, a key claim of transformational grammar (in all its versions) is that an empirically adequate grammar requires that sentences be associated not with a single tree structure, but with a sequence of trees, each related to the next by a transformation. The initial trees in Chomsky's *Syntactic Structures* theory were to be generated by a CFG. For example, passive sentences (such as *The cat was chased by the dog*) were derived from the same underlying structures as their active counterparts (*The dog chased the cat*) by means of a passivization transformation that permuted the order of the two NPs and inserted the words *be* and *by* in the appropriate places.

The most celebrated analysis in this theory is its treatment of the English auxiliary system (roughly, the material covered in Chapter 13 of this text). Chomsky (1957) proposed that tense was, in the underlying syntactic structure, a 'formative' separate from the verb on which it ultimately appears. A movement transformation was posited to account for inversion in questions (deriving, e.g. *Is the sun shining?* from

the same underlying structure as *The sun is shining*); and an insertion transformation placed *not* in the appropriate position for sentence negation. Both these transformations in some instances have the effect of stranding tense – that is, leaving it in a position not adjacent to any verb. For these cases, Chomsky posited a transformation to insert *do* as a carrier of tense. Several other uses of auxiliary *do* (e.g. in ellipsis) were also treated on this view as instances of tense stranding. This unified account of apparently disparate uses of *do*, together with the formal explicitness of the presentation, won many converts to transformational grammar.

The Standard Theory (1965–1970) Katz and Postal (1964) and Chomsky (1965) introduced a number of major changes into transformational grammar, and Chomsky dubbed the resulting theory 'the standard theory'. It differed from early transformational grammar in several ways, some rather technical. Among the important innovations of this theory were the use of recursive phrase structure rules (allowing for the elimination of transformations that combined multiple trees into one) and the introduction of syntactic features to account for subcategorization (valence).

Perhaps the most important conceptual change was the addition of a semantic component to the theory of transformational grammar. In this theory, the initial tree in each sentence's derivation, known as its 'deep structure', transparently represented all the information necessary for semantic interpretation. In particular, it was claimed that there is a simple mapping between the semantic roles played by arguments to a verb (intuitively, who did what to whom) and the deep structure grammatical relations (subject, object, etc.). In the final tree of the derivation (the surface structure), the words and phrases were arranged as the sentence would actually be pronounced. On this theory, then, transformations were thought to be the primary link between sound and meaning in natural language.

The standard theory had great intuitive appeal and attracted much attention from neighboring disciplines. In particular, many philosophers were attracted by the idea that deep structures might provide something very much like the 'logical form' of sentences needed for precise analysis of their role in inference. Likewise, psychologists hoped that the transformational derivations were a first approximation to the mental processes involved in the production and comprehension of utterances. Initial experiments gave credibility to this idea, in that they showed a correlation between the psychological complexity of a sentence and the number of transformations posited in its derivation. Further research on this idea (known as the 'derivational theory of complexity') failed to support it, however, and by the early 70s it had been largely abandoned (Fodor, Bever and Garrett (1974)).

Most contemporary grammatical theories have preserved the most important innovations of the standard theory, namely, syntactic features, recursive phrase structure, and some sort of semantic component. On the other hand, no current theory maintains the centrality of transformations in mediating between sound and meaning.

Generative Semantics (1967–1974) Generative Semantics was the first major challenge to Chomsky's views within the generative paradigm; its leading figures included George Lakoff, James McCawley, Paul Postal, and John ('Haj') Ross. They carried the central idea of the standard theory to its logical conclusion, claiming that deep structures should themselves be viewed as representations of meaning, and denying that syntactic and semantic rules should be considered distinct components of a grammar. That is, on the generative semantics view, something was considered a possible input to the transformational rules just in case it represented a proposition that made sense. Hence all languages could be derived from the same underlying source, differing only in how the underlying representations get transformed into sounds.

The underlying trees of generative semantics were far larger and more elaborate than those of the standard theory (though the inventory of grammatical categories was much reduced). Virtually all the work involved in describing the relationships between form and meaning in language was done in this theory by transformations, though these rules were rarely formulated explicitly.

Generative semantics enjoyed wide currency for a few years and served as the vehicle for the exploration of a wide range of fascinating phenomena in many languages. Although the theory itself had a short life span (for reasons that have been debated by historians of linguistics), many of the constructions first discovered by generative semanticists continue to figure prominently in theoretical discussions. Moreover, some recent analyses have borne striking resemblances to earlier generative semantics proposals; see Harris (1993) and Huck and Goldsmith (1995) for discussion.

The Extended Standard Theory (1967-1980) Unlike the generative semanticists, Chomsky and some others (notably, Ray Jackendoff) quickly abandoned the idea that pairs of sentences with identical deep structures must be synonymous. In particular, they argued that transformations that reordered quantified NPs could change the scopes of the quantifiers (e.g. *Many people read few books* was claimed to have a range of interpretations different from *Few books are read by many people*). Hence they claimed that structures other than deep structures must play a role in semantic interpretation.

Instead of the complex underlying trees and elaborate transformational derivations of generative semantics, the framework that Chomsky dubbed the 'Extended Standard Theory' (EST) posited a relatively impoverished theory of transformations; instead, it enriched other components of the theory to carry much of the descriptive burden. In addition to the new types of semantic rules alluded to above, schematization over phrase structure rules and an enriched conception of the lexicon – including lexical rules – were introduced. These innovations have been carried over into much contemporary work, including the theory developed in this text. The approach of EST led to a highly 'modularized' theory of grammar, with a variety of distinct types of mechanisms to account for different kinds of empirical phenomena.

EST also saw the introduction of 'empty categories' – that is, elements that occupy positions in a tree but which have no phonetic realization. These included a type of null pronoun used in control constructions (e.g. the subject of *leave* in *We tried to leave*) and 'traces' of elements that have been moved.

A central concern of EST and much subsequent work has been to constrain the power of the theory – that is, to restrict the class of grammars that the theory makes available. The primary rationale for seeking such constraints has been to account for the possibility of language acquisition, which (as noted in Chapters 1 and 9) Chomsky regards as the central question for linguistics.

Government and Binding Theory (1980 to the present) Government and Binding theory, or GB, as it is generally called, was first laid out in Chomsky's (1981) book, *Lectures on Government and Binding.*[6] It develops the modular style of EST, dividing the theory of grammar into a set of subtheories, each with its own set of universal principles. Although GB still uses transformational derivations to analyze sentences, it reduces the transformational component to a single rule (referred to as 'Move α'), which can move anything anywhere. The idea is that general principles will filter out most derivations, preventing the massive overgeneration that might be expected.

Elaborating on earlier work in EST, GB analyses posit a rich array of empty categories. Binding theory, which has been a major topic of research within GB, is applied not only to overt pronouns, but also to empty categories. Movement leaves behind traces (a kind of empty cat-

[6]For an introductory presentation, see Haegeman (1994).

egory), which are bound by the moved element. Binding theory thus relates constraints on movement to possible pronoun-antecedent relations. Since movement is used to deal with a wide range of phenomena (including filler-gap dependencies, the active-passive relation, raising, extraposition, and auxiliary inversion), linking all of these to the binding principles yields a richly interconnected system.

The primary focus in GB has been the development of a theory of universal grammar. GB claims that many of the principles that make up the theory of grammar are parameterized, in the sense that they vary within a narrow range. (Another name for this approach to syntax is 'Principles and Parameters'). Learning a language, on this view, consists of fixing a small set of parameters (plus learning vocabulary). That is, GB claims that all languages are essentially alike, with only a few restricted parameters of possible variation. Working out the details of this ambitious program has been the most active area of syntactic research since the early 1980s.

The literature within this framework is massive, and it represents a much wider range of analyses than any of the other theories listed here, though these analyses are seldom formulated with a precision comparable to that assumed in this text and hence are often difficult to evaluate. However, they tend to share certain noteworthy characteristics, including the following:

- Highly articulated phrase structures (linguistically significant distinctions and relations are encoded into tree configurations);
- Use of movement (that is, the transformation Move α);
- Extensive use of empty categories;
- A rich set of universal principles, some of which are parameterized;
- Avoidance of language-particular rules (properties specific to a language are to be expressed in terms of values of universally available parameters);
- Deductive structure (small changes in a grammar should have far-reaching consequences for the language, so that stipulation is minimized).

The theory we have presented here has been influenced by GB in a number of ways. These include very general goals, such as striving for deductive structure in the theory. They also include more specific design features, such as the general form of the Binding Theory (though not the detailed statement of the binding principles). Finally, there are specific points of our grammar that were first proposed within GB analyses, such as treating complementizers as heads that could take sentences as their complements.

The Minimalist Program As of this writing, the most recent descendant of GB is the 'Minimalist Program'. As its name implies, MP is a program for research, rather than a theory of syntax.

MP explores the idea that instead of generating sentences directly, what grammars do is pick out the best expressions from some candidate set. MP grew out of Government and Binding theory, but it represents a significant departure from earlier work in that framework. Its goal is to explain linguistic structure in terms of intuitively natural 'economy conditions' on grammars and their operations. Analyses are most highly valued if they minimize the amount of structure and the length of derivations posited. In his seminal work on MP, Chomsky (1995) lays out some principles that embody this general idea. These include 'GREED', which says that a constituent will move only to satisfy its own licensing requirements, and 'PROCRASTINATE', which says that movement will take place as late as possible. More recent work has sought to localize such effects, applying economy constraints at each step of a transformational derivation. This conception of grammar, in which the properties of competing transformational derivations are crucial in determining sentence well-formedness,[7] represents a radical departure from the original goals and methodology of generative grammar and has no direct connection with the theoretical orientation of the present work. For an extensive comparison of MP with CBL approaches in general, see Johnson and Lappin (in press).

The work of filling in the details of MP is still in the early stages, but it has stimulated a great deal of interest within the field. For an elementary exposition of MP, see Radford (1997); also useful is Webelhuth, ed. (1995).

Constraint-Based Lexicalist Grammar

Categorial Grammar (1974 to the present) Categorial Grammar (CG) has a long history dating back to the 1930s, but it was developed primarily by mathematical logicians before the early 1970s. It came to the attention of linguists when the logician Richard Montague used it as the syntactic framework to go with his new approach to analyzing natural language semantics.[8]

The central idea of CG is that an enriched conception of grammatical

[7] Generative semanticists in the early 1970s briefly discussed the need for what were then termed 'transderivational constraints', but the idea was not pursued for long.

[8] Montague's intensional logic and his precise framework for studying the relation between expressions and their meaning had a considerable influence on work in linguistics. His famous remark (Montague, 1970:373) that 'there is in my opinion no important theoretical difference between natural languages and the artificial lan-

categories can eliminate the need for many of the constructs (e.g. transformations) found in other theories of grammar. CG makes no formal distinction between lexical and nonlexical categories. Hence, for example, an intransitive verb like *sleeps* is treated as belonging to the same category as a phrase consisting of a transitive verb plus a direct object, such as *gets some rest*. Categories are defined in terms of their members' potential for combining with other constituents (and thus CG is often seen as a variety of Dependency Grammar - q.v.). So, for example, verb phrases (and intransitive verbs) can be characterized as those elements which, when combined with a noun phrase on their left, form sentences; one notation for this is NP\S. A transitive verb like *gets* belongs to the category of elements that take an NP on their right to form a NP\S; this can be written (NP\S)/NP. A categorial grammar consists simply of a lexicon together with a few simple rules for how categories can be combined.

The primary attractions of CG have always been its conceptual simplicity and the fact that it is well suited to the formulation of tightly linked syntactic and semantic analyses. It also provides particularly elegant and appealing accounts of coordination. For a general introduction to categorial grammars, see Wood (1993) and Carpenter (1997). Steedman (1996) summarizes a tradition within CG that makes use of logical 'combinators'. For the competing 'type-logical' approach, see Morrill (1994) and Moortgat (1997).

The influence of CG on the theory developed in this text is quite clear. The valence features of HPSG do much the same work as complex category labels do in CG. The nodes of trees in HPSG are labeled with feature structures that contain all the information in CG category labels (plus quite a bit more). Our grammar rules cancel elements off our valence lists in a way analogous to the combinatory rules of CG. Hence many CG analyses can be translated fairly straightforwardly into HPSG.

Construction Grammar (1988 to the present) Construction Grammar (CnG) represents a related yet interestingly different perspective from other CBL frameworks. Linguistic objects (sentences, phrases, and words), viewed formally, are taken to be constituent structure trees whose nodes are occupied by feature structures. The feature structures contain additional syntactic as well as semantic and phonological information. The constructions that license linguistic objects are partial descriptions of such feature structure trees, much as in the presentation of this text.

guages of logicians' is sometimes referred to (following Bach 1989) as Montague's Hypothesis.

A construction grammar is a set of constructions that can be unified to create the set of sentences of a language (and no sentence objects not in the language). A CnG feature-structure tree can be translated into either an HPSG feature structure of type *sign*, or the analogue of this in Lexical Functional Grammar (q.v.) (insofar as the detailed kinds of information contained in the particular implementations of these theories at hand are comparable).[9]

There are two principle substantive motivations for CnG. The first is to account for grammatically determined, non-truth-conditional aspects of meaning – including such 'pragmatic' factors as conventional implicature and presupposition – in the formal representations of sentences and of the grammatical constructions that license them. The second is to account for the full range of idiomatic and semi-idiomatic constructions that occur in every language. Although every generative approach to the grammar of natural languages is interested in full coverage of the facts of every language, as well as in the extraction of intralanguage and interlanguage generalizations – the latter usually considered to constitute the stuff of universal grammar – varying approaches differ in their relative emphasis on the full coverage of language facts versus the development of a parsimonious theory of universal grammar. CnG falls at the end of this scale concerned primarily with empirical coverage. For more on CnG, see Fillmore and Kay (forthcoming), Fillmore et al. (1988), and Goldberg (1995).

Dependency Grammar (1959 to the present) Work on transformational grammar rests on two crucial (but controversial) assumptions about sentence structure: that it is organized hierarchically into 'phrases' (hence 'phrase structure'), and that grammatical relations such as 'subject' and 'object' are redundant. The assumption of phrase structure is a distinctively American contribution to linguistics, having been suggested by Leonard Bloomfield (1933). Bloomfield suggested that sentences should be analysed by a process of segmentation and classification: segment the sentence into its main parts, classify these parts, then repeat the process for each part, and so on until the parts are 'morphemes', the indivisible atoms of grammar. Thus *Cool students write short essays* divides into the noun phrase *cool students* plus the verb phrase *write short essays*, which in turn divides into the verb *write* plus *short essays*, and so on. This contrasts with the European tradition (which dates back to classical Greece) in which the focus is on individual words and their

[9] Recent developments in HPSG have reduced many of the analytic differences between CnG and HPSG. See Sag (1997) and the discussion of phrase hierarchies in Chapter 16.

relationships - for example, *cool* is an 'attributive modifier' of *students*, and *students* is the subject of *write*.

The attraction of phrase structure analysis is its formal clarity, which is revealed by the familiar phrase structure trees. Various linguists (mainly European) have attempted to develop the traditional approach in the same way, with the emphasis on the relationships among words rather than on the groupings of words. One of the characteristics of these relationships is that the words concerned are generally not equal, in that one serves to modify the meaning of the other; so *cool students* denote certain students, and *students writing essays* denotes a kind of writing. The relationships are called 'dependencies', with the modifying word depending on the modified (so *cool* depends on *students*, and *students* on *write*), and the approach is called 'dependency grammar' (DG) to contrast it with phrase structure grammar.

There are several ways to represent DG analyses diagramatically, including a system that has been widely used in American schools since the nineteenth century which is often called simply 'sentence diagramming'. The first real attempt to build a theory of DG analysis was Tesnière (1959), but since then developments in PSG theory have been parallelled in DG theories. One of these which is particularly close in other respects to HPSG is 'Word Grammar' (Hudson 1984, 1990, 1998). In some respects, HPSG bridges the gap between DG and PSG, for in HPSG all the parts of a phrase depend directly on its head word - the phrase is 'head-driven', just as in DG. On the other hand, in HPSG the dependent parts are themselves phrases with their own internal structure consisting of a head word and its dependents.

Generalized Phrase Structure Grammar (1979–1987) Generalized Phrase Structure Grammar, or GPSG, as it was known, was initiated by Gerald Gazdar in a pair of papers (Gazdar 1981, 1982) that attracted the attention of numerous researchers in the field of syntax. The theory was further developed by him and a number of colleagues in the early 1980s and was codified in the 1985 book, *Generalized Phrase Structure Grammar* (Gazdar et al. 1985), which provides a detailed exposition of the theory.

The central idea of GPSG is that standard context-free phrase structure grammars can be enhanced in ways that do not enrich their generative capacity, but which do make them suitable for the description of natural language syntax. The implicit claim of work in GPSG was that the tenable arguments against CFG as a theory of syntax were arguments about efficiency or elegance of notation, and not about coverage in principle.

Among the important ideas that originated in GPSG are the separation of CFG rules into (i) rules of immediate dominance ('ID rules'), which specify only which phrases can appear as daughters in a local syntactic tree, and (ii) rules of linear precedence ('LP rules'), which specify general constraints determining the order of daughters in any local tree. This factorization of the two functions of traditional CFG rules is preserved in HPSG, though we have not employed it in the formulation of grammar rules in this text.

A second idea stemming from work in GPSG is the treatment of long-distance dependency constructions, including filler-gap constructions (such as topicalization, *wh*-questions, and relative clauses). The GPSG treatment of these phenomena involved locally encoding the absence of a given constituent via a feature specification. The remarkable result of the transformationless GPSG analysis of filler-gap dependencies was that it succeeded where transformational theories had failed, namely in deriving the coordinate structure constraint and its 'across-the-board' exceptions (see Chapter 15). This feature-based analysis of filler-gap dependencies is preserved in HPSG, and we have carried it over virtually intact to the current text.

Head-Driven Phrase Structure Grammar (1984 to the present) HPSG evolved directly from attempts to modify GPSG in the interdisciplinary environment of Stanford's Center for the Study of Language and Information (CSLI), the site of several experimental computational systems for language processing. From its inception, HPSG has been developed as a conscious effort to synthesize ideas from a variety of perspectives, including those of Situation Semantics (which originated at CSLI at about the same time as HPSG), data type theory, and a variety of other linguistic frameworks under development in the early and mid-1980s. The name 'Head-driven Phrase Structure Grammar' was chosen to reflect the increasingly recognized importance (as compared with, say, GPSG) of information encoded in the lexical heads of syntactic phrases. Dependency relations are lexically encoded, as they are in Dependency Grammar (q.v.), Categorial Grammar (q.v.) and LFG (q.v.). The theoretical aspects of HPSG have been developed in considerable detail in two books (Pollard and Sag 1987, 1994) and a number of major articles.

Some of the key ideas of work in HPSG are: (1) a sign-based architecture (see Chapter 16); (2) the organization of linguistic information via types, type hierarchies, and constraint inheritance; (3) the projection of phrases via general principles from rich lexical information; (4) the organization of such lexical information via a system of lexical types; and (5) the factorization of phrasal properties into construction-specific and more general constraints. These properties have all been discussed at various places in this text.

Since the inception of HPSG, researchers have been involved with its computational implementations. From 1980 until 1991, Hewlett-Packard Laboratories in Palo Alto, California supported one such project, which involved the authors of this text and a number of colleagues and students. It was with this project that many of us learned for the first time how far the rhetoric of theoretical linguistics can be from the reality of working grammars. At the time of this writing, implementations of HPSG and HPSG-like grammars are being developed at numerous universities and industrial research laboratories around the world, including sites in Canada, the United States, western and eastern Europe, Japan, Korea, Taiwan, and Australia.

Lexical Functional Grammar (1979 to the present) The theory of Lexical Functional Grammar, commonly referred to as 'LFG' (Bresnan (1982); Dalrymple et al. (1995); Bresnan (to appear)) shares with Relational Grammar (q.v.) the idea that relational concepts like 'subject' are of central importance and cannot be defined in terms of tree structures. But it also treats phrase structure as an essential part of grammatical description and has focussed on the development of a universal theory of how constituent structures are associated with grammatical relations.

In LFG, each phrase is associated with multiple structures of distinct types, with each structure expressing a different sort of information about the phrase. The two representations that have been the center of attention in most LFG literature are: the 'functional structure', which expresses the relational information that is analogous in certain respects to our ARG-ST and in other respects to the valence features SPR and COMPS; and the 'constituent structure', which is a tree diagram very similar to the surface structures of the Standard Theory. General principles and construction-specific constraints define the possible pairings of functional and constituent structures. In addition, LFG recognizes a number of further levels of representation. Perhaps most notable among these are σ-structure, which represents linguistically significant aspects of meaning, and a-structure, which serves to link syntactic arguments with aspects of their meanings. Thus the analogue of the HPSG sign presented in Chapter 16 is a tuple of LFG structures, possibly the four-tuple consisting of a sentence's c-structure, f-structure, a-structure, and σ-structure.

There are no transformations in LFG. Much of the descriptive work done in earlier theories by transformations is handled by an enriched lexicon, an idea pioneered by LFG researchers. For example, the active-passive relation in English is treated as a lexical relation between two forms of verbs. In early LFG, this was codified in terms of lexical rules similar to those presented in this text. Subsequent work has sought to develop a more abstract conception of lexical relations in terms of 'lexical mapping theory'. LMT provides for constraints on the relation between f-structures and a-structures, that is, constraints associated with particular arguments that partially determine their grammatical function. It also contains mechanisms whereby arguments can be supressed in the course of lexical derivation. In LFG, information from lexical entries and phrasal annotations is unified to produce the functional structures of complex expressions.

As the above description makes clear, LFG and HPSG bear many resemblances. In particular, HPSG has been able to incorporate many insights from work in LFG, most notably: the significant use of lexical analyses, well-developed dependency-based analyses of numerous phenomena (rather than accounts based on constituent structure), and the general constraint-based approach to grammatical description. There are crucial differences between LFG and HPSG as well (e.g. the use of types and type-based inheritance, which plays no role in the LFG literature, and HPSG's use of defaults). The differences in practice between the HPSG and LFG communities often lead to rather different analyses of the same phenomena; yet these analyses are often compatible with either framework. For an overview of current developments in LFG, see Bresnan (forthcoming).

Two Other Grammatical Frameworks

Relational Grammar (1974 to the present) We can now return to the second controversial claim of PSG, namely, that grammatical relations are redundant. In early theories of generative grammar, transformations were defined in terms of structural properties of tree diagrams. To the extent that traditional notions like 'subject' and 'direct object' were employed in these theories, they were regarded simply as shorthand for relations between linguistic elements definable in terms of the geometry of trees. Relational grammar (RG), developed by Paul Postal, David Perlmutter, David Johnson and others, adopts primitives that are conceptually very close to the traditional relational notions of subject, direct object, and indirect object. In this respect there is a strong affinity between RG and Dependency Grammar (q.v.). The grammatical rules of RG are formulated in relational terms, replacing the earlier formulations based on tree configurations. For example, the passive rule is stated in terms of promoting the direct object to subject, rather than as a structural rearrangement of NPs.

This approach allows rules to be given very general formulations that apply across languages. The characterization of passivization as promotion of the object does not depend on whether subjecthood and objecthood are indicated by word order or by other means, such as case marking on the nouns or some marking on the verb.

Although the influence of RG on the theory presented here may not be obvious, it is real. The notions of 'specifier' and 'complement' employed in this text are generalizations of 'subject' and 'object'. Languages use different grammatical devices to mark these relations (word order, case marking, agreement, etc.), and so a theory whose primitives are too closely linked to these devices would be unable to express cross-linguistic similarities. A number of contemporary theories, including LFG (q.v.) and HPSG, have adopted this central insight of RG.

The RG framework was applied to the description of a much wider variety of languages than were earlier generative theories (which tended to concentrate on the familiar European languages, East Asian languages, and a few others). Various results of work in this framework are anthologized in Perlmutter, ed. (1983) and Postal and Joseph, eds. (1990). 'Arc Pair Grammar' (Johnson and Postal (1980)) is an axiomatization and elaboration of many of the central ideas of Relational Grammar. The graph-theoretic foundations of HPSG are essentially the same as those first developed for Arc Pair Grammar by Johnson and Postal.

Optimality Theory Optimality Theory, or OT was first developed as a phonological framework (Prince and Smolensky (forthcoming)), and has recently been adapted to syntactic analysis (see Barbosa et al. (1998)). OT posits a universal set of defeasible constraints. The grammar of a language consists of a ranking of the constraints. Determining whether a given string of words is a well-formed sentence involves comparing it with other candidate expressions of the same proposition. The candidate whose highest-ranking constraint violation is lower than any other candidate's is grammatical. For example, if constraint A outranks constraint B, which outranks constraint C, and if candidate sentence 1 violates A whereas candidate sentence 2 violates B and C, then sentence 2 is preferred over sentence 1, and sentence 1 is ungrammatical. If no other candidate sentence wins such a competition against sentence 2, then sentence 2 is licensed by the grammar.

The idea of constraints that can be violated is also incorporated in the theory presented in this book, since default constraints specified in type hierarchies can be overridden. Moreover, a hierarchy of types with

defeasible constraints defines a partial ordering on those constraints, with those introduced lower in the hierarchy taking precedence over those introduced at higher levels. Although there are substantive differences, certain central properties of OT can also be found in inheritance hierarchies with default constraints.[10]

OT follows much earlier work in generative grammar in positing rich systems of universal grammar. However, the idea that determinations of well-formedness necessarily involve comparing structures or derivations is a break with past views, as we already noted in discussing the Minimalist Program (q.v.). Another common characteristic of MP and OT is the use of defeasible constraints. As noted above, such constraint mechanisms of various sorts have been proposed from time to time within some theories, including the theory presented in this book. This is not surprising, since idiosyncratic exceptions to general patterns are commonplace in natural languages. Defeasible constraint mechanisms are now accepted fairly widely in various theories of syntax. It remains to be seen whether a similar consensus will arise concerning the idea of defining well-formedness in terms of the outcome of some sort of competition.

[10] Such hierarchies are explored in some detail in the artificial intelligence literature of the 1970s.

Glossary

This glossary contains linguistic terms that either play a direct role in or are presupposed by this book. For further information, there are a number of dictionaries of linguistics, including Crystal (1985) and Trask (1993).

AAVE In informal speech, many African Americans use a distinctive variety of English known as African American Vernacular English, or AAVE for short. Also known as Black English, African American English, and Ebonics, both the phonology and aspects of the syntax of AAVE have been extensively studied, largely by sociolinguists.

active A verb form or clause that is not in the passive is referred to as active. *See also* passive; voice.

affix An affix is a morphological element added to a stem to form another stem or a word. Two common types of affix are prefixes (e.g. *re-*, as in *reread*; *out-*, as in *outperform*) and suffixes (*-ed*, as in *visited*; *-s*, as in *visits*. Many languages exhibit other types of affix as well, including infixes (an element inserted into a stem) and circumfixes (e.g. a pair of elements wrapped around a stem).

agreement In many languages, the forms of certain elements can vary to indicate such properties as person [q.v.], number [q.v.], animacy, gender [q.v.], etc. Often, these variations are marked with affixes. Some grammatical relationships between pairs of linguistic elements require that they agree on these properties. In English, for example, present tense verbs are marked to indicate whether their subjects are third-person singular (with the suffix *-s*), and nouns indicate plurality (also with a suffix *-s*). The systematic covariation of the forms of the subject and verb is called 'subject-verb agreement.' Similarly, third-person pronouns must agree with their antecedents in person, number, and gender. *See also* inflection.

anaphor *See* anaphora.

anaphora Certain expressions depend for their interpretation on their association with some other element in the discourse (usually earlier). Paradigm examples are pronouns like *he, her*, and *itself*; other examples include *do so* and verb phrase ellipsis. 'Anaphora' is the term for the relationship between such elements and their antecedents. The term 'anaphor' is sometimes used for all anaphoric elements and is sometimes reserved for only certain kinds (primarily reflexives [q.v.] and reciprocals [q.v.]). *See also* antecedent; binding; ellipsis.

antecedent This term is used for a linguistic element that is the basis for interpreting some anaphoric element occuring (typically later) in the sentence or discourse. In particular, pronouns are often described as referring back to their antecedents (or to the referents of their antecedents). *See also* anaphora.

argument (or **syntactic argument)** This is a general term for any phrase that is selected for by a lexical head, such as a complement or specifier. This usage derives from the semantic term 'argument', which refers to a component of a proposition that must occur with a given predicate or relation. For example, the meaning of the verb *wash* has two semantic arguments (the washer and the washee) that correspond to the two syntactic arguments of the verb *wash* (the subject and the object) – as in *Alex washed the car*. The simplest examples of (syntactic) arguments are noun phrases, but prepositional phrases and subordinate clauses can also function as arguments. *See also* complement; specifier; subcategorization; valence; argument structure.

(argument)-marking preposition English prepositions serve two distinct functions. In some cases, a preposition is used to indicate the role its object NP plays within the semantic structure of some predicate. In other cases, the preposition itself functions as a predicate, and its object is one of its arguments. In this text, the first kind of use is called an 'argument-marking preposition,' or just a 'marking preposition.' An example is the preposition *on* in *They rely on us*. We call the second kind of preposition 'predicational,' illustrated by the use of *on* in *They are on the porch*.

argument structure In the theory developed in this text, the phrases that serve as arguments of a given head are listed in the value of a feature called ARGUMENT-STRUCTURE. This term is also sometimes used in a less technical sense to designate the semantic relations between a head [q.v.] and its arguments. *See also* argument.

aspect Many languages have special grammatical elements for locating in time the situations referred to. Among the temporal notions often expressed are whether situations are in process or completed and whether they occur repeatedly. These notions are often called 'aspect,' and words or affixes whose function is to express aspect are called 'aspectual markers.' *See also* perfective, progressive.

aspectual marker *See* aspect.

auxiliary This term refers to elements found in many languages that share the following semantic and syntactic characteristics: (i) they express such notions as time (past, present, future; continuation, completion), necessity, possibility, obligation, permission, negation, or questioning; and (ii) they occur in fixed positions in sentences, usually at or near the beginning or end. English auxiliaries are a special kind of verb. It is the auxiliary verb that is inverted with the subject in yes/no questions (e.g. *Did she fall?*) and that carries the negative suffix in contractions [q.v.] (e.g. *can't, won't*).

binding Pronouns are often said to be 'bound' by their antecedents [q.v.], and the term 'binding' is used to refer to the relationship between pronouns and their antecedents. The study of the principles governing pronominal anaphora [q.v.] is called 'binding theory.' *See also* reciprocal; reflexive.

case Certain words – particularly nouns and pronouns – can appear in different forms depending on their relationship to other elements in the sentence in which they appear. In English, for example, personal pronouns exhibit nominative case (e.g. *I, they*) or accusative case (e.g. *me, them*), depending on whether they are subjects or objects. In many languages, case is the primary way of indicating the roles of the noun phrases in the clause – that is, who did what to whom. Among the names of cases commonly used across languages are 'nominative,' 'accusative,' 'dative,' 'genitive,' 'ergative,' and 'absolutive.' *See also* inflection.

clause A clause is a phrase that includes a predicate and all of its arguments and modifiers. The term is sometimes limited to phrases headed by a verb.

common noun Nouns are often divided into two kinds: proper and common. Proper nouns are names, denoting individual things by themselves, and do not normally take determiners, complements, or modifiers. Common nouns stand for kinds of things and take determiners [q.v.], modifiers [q.v.], and (sometimes) complements [q.v.]. In English orthography, proper nouns are conventionally capitalized, but common nouns are not.

competence In a number of works, Chomsky has distinguished between the (largely unconscious) knowledge of language that people have and how they put that knowledge to use in speech and writing. The former is called 'competence'; the latter 'performance.' The study of linguistic competence abstracts away from such factors as memory limitations, disfluencies, and speech errors. Work in generative grammar [q.v.] has concentrated largely on developing models of competence, though there has been much discussion of how such models relate to what is known about performance.

complement The lexical head [q.v.] of a phrase characteristically selects which arguments co-occur with it, and some of these are referred to as 'complements.' When the phrase's head is a verb, the complements include what are traditionally called direct and indirect objects, as well as some prepositional phrases and subordinate clauses [q.v.]. Subjects – and determiners of NPs – are arguments that are not complements, but specifiers. Complements occur as sisters to the lexical head in syntactic structure and, in English, follow the head. For example, a verb such as *hit* takes one complement, namely, an NP (e.g. *hit the ball*); *rely* takes a PP complement (e.g. *rely on Sandy*). A preposition such as *in* also takes a single NP complement (e.g. *in the box*). Some nouns can also take complements, such as *picture* which takes an optional PP complement (e.g. *picture of Kim*). *See also* argument; specifier.

complementizer Words whose sole function is to introduce certain kinds of complements are known as 'complementizers.' This label is normally reserved for elements introducing clausal complements headed by a verb. In English, the use of *that* to introduce subordinate clauses [q.v.] (as in *It is remarkable that ice floats*) is the clearest example of a complementizer. In this text, the *to* that introduces VPs (as in *Everybody wants to win*) is also analyzed as a complementizer. *See also* complement.

conjunction (conjunct) Traditional grammarians use the term 'conjunction' to refer to words that connect two linguistic units in some way. In this text, we use it only for what are traditionally called 'coordinate conjunctions,' that is, words connecting elements that are, intuitively, of equal status. In English, the paradigmatic coordinate conjunctions are *and* and *or*, though *but* and *nor* can also function in this way. The individual words or phrases that have been conjoined can be referred to as conjuncts. *See also* coordination.

constituent The term 'constituent' is used by linguists as a near synonym for 'phrase,' meaning a part of a sentence that functions syntactically as a single unit. The difference is that 'constituent' is usually limited to phrases that are proper parts of larger expressions.

context-free grammar (CFG) A context-free grammar is a particular type of formal system that has proved very useful in the precise characterization of computer languages and also serves as the starting point for much work in syntactic theory. CFGs consist of an initial symbol [q.v.], a finite lexicon with words classified into grammatical categories [q.v.], and a finite collection of rules of the form A $\rightarrow \omega$, where A is a single symbol (representing a type of phrase), and ω is a finite string of lexical and/or phrasal categories.

contraction Reduced forms of words are sometimes combined with other words (that would typically occur adjacent to the reduced words) to form a new word; these are referred to as 'contractions.' English examples include combinations of a finite auxiliary [q.v.] verb with a reduced form of *not* to produce such words as *isn't* and *can't*, as well as simple contraction of finite auxiliaries, e.g. *They're arriving tomorrow* and *Kim's here.*

control Some complements have no overt specifier, but are interpreted as if they had subjects with the same reference as (i.e. coindexed with) another complement to the same predicate. For example, in both *Pat tries to be on time* and *We urged Pat to be on time* the individual Pat is understood as the person who is meant to be on time. This relationship (between two noun phrases, the second typically an unexpressed subject) is referred to as 'control'; in this case with the NP *Pat* being the 'controller' of the unexpressed subject of the infinitival phrase. Control predicates are not to be confused with raising [q.v.] predicates (like *continue* and *expect*), one of whose arguments actually is simultaneously an argument of another complement. A number of syntactic and semantic diagnostics distinguish these two types of predicates. *See also* raising.

coordination This term refers to the linking of two words or phrases of equivalent syntactic status (i.e. neither conjoined element is subordinate to the other). An example of a coordinated clause is *Kim cooked the food and Sandy washed the dishes*. *See also* conjunction.

copula This term is used by traditional grammarians to refer to verbs with little semantic content, which serve to link a subject with a predicate. In English, the copula is *be* and its various inflections.

coreference (or) coreferential Two referring expressions that refer to the same entity are called 'coreferential,' and the relationship between them is called 'coreference.' *See also* anaphora.

count noun Nouns are divided into two subclasses known as 'count' and 'mass' according to which determiners they can combine with. Count nouns co-occur with *a(n), several, few*, etc; mass nouns co-occur with *much* and can occur in the singular with no determiner. This distinction is correlated with a semantic distinction: mass nouns usually are used to refer to substances and count nouns to (sets of) entities. A portion of a substance (e.g. helium) is still the same substance, whereas a portion of an entitiy (e.g. a bicycle) is not usually an entity of the same kind. This correlation is not perfect, however, as evidenced by the mass noun *furniture* and by minimal pairs like *cabbage* (which can be either count or mass) vs. *lettuce* (which, for many speakers, must be mass).

declarative/interrogative/imperative These are terms used in the classification of sentence types. Declarative sentences are used to make a statement (or – equivalently for our purposes – to assert the truth of a proposition), as in *The mayor is reading a book.* Interrogative sentences are used to ask questions, as in *What are they doing?* Imperative sentences are used to give orders (or to issue 'directives'), as in *Read a book!*

defeasible A constraint is said to be 'defeasible' if it can be overridden – that is, if it allows for the existence of exceptions.

demonstrative Expressions used for referring through direct indication (often accompanied by pointing) are called 'demonstratives.' The best examples in English are *this, that, these*, and *those*.

descriptive grammar *See* prescriptive grammar.

determiner The sorts of specifiers [q.v.] that nouns take are called 'determiners.' These include articles (*a, the*, etc.), quantifiers [q.v.] (*some, every, many, two*, etc.), and possessives [q.v.] (*my, Kim's*, etc.). *See also* specifier.

discourse This term refers to units of language longer than a sentence – for example, dialogues or paragraphs.

distribution Linguists use this term to refer to the set of total environments – or contexts – in which some linguistic unit can occur.

ditransitive verb Verbs that take two NP objects are called 'ditransitive.' The standard example is *give*, in examples like *The teacher gave the students an exam. See also* intransitive verb; transitive verb; valence.

dummy Words that evidently have no meaning and serve only to fill some grammatical function are sometimes called 'dummies.' The paradigm examples in English are the *there* that occurs in existential sentences (e.g. *There is a seat available* and the *it* of extraposition [q.v.] (e.g. *It is fortunate that you have a seat*). Other terms used for these are 'expletives' and 'pleonastic' elements.

ellipsis Ellipsis means 'leaving out' or 'omitting': in certain contexts, parts of a sentence can be omitted if their interpretation is reconstructable. An example is the following case of verb phrase ellipsis, where the bracketed material may be left out:

(107) Pat won't taste the soup, but Chris will [taste the soup].

See also anaphora.

existential *be*/existential *there* English has a special construction for expressing existence, involving the dummy *there* as subject and forms of the verb *be*. These are called 'existential.' *See also* dummy.

extraposition Predicates that can take complementizer [q.v.] phrases (i.e. *that*-clauses or *to*-infinitive phrases) as subjects can also occur with a dummy *it* as subject and the CP as the last complement. The latter construction is called 'extraposition.' The term is also sometimes used for expressions in which a complement or modifier is separated from its head by intervening material, as in *A review appeared of Lee's latest book. See also* dummy.

feature structure A standard way of representing linguistic information is in terms of complexes of features and values. A feature can be thought of as a dimension along which different linguistic entities (such as words, phrases, or sentences) may differ, and values identify locations on those dimensions. A feature-value pair models a property of an expression that distinguishes it in a linguistically interesting way from some other expressions. For example, the feature PERSON in English has three possible values, namely '1st,' '2nd,' and '3rd.' It is a property of the word *you* that it is second person, and we represent that with the feature-value pair [PERSON 2nd]. A feature structure can thus be treated as a set of such feature-value pairs, in which no feature is paired with more than one value. Values of features in our theory may themselves be feature structures, or even lists of feature structures. A variant of this idea formalizes feature structures as directed graphs, where the arcs are labelled by feature names. Feature structure descriptions are standardly given in terms of matrices, listing feature names paired with their values, also known as 'feature specifications.' *See also* inheritance hierarchy; type.

finite-state grammar finite-state grammars are a type of formal system sometimes used to describe certain rather simple artificial languages. They are mathematically equivalent to regular expressions. *See also* context-free grammar; regular expression.

finite verb A finite verb is one that is marked for tense [q.v.] (present or past, in English).

gap *See* long-distance dependency.

gender The nouns in many languages divide into classes, differing in their patterns of inflection and agreement. In a number of languages (e.g. French and German), these noun classes are referred to as 'genders,' because nouns used to refer to males or females (of any species) are generally (though not invariably) grammatically masculine or feminine, respectively. In English, gender is marked grammatically only on third-person singular pronouns (*he, she,* and *it,*) and is virtually always predictable from the actual gender of the referent.

generative grammar Chomsky introduced this term based on the idea that a grammar is a formal system for generating the sentences of a language. The term is now used somewhat ambiguously, either to mean work in the Chomskyan tradition (fairly broadly conceived), or to mean an explicit system of rules, principles, and/or constraints that characterizes all and only the well-formed sentences of a language.

grammatical category Words and phrases can be classified in various ways, any of which can be called a 'grammatical category.' The term is usually used to refer to parts of speech [q.v.], such as noun, verb, etc., as well as types of phrases, such as noun phrase, verb phrase, and sentence. But it can also be used for less traditional classifications, such as the various types of lexemes [q.v.] presented in this text.

head The constituent [q.v.] of a phrase that is grammatically the most important constituent of that phrase is called the 'head' of the phrase. The head usually determines the category of the phrase, as well as many of its other properties. Thus noun phrases have nouns as heads, verb phrases have verbs as heads, etc. The term is used ambiguously to refer to the word that functions as head of the phrase and any subphrase containing that word. For example, in *the destruction of the city*, both *destruction* and *destruction of the city* can be called heads of the phrase.

idiom Some combinations of words have interpretations that are not fully predictable from the meanings that those same words have in other contexts. These are known as 'idioms.' English examples include *take advantage* to mean (roughly) 'exploit,' *keep tabs on* for 'monitor,' and *kick the bucket* for 'die.' Parts of an idiom are sometimes called 'idiom chunks,' e.g. *advantage* in *take advantage*. Idiom chunks play a central role in one of the diagnostics for distinguishing raising [q.v.] predicates from control [q.v.] predicates.

imperative *See* declarative

infinitive A certain class of nonfinite verbs is referred to as 'infinitives.' English infinitives are uninflected, but in many other languages, there are special infinitive affixes. Use of the term in English grammar is sometimes limited to verbs preceded by 'to,' but we also use it elsewhere, e.g. for verbs following modals [q.v.].

inflection Languages often add affixes to words to mark the syntactic function or relationships of the word in the sentence. For example, present tense verbs in English are usually inflected with the suffix *-s* when the subject is third person singular, and past tense verbs are inflected with *-ed*. The term may also be used to refer to the affix itself. Among the common uses of inflectional affixes are to indicate tense [q.v.], agreement [q.v.], number [q.v.] (singular or plural), and case [q.v.].

inheritance hierarchy The elements of some domains of study can naturally be organized into classes, based on shared properties. Some classes can be further subdivided into subclasses, with additional shared properties. The organization of such domains can be thought of as a hierarchy, with the most inclusive class (encompassing the entire domain) at the top, and the individual members of the domain at the bottom. In between are the various classes of interest, with classes above their subclasses. The properties associated with particular classes are inherited by their subclasses, and ultimately by their individual members. Domains organized in this way are referred to as 'inheritance hierarchies.' In linguistics, inheritance hierarchies have been used to organize lexical information, among other things. *See also* type.

initial symbol Grammars characterize languages. But languages can be conceived of in a variety of ways: as consisting of sentences, of phrases, of any expressions that can serve as stand-alone utterances, etc. A formal theory of grammar must include a specification of which of the expressions it characterizes are to be regarded as those that constitute the language. The initial symbols of a formal theory are precise statements of what is to count as an element of the language. In this book, the initial symbol definition specifies conditions that phrases must satisfy if they can stand alone, i.e. be used in isolation to communicate a message.

interrogative *See* declarative.

intonation This term is used to refer to the patterns of pitch in speech.

intransitive verb A verb that does not take any NP objects is referred to as 'intransitive.' A standard example in English is *die*. *See also* ditransitive verb; transitive verb; valence.

inversion Grammarians use this term fairly generally to refer to any construction in which two elements appear with their typical ordering reversed. In this text, it is used in particular for sentences (mostly questions) in which a finite auxiliary [q.v.] verb precedes the subject, as in *Are you sleeping?*

island constraint While long-distance dependencies can, in principle, stretch over arbitrary distances, there are some pairings of filler and gap positions that are not possible. For example, a gap inside a CP subject cannot, in general, be paired with a filler outside that CP, as in **Which candidate did [that I voted for __] bother you*. The constraints on possible filler-gap pairings are known as 'island constraints.' *See also* long-distance dependency.

Kleene star It is useful in the formal representation of languages (both natural and artificial) to allow certain patterns to be repeated any finite number of times (including zero). The standard notation for this is a superscripted asterisk, known as the 'Kleene star' (after the mathematician Stephen Kleene). For example, ab^*c is shorthand for the infinite set of strings: *ac, abc, abbc, abbbc,* ..... 'Kleene plus,' denoted by a superscripted plus sign, means any nonzero number of repetitions. *See also* regular expression.

lexeme The term 'word' is used ambiguously to mean either a particular form, such as *sees*, or a set of related forms such as *see, sees, saw, seen,* and *seeing*. To avoid this ambiguity, linguists sometimes posit an abstract entity called a 'lexeme' that gives rise to a family of related words. *See also* word.

lexicalism Lexicalism often refers to the doctrine that (1) the internal structure of words is independent of how words are put together to make sentences, and (2) words are the atoms of syntactic combination. For example, in a lexicalist theory, bound morphemes (inflectional affixes that must be attached to a word) are not treated as independent syntactic elements, as they are in most (non-lexicalist) versions of Transformational Grammar (see Appendix B). Theories of grammar also differ in their organization and in where they locate syntactic information. Some theories (e.g. Generalized Phrase Structure Grammar) have rich systems of rules and relatively impoverished lexical entries. Others (e.g. Categorial Grammar or Lexical Functional Grammar) have highly structured lexical entries and a small number of very general rule schemata. 'Lexicalism' is sometimes also used to distinguish the latter sort of theory.

lexicon The list of all words [q.v.] (or lexemes [q.v.]) of a language is called its 'lexicon.' The lexicon is the repository of all idiosyncratic information about particular words, including syntactic, semantic, and phonological information. In some theories of grammar, the lexicon can also contain a great deal more systematic information, organized by a type hierarchy [q.v.] and/or lexical rules.

long-distance dependency Certain constructions, including *wh*-questions, relative clauses, and topicalization, permit an element in one position to fill the grammatical role associated with another position. The two positions can be arbitrarily far apart. For example, in *Which student did the principal say that the teacher thought was responsible?* the NP *which student* functions as the subject of *was responsible*, although they are separated by most of the sentence. Such constructions are called 'long-distance dependencies' (LDDs). Elements like *which student* in the above example are called 'fillers,' and the position normally associated with the filler's role (in this case, immediately preceding *was responsible*) is called the 'gap.' *See also* island constraints.

main clause *See* root sentence.

modal The English verbs *can, could, may, might, must, shall, should, will,* and *would*, along with their negated forms (*can't*, etc.) are referred to as 'modals' or 'modal verbs.' They share the following properties: they function only as finite verbs [q.v.]; they exhibit auxiliary behavior (negation, inversion, contraction, and ellipsis); they take infinitival [q.v.] VP complements; and they show no agreement [q.v.] (i.e. no third-person singular *-s* suffix). Some other languages have similar syntactically distinctive classes of words expressing necessity, possibility, obligation, and permission; these are also known as modals. *See also* auxiliary.

mass noun *See* count noun.

modifier Most phrases consist of a head [q.v.], together with that head's arguments [q.v.]. Semantically, the head typically denotes either a situation or an individual, and the arguments denote essential associated entities. In addition, phrases may contain modifiers, which serve to place further restrictions on the situation or individual picked out by the phrase as a whole. Modifiers can take a wide variety of syntactic forms, including adjectives and adjective phrases, adverbs and adverbial phrases, prepositional phrases, and modifying clauses (such as relative clauses). *See also* argument structure.

morphology This term refers ambiguously to the study of word structure – how words are put together out of stems and affixes – or to word structure itself.

negation Languages include devices for reversing or contradicting the meaning or truth conditions of expressions, a semantic effect known as 'negation.' In English, the paradigmatic element expressing negation is the word *not*.

nominalization Nominalizations are nouns constructed out of words of other categories, usually through affixation. An example is *destruction*, derived from the verb *destroy* through the affixation of *-tion* (together with some other modifications). The term 'nominalization' is also used to refer to a process of turning verbs and adjectives into nouns.

number Most English nouns take different forms depending on whether they refer to single entities or multiple entities, e.g. *dog/dogs, man/men*. Similarly, present tense [q.v.] verbs with third-person subjects have different forms depending on whether the subjects are singular or plural. The term 'number' is used for such distinctions. Some languages also mark number on other types of words, e.g. adjectives may be marked for the number of the noun they modify. There are also languages that make finer number distinctions than just singular vs. plural, notably languages that have special 'dual' forms for expressions referring to sets with exactly two members.

orthography This term refers to written representations of language. For example, the plural of the noun *doe* and the present tense form of the verb *do* that goes with a third-person singular subject share the same orthography (namely, 'does'), although their pronunciations (and almost everything else about them) are different.

paradigm Certain words have multiple inflectional forms. For example, verbs in English typically change their form depending on whether

they are past or present tense, and their present-tense forms depend on the person and number of the subject. They also have a variety of nonfinite forms. The full array of inflectional forms of a word is known as its 'paradigm.' *See also* inflection.

parsing This term refers to the process of assigning a structural description to a sentence. Many computer systems designed to process natural language include components for parsing, and much psycholinguistic research is concerned with discovering what (if any) parsing strategies humans use in language comprehension.

part of speech This is the traditional term for lexical categories (i.e. categories of words), based on a combination of semantic and distributional criteria. Among the standard parts of speech are noun, verb, adjective, preposition, adverb, and conjunction. *See also* grammatical category.

participle Certain nonfinite verbs – usually ones that share some properties with adjectives – are referred to as 'participles.' English has three types of participles: present participles, which end in *-ing* and usually follow some form of *be*; past participles, which usually end in *-ed* or *-en* and follow some form of *have*; and passive participles, which look exactly like past participles but indicate the passive voice [q.v.]. The three participles of *eat* are illustrated in the following sentences:

a. Termites are eating the house.
b. Termites have eaten the house.
c. The house was eaten by termites.

passive Many languages have a construction in which the grammatical subject of a verb plays the same semantic role that the object plays when the verb in question appears elsewhere (in active [q.v.] forms). The term 'passive' is used to refer both to this construction, and to the verb whose arguments' roles are at issue. In English, the passive form of the verb looks exactly like the past participle and is usually preceded by a form of *be*; a prepositional phrase headed by *by* is also common, and is used for marking what would be the subject if the verb were not passive. An example is *The dog was attacked (by wombats)*. *See also* participle; voice.

perfective Many languages have special verb forms or constructions used to indicate that the event denoted by the verb is completed. These are referred to as 'perfective' (or just 'perfect') in aspect. The English perfective involves the combination of *have* with a past participle [q.v.], as in *The dog has eaten the cake*. *See also* aspect.

performance *See* competence.

person Many languages distinguish grammatically among expressions referring to the speaker, to the hearer, and to third parties. This is called the expression of 'person.' Reference to the speaker or a set including the speaker is called 'first person'; reference to (sets including) the adressee(s) is called 'second person'; and everything else is called 'third person.' Person distinctions are clearest with pronouns, since these are the most common forms used to refer to the speaker and hearer. But in some languages nouns also show person marking, and verbs and adjectives may then agree with the noun in person.

phonetics Phonetics is the study of the acoustic or articulatory properties of speech sounds.

phonology Phonology is the study of the sound systems of languages, i.e. the systematic grammatical patterns in the distribution [q.v.] of speech sounds.

possessive Many languages have grammatical mechanisms for indicating a relation of possession between the referents of two NPs. When one noun or NP is marked as the possessor of another, this marking is referred to as the 'possessive.' In English, the possessive is marked by *'s* attached at the end of the noun phrase functioning as the 'possessor.'

pragmatics The information conveyed by a linguistic expression in a particular instance of use is typically much more than just its literal (or 'linguistic') meaning. The study of how linguistic meaning contributes more generally to communication is called (linguistic) 'pragmatics.'

predicational preposition *See* (argument)-marking preposition.

prescriptive grammar Much of traditional work in grammar is concerned with setting norms – that is, dictating that some usages are 'incorrect' and hence to be avoided. Modern linguists refer to this as 'prescriptive grammar' (or just 'prescriptivism') and argue that it has no scientific basis. Instead, they advocate describing languages as they are ('descriptive grammar') and seeking scientific explanations for what they find.

productive A relationship between two linguistic forms is said to be 'productive' if it generalizes to novel forms. For example, the use of the suffix *-ing* to mark the present participle form of a verb is productive, since it gets applied to new coinages (as in *faxing*). Productivity is usually thought of as a matter of degree, with exceptionless relationships counting as more productive than those with exceptions.

progressive Special verb forms or constructions used to indicate that the event denoted by the verb is in progress are referred to as 'progressive' aspect. The English progressive involves combination of *be* with a present participle [q.v.], as in *The dog is eating the cake. see also* aspect.

proper noun *See* common noun.

quantifier Words or phrases used to restrict the number or amount of some referent are called 'quantifiers.' In English, these include such expressions as *all, each, some, many, few, two, more than half*, etc.

raising Some predicates take one more syntactic argument than semantic argument. In these cases, the extra syntactic argument functions as the subject of another complement and must obey any special co-occurrence restrictions imposed by that complement. These predicates are called 'raising' predicates. Raising is exemplified by the sentences *Pat continues to be on time* and *We expected Pat to be on time.* In these examples, *Pat*, though a syntactic argument of *seem* and *expect*, is semantically an argument only of *be on time.* A semantically empty dummy [q.v.] is possible with raising predicates, where it would not be possible in the corresponding positions with control predicates: *There continued/*tried to be demonstrations on campus. See also* control.

reciprocal A reciprocal pronoun is one that expresses a mutual relationship, such as the English pronoun *each other. See also* anaphora; reflexive.

referent This term is used for the entity (e.g. a person, object, notion, or situation) that is denoted by (a use of) a linguistic expression.

reflexive Many languages use special forms of pronouns when the subject and object refer to the same individual or individuals, e.g. the English forms ending in *-self* or *-selves.* These are called 'reflexives' or 'reflexive pronouns.' It is common for these pronouns also to be acceptable in some other environments, but those environments differ from language to language. *See also* anaphora; binding; reciprocals.

regular expression It is possible to characterize the well-formed expressions of some simple formal languages by means of a few abbreviatory devices. One system that has proved very useful in some contexts involves templates, made up of words and/or categories of words, together with parentheses (to indicate optionality), a disjunction symbol (to indicate alternatives), and Kleene star [q.v.] (and/or Kleene plus), to indicate arbitrary numbers of repetitions of a sequence. Such templates are called 'regular expressions.' *See also* finite-state grammar.

relative clause These are clauses that are used to modify nouns or noun phrases. A relative clause characteristically contains either a gap or a pronoun understood to be coreferential with the noun or NP they modify.

root sentence The traditional distinction between main clause and subordinate clause is motivated in part by the fact that certain phenomena seem to be restricted to main clauses, e.g. the inversion of finite auxiliaries [q.v.] in English questions (compare: *Will I win?* vs. *I wonder whether I will win*). Consequently, some version of this distinction has been maintained in most formal theories of grammar. The term 'root sentence' is sometimes used for main clauses, or, more technically, a phrase of category S that is not dominated by anything else. *See also* subordinate clause.

saturated In the system of grammar developed in this book, a saturated phrase is one that is specified as [SPR ⟨ *rangle*] (and [COMPS ⟨ *rangle*]). The intuition behind this is that headed phrases can be thought of as being generated bottom-up, starting from the lexical head, via a regime of cancelling elements from the head's valence specifications. For example, a verb combines first with however many complements are on its COMPS list to build a VP (a verbal phrase that is [COMPS ⟨ *rangle*] but [SPR ⟨*NPrangle*]); the resulting (SPR-)unsaturated phrase then combines with the subject NP to build a saturated phrase, i.e. an S.

semantics Semantics is the branch of linguistics concerned with the study of linguistic meaning. Linguists also use the locution 'the semantics of' some expression as a way of talking about the literal interpretation of that expression. Not all information that is conveyed by the utterance of an expression is part of its semantics, but the line between literal meaning and what is conveyed can be hard to draw. At a minimum, the semantics of a (declarative) sentence is usually taken to include a specification of the conditions under which it would be true. *See also* pragmatics.

specifier We use the term 'specifier' to cover subjects of clauses, determiners of noun phrases, and certain other constituents that are neither heads of the phrases they appear in nor complements to the heads. In English, the specifier of a phrase precedes its head [q.v.] and complements [q.v.]. *See also* determiner.

structural description (SD) In this text, phrases are modeled by phrase structures – trees consisting of subtrees whose nodes are fully specified feature structures. Phrase structures are informally described by means of 'structural descriptions,' which share the same tree configuration as the phrase structures themselves, but can leave some features underspecified. Likewise, a word is modeled by a word structure (tree), consisting of a fully specified feature structure that exhaustively dominates the word. Partial descriptions of word structures (lexical SDs) are also structural descriptions. *See also* feature structure.

subcategorization Lexical heads differ according to how many and what types of things they must combine with in order to make complete phrases. Each grammatical category [q.v.] (that is, part of speech [q.v.]) can be divided into subcategories, based on the valence, or combinatory potential, of the particular words. When we talk of the subcategorization of a verb (or other type of head), we mean the restrictions on which sorts of phrases it can combine with. Another common locution is to say that a given verb 'subcategorizes for' a certain phrase, meaning that it combines with such a phrase. *See also* valence

subordinate clause A subordinate clause is one that is dependent on, and usually a constituent [q.v.] of, another clause [q.v.]. An example of a subordinate clause is *when Kim went* in *Sandy came when Kim went*. *See also* root sentence.

tense Finite verbs come in different forms depending on the time they denote; these forms are called 'tenses.' English has present and past tense, exemplified by the present tense forms *walk* and *walks*, and by the past tense form *walked*. Some languages also have future tenses, but English uses other means (e.g. the modal [q.v.] *will*) to express future time. *See also* aspect; finite verb.

transitive verb Verbs that take an NP object are called 'transitive.' The term can also be used for other parts of speech that can take objects, e.g. prepositions. It is sometimes taken to encompass both simple transitive verbs (that is, those taking a single object) and ditransitive verbs. A standard example of a transitive verb is *hit*. *See also* ditransitive verb; intransitive verb; valence.

type Elements of any collection can be sorted into types, based on similarities of properties. In the theory presented in this text, linguistic entities (e.g. words and phrases) are described by means of feature structures [q.v.]. Particular features are appropriate only to certain types of entities, and constraints on possible feature-value pairings are also associated with some types. The types of linguistic entities are arranged in an inheritance hierarchy. The type hierarchy is especially important for capturing regularities in the lexicon. *See also* feature structure; inheritance hierarchy; lexicon.

unification The operation of unification merges two feature structure descriptions into a description that contains all the information in both. Two feature structure descriptions can unify so long as the information in them is consistent – that is, so long as there is no feature for which they have conflicting values. The unification simply consists of all of the features and values specified in the two feature structure descriptions. If description D_1 is satisfied by a family of feature structures F_1 and description D_2 is satisfied by a family of feature structures F_2, then the unification of D_1 and D_2 (written $D_1 \sqcup D_2$) is satisfied by all feature structures in the intersection of F_1 and F_2.

universal grammar Many linguists claim that there is a great deal in common among the grammars of the world's languages. Most advocates of this position believe that the commonalities exist because linguistic structure is largely determined by human biology. The term 'universal grammar' is used to mean three subtly different things: (i) what is common to the world's languages; (ii) linguists' representations of these commonalities; and (iii) the biological structures that are claimed to underlie the common features.

unsaturated *See* saturated.

valence This term is used (by analogy with the chemical term) to refer to the combinatoric potential of words and phrases. In this text, the VALENCE features are those that specify this kind of information. Specifically, the VALENCE features SPR and COMPS for the verb *put* specify that it requires a subject NP, an object NP, and a PP in order to form a clause. *See also* argument; argument structure; ditransitive verb; intransitive verb; transitive verb.

voice This term refers to the way the semantic arguments of the verb are expressed grammatically. The term is used in English primarily to distinguish active voice and passive voice, but some other languages have far richer systems of voice. *See also* active; passive.

word This term is used in many different ways. In this text, a word is a particular form whose lexical entry is derived from a lexeme by some inflectional rule. *See also* lexeme, lexicon.

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