Linguistic Inquiry Volume 10 Number 2 (Spring, 1979) 279–326.

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Complement Selection and the Lexicon*

0. Introduction

This article presents evidence that the combinatorial properties of predicates and their complements can be explained only in terms of two independent sets of cooccurrence restrictions. Subcategorization expresses restrictions between predicates and the syntactic category of their complements. Semantic selection expresses restrictions between predicates and the semantic type of their complements. Subcategorization and selection impose well-formedness conditions on different levels of representation: subcategorization on the syntactic level, and selection on the level of semantic representation.

It is well known that predicates do not occur indiscriminately with all complement types. *Wonder*, for example, takes questions but not *that*-complements; *think* allows *that*-complements but not questions.

(1) a. John wondered who Bill saw.
b. *John wondered that Bill saw someone.
c. John thought that Bill saw someone.
d. *John thought who Bill saw.

In discussions of complement selection (such as those in Bresnan (1972) and Chomsky (1973)), it has generally been assumed that the selection relationships between predicates and complements are stated over syntactic structure; put differently, that the distribution of complement types is a function of their syntactic form. For example, Bresnan proposed that selection for *that*- and *for-to*-clauses is implemented by subcategorization for the complementizers *that* and *for*.

Details aside, the general predictions of such a theory can be summarized as in (i) and (ii):

(i) Complements of the same syntactic form will be selected by the same predicates.

* This article is a revised version of Chapters III–VI of Grimshaw (1977). I would like to acknowledge the many contributions to the research presented here of Joan Bresnan, Elan Dresher, Ray Jackendoff, Alan Prince, Edwin Williams, those who attended the Lexical Representation Workshop at MIT in Fall 1977, and two *Linguistic Inquiry* reviewers.

(ii) Complements of distinct syntactic form may be selected by distinct (though not necessarily disjoint) sets of predicates.

It is the goal of this article to present and justify an alternative conception of complement selection. I will articulate and provide evidence for a theory in which complement selection is separated from subcategorization: while subcategorizational restrictions must be met at the syntactic level, complement selection is checked at the level of semantic representation. Predicates do not select for complements of a particular syntactic form, but rather for complements of a particular semantic type. Thus, for a predicate–complement combination to be well-formed, two criteria must be satisfied. The complement must belong to a syntactic category for which the predicate is subcategorized, and it must belong to a semantic type which the predicate selects.

The predictions of this theory with respect to complement selection, summarized in (iii) and (iv), differ transparently from those of the syntactic theory of complement selection.

(iii) Complements of the same semantic type will be selected by the same predicates.

(iv) Complements of different semantic types may be selected by different (though not necessarily disjoint) sets of predicates.

Wherever syntactic form and semantic type happen to match one-to-one, the two theories will, of course, be indistinguishable, but it is clear what kinds of cases would serve to choose between them. Suppose a complement sentence of a given syntactic form is associated by interpretation rules with two semantic types. The syntactic theory predicts that the complement will occur with the same range of predicates under either interpretation, whereas the semantic theory predicts that predicates might select the complement under one interpretation but not under the other. Conversely, if complements of different syntactic form are mapped onto the same semantic representation, the semantic theory predicts that the complements will be selected by the same set of predicates,[1] the syntactic theory that they may be selected by different sets of predicates.

Crucial cases can be found in the grammar of English. I will show that selection for interrogative and exclamatory complements, and for *that*-clauses, consistently displays characteristics which can be explained by positing semantic selection in conjunction with syntactic subcategorization, but not by a theory in which selection is implemented syntactically, whether by subcategorization or by some other means.

The next five sections are devoted to setting up the semantic theory of complement selection and exploring its consequences. Comparison between the syntactic and semantic treatments is postponed until section 6.

[1] Though where the complements differ in syntactic category they may not actually cooccur with the same set due to the effect of subcategorization.

1. Interrogative and Exclamatory Complements

In addition to the familiar interrogatives, there is another class of sentences with initial *wh*-phrases, termed *exclamations* in Elliott (1971; 1974).[2]

(2) a. What a fool he is!
b. What a large house he lives in!

Neither of these examples corresponds to a well-formed question; the configuration *what a (Adj) N* is not a possible interrogative structure:

(3) a. *What a fool is he?
b. *What a large house does he live in?

In embedded *wh*-complements, the contrast between (2) and (3) reappears as a difference in possible predicate–complement combinations. *What a (Adj) N* can introduce complements to *amazing* or *be surprised at*, but not complements to *ask* or *wonder*:

(4) a. It's amazing what a fool he is.
b. I'm surprised at what a large house he lives in.
(5) a. *John will ask what a fool he is.
b. *I wonder what a large house he lives in.

Thus, the distinction between matrix questions and exclamations is apparently preserved in embedding, with the configurations characteristic of exclamations occurring with some predicates but not all.

The distribution of *whether* is complementary to that of *what a (Adj) N*: it is found with *ask* and *wonder* but not with *amazing* or *be surprised at*:

(6) a. Fred will ask whether he is a fool.
b. I wonder whether he lives in a large house.
(7) a. *It's amazing whether he is a fool.
b. *I was surprised at whether he lived in a large house.

Many predicates, such as *know* and *find out*, allow complements introduced by *whether* and by *what a (Adj) N*:

(8) a. John knows whether he is a fool.
b. John knows what a fool he is.
c. John found out whether he lives in a large house.
d. John found out what a large house he lives in.

The distribution of *what a (Adj) N* and *whether* suggests that *wh*-complements, like matrix *wh*-sentences, fall into two classes: exclamatives and interrogatives. *What a (Adj)*

[2] Other discussions of exclamations are contained in McCawley (1973) and Ross (1971). I will draw freely on these and on Elliott's work throughout this section.

N is limited to exclamatives, and *whether* to interrogatives. *Ask* and *wonder* select interrogatives, *amazing* and *be surprised at* select exclamatives, and *know* and *find out* select both.

In the examples considered so far, the exclamative and interrogative complements differ in overt ways from one another, but this is not always the case. The complements in (9) must be exclamatives, yet they are identical in form to the interrogative complements in (10):[3]

(9) a. It's amazing how tall John is.
b. I'm surprised at how fast John can run.
(10) a. Fred will ask how tall John is.
b. Fred is wondering how fast John can run.

Ambiguity between exclamatory and interrogative readings results when the complements in (9) and (10) are embedded under *know* and *find out*:

(11) a. Fred knows how tall John is.
b. Fred found out how fast John can run.

Under the exclamatory interpretation, John must be unusually tall in (11a), and run unusually fast in (11b). Under the interrogative reading, there is no implication that John's height or speed are extreme in any way. The difference between the two readings is comparable to that between (12) and (13):

(12) a. How tall John is!
b. How fast John can run!
(13) a. How tall is John?
b. How fast can John run?

While exclamatory complements permit modification of the *wh*-phrase by an intensifier like *very*, this is not possible in indirect questions. Compare (14) with the ill-formed (15):

(14) a. It's amazing how very tall John is.
b. I'm surprised at how very fast John can run.
(15) a. *Fred will ask how very tall John is.
b. *Fred is wondering how very fast John can run.

[3] *Wh*-complements introduced by *who* and *what* also occur as both exclamations and questions:

(i) a. It's amazing $\begin{Bmatrix}\text{who}\\\text{what}\end{Bmatrix}$ John saw.
b. Fred asked $\begin{Bmatrix}\text{who}\\\text{what}\end{Bmatrix}$ John saw.

Who and *what* do not occur readily in matrix exclamations:

(ii) a. *Who John saw!
b. *What John saw!

The reason for this is not yet understood.

Thus, the addition of *very* to the examples in (11) should lead to disambiguation in favor of the exclamatory reading. As (16) shows, this is in fact the case.

(16) a. Fred knows how very tall John is.
b. Fred found out how very fast John can run.

Disambiguation in the other direction is also possible. As Elliott showed, exclamations are inconsistent with a state of ignorance on the part of the speaker; hence the contrast between (17a, b) and (18):

(17) a. I know what a fool Bill is.
b. John doesn't know what a fool Bill is.
(18) *I don't know what a fool Bill is.

Questions, on the other hand, are compatible with both speaker ignorance and speaker knowledge:

(19) I don't know whether Bill is a fool.

When the examples in (11) are modified in the relevant respects, only the question reading is found, and, of course, *very* cannot modify the adjective or adverb.

(20) a. I don't know how (*very) tall John is.
b. I haven't found out how (*very) fast John can run.

Thus, the complements to *know* and *find out* are ambiguous when the complement has a form that is common to both questions and exclamations; this supports the claim that *know* and *find out* take both interrogative and exclamative complements.

Exclamatory and interrogative complements are a crucial case of exactly the kind mentioned in the introduction. They do not differ in syntactic form in any systematic way; both are derived by *Wh* Fronting, and at the surface are composed of a *wh*-phrase followed by a clause in which there is a "gap":

(21) a. It's amazing $_{\bar{S}}$[what a fool $_{S}$[he is ____]]
b. I'm surprised at $_{\bar{S}}$[what a big house $_{S}$[he lives in ____]]

The *wh*-phrase in exclamations can be an NP (as in (4)), an AdjP or AdvP (as in (9)), or a PP (as in (22)).

(22) It's amazing in what a big house he lives.

Thus, the differences between exclamatory and interrogative complements do not seem to call for syntactic description—all the available evidence indicates that the two complement types have the same constituent structure, and are derived by the same rules. Indeed, in many cases, the two types are completely identical in form.

Despite their structural identity, exclamatory and interrogative complements have radically different semantic properties. A general picture of the differences between them can be constructed, borrowing from Bresnan (1972) the notion of "indeterminacy".

Interrogatives are characterized by indeterminacy in the value of the variable represented by the *wh*-word. Thus, in (23), the value of x (where x is John's height) is indeterminate:

(23) a. How tall is John?

b. Bill {wondered / asked} how tall John was.

The requirement of indeterminacy explains the ill-formedness of interrogatives like (15), in which the value of *wh* is made determinate by the presence of *very*, and the conditions of well-formedness for interrogatives are destroyed.

Exclamatives, in contrast, require determinacy on the part of the *wh*-variable. In (24), John's height is determinate:

(24) a. How tall John is!

b. {It's amazing / Bill was surprised at} how tall John is.

(In addition, the value of *wh* must be in some sense extreme—John must be of extreme, not average, height. This is presumably because it is inappropriate to exclaim over the norm.) Modification by *very* thus does not affect the well-formedness of the exclamations in (14) and (24).

This distinction explains many of the differences between exclamatory and interrogative complements that have been attested in the literature. Ross (1971) observed the generalization exemplified in (25) and (26):

(25) a. John {asked / wondered} who, Tom or Harry, had gone to the movies.

b. {John was surprised at / It's amazing} who, (namely) Tom and Harry, had gone to the movies.

(26) a. *John {asked / wondered} who, (namely) Tom and Harry, had gone to the movies.

b. *{John was surprised at / It's amazing} who, Tom or Harry, had gone to the movies.

The *wh*-word in an interrogative may take an appositive disjunction only; in an exclamatory complement, the *wh*-word takes an appositive conjunction only.[4]

These facts follow from the determinacy/indeterminacy distinction. In (25a), the interrogative complement meets the indeterminacy requirement—although the two possible values of *wh* are specified, the *actual* value of *wh* is not. The choice between Tom

[4] A *Linguistic Inquiry* reviewer has pointed out to me that (26b) is well-formed under a *namely* reading, where it is known that either Tom or Harry went to the movies, and the subject of the exclamation is the fact that it was either one (no matter which) that went.

and Harry is not determinate. In the interrogative in (26a), the value of *wh* is fully specified, and the indeterminacy requirement is not met. The exclamatory complement in (25b) is well-formed because the conjunction *Tom and Harry* is consistent with *wh* being determinate. (26b) is anomalous because, as in (25a), the choice between the two disjuncts is indeterminate, and so the determinacy requirement for exclamations is not met.

The semantic difference between interrogative and exclamatory complements is illuminated further by the incompatibility of exclamations with contexts of speaker ignorance, illustrated by (17) and (18). Elliott observed that the ill-formedness of these examples is reminiscent of a prohibition against factive predicates in similar environments, noted by Kiparsky and Kiparsky (1970).

(27) a. *I don't realize that he has gone away.
b. *I have no inkling that a surprise is in store for me.

The examples in (27) are anomalous because in using a factive predicate the speaker implies that he or she knows that the proposition expressed by the complement is true. *I don't realize* and *I have no inkling* deny that the speaker has this knowledge, hence the anomaly. As Kiparsky and Kiparsky put it: "The top sentence denies what the complement presupposes."

The incompatibility between exclamatory complements and contexts of this kind can be explained if exclamations are analyzed as inherently "factive"—if the propositional content of an exclamation (that Bill is a fool in (17), for example) is always presupposed.[5] Then (17) is explained in the same way as (27): the exclamatory complement in (17) carries the presupposition that Bill is in fact a fool. To use the complement appropriately, the speaker must therefore know that Bill is a fool, but *I don't know* contradicts this. Of course, interrogatives are perfectly consistent with this context; since interrogatives have the indeterminacy property, they could not possibly carry the presupposition associated with exclamations.

These systematic differences in semantics between indirect questions and exclamations warrant the conclusion that they belong to two different semantic types: the type of "interrogative" with the property of indeterminacy, and the type of "exclamative" with the property of determinacy.

We can now evaluate the implications of interrogative and exclamatory complements for complement selection. Since they do not have distinct syntactic representations, the syntactic theory predicts that they will occur with the same set of predicates. This prediction is falsified by the existence of *wonder, ask, amazing,* and *be surprised at* (and many other predicates too, of course) which select one kind of complement but not the other.

However, exclamatory and interrogative complements do belong to different semantic types. The semantic theory of complement selection therefore predicts that

[5] See the appendix for a more detailed discussion.

predicates may select either of the two complement types, or both (or neither). This is exactly the observed state of affairs. *Ask* and *wonder* select the semantic type "interrogative", *amazing* and *be surprised at* select the semantic type "exclamative", and *know* and *find out* select both types. This investigation thus provides some quite strong initial support for the semantic theory of selection.

2. Complement Selection and Semantic Types

At this point, I want to consider more precisely how complement selection might be treated within the semantic component. To begin with, I will assume two rules of interpretation, both applying at surface structure. These rules will interpret clauses with initial *wh*-phrases as either interrogative or exclamative.[6]

Two variables ranging over semantic types can be set up: Q, ranging over interrogatives, and E, ranging over exclamatives. Thus, a *wh*-complement interpreted as a question will be an instance of Q, while a complement interpreted as an exclamation will be an instance of E. Restrictions on complement selection can now be stated using these variables. Each predicate in the lexicon will have associated with it a *semantic frame*, analogous to the syntactic frames of subcategorization. The frame consists of a specification of the semantic types which the predicate selects.

When a complex sentence is interpreted, the interpretation of the complement is checked against the semantic frame of the predicate. If the complement is an instance of a variable in the semantic frame of the predicate, the sentence is well-formed with respect to complement selection. Otherwise, the sentence is anomalous.

The distribution of interrogative and exclamatory complements established in section 1 can be described simply in these terms. The verbs *wonder* and *ask* have the frame [___ Q], *amazing* and *be surprised at* have [___ E], and *find out* and *know*, which take both questions and exclamations, have [___ $\begin{Bmatrix} E \\ Q \end{Bmatrix}$]. Consider again the pair of examples in (28).

(28) a. John wondered what a fool Bill was.
b. John wondered whether Bill had left.

In (28a), the *wh*-complement can only be interpreted as an exclamation, an instance of E. The frame of the predicate *wonder* contains only Q, and not E, and the sentence is therefore ill-formed. On the other hand, (28b) is well-formed, because the *wh*-complement is an instance of Q, which does appear in the frame for *wonder*.

The disambiguation of *wh*-complements follows the same lines:

(29) It's amazing how tall John is.
(30) I'll ask how tall John is.

[6] The exact nature of the interpretation assigned is, as far as I can tell, irrelevant to the point at hand. A model theoretic semantics for English questions is given in Karttunen (1977). I leave open the question of exactly how *whether* is to be limited to interrogatives and *what a* to exclamatives.

The complement *how tall John is* can be interpreted either as a question, an instance of Q, or as an exclamation, an instance of E. If in (29) it is interpreted as a question, the sentence will be ill-formed, because *amazing* does not select Q—does not have Q in its semantic frame. When the complement is interpreted as an exclamation, the sentence is well-formed: *amazing* does select E. The case of (30) is exactly the converse; thus, *how tall John is* has only an exclamatory reading in (29), and only an interrogative reading in (30).

The system extends readily to *that*-complements: tensed clauses introduced by *that* (or with the subject NP in initial position in case *that* has been deleted) will receive uniform interpretations, as propositions, let us say. A third complement variable P can be added, and predicates can select for P just as for Q and E. The verb *think,* which takes *that*-clauses only (cf. (1)), will be associated with the frame [____ P]; *know* and *find out*, taking all three complement types, will have P, Q, and E in their frames.

The central features of the theory should now be clear. Since the semantic frames which implement selection relationships mention only semantic types, the syntactic form of a complement is relevant to selection only insofar as syntactic structure constitutes the input to rules of interpretation. The fact that questions, exclamations, and *that*-clauses occur with different sets of predicates follows from the fact that they have different semantic properties, and not from anything that might be said about their syntax.

This is not to say, of course, that the syntactic form of a complement is entirely irrelevant to the well-formedness of predicate–complement combinations, just that it is irrelevant to those aspects of well-formedness which complement selection captures. Any syntactically ill-formed combinations which are generated by the base rules are ruled out by subcategorization, which expresses cooccurrence restrictions on predicates in terms of syntactic categories (NP, $\bar{S}$, PP, etc.) rather than semantic types (P, Q, E, etc.). I will assume here a rather restrictive theory of subcategorization, essentially that of Chomsky (1965), in which predicates can be subcategorized for sister phrasal constituents. Subcategorization frames specify the optionality (indicated by parentheses) or obligatoriness of phrases for which the predicate is subcategorized. Thus, *leave*, which occurs both transitively and intransitively (*John left, John left the party*), will have the frame in (31):

(31) *leave* [____ (NP)]

Hit, on the other hand, has the frame in (32), since it occurs only transitively (*John hit the ball, *John hit*).

(32) *hit* [____ NP]

Fleshing out the lexical representations of the predicates discussed so far, we can see that all of them are subcategorized for $\bar{S}$: *that*-clauses, exclamations, and questions are all instances of $\bar{S}$. Thus, the relevant aspects of the distribution of *think, amazing,*

wonder, and *find out* are expressed by the lexical entries in (33):

(33) a. *think* [___ $\bar{S}$], [___ P]

b. *amazing* [___ $\bar{S}$], [___ $\left\{\begin{matrix}P\\E\end{matrix}\right\}$]

c. *wonder* [___ $\bar{S}$], [___ Q]

d. *find out* [___ $\bar{S}$], [___ $\left\{\begin{matrix}P\\Q\\E\end{matrix}\right\}$]

To sum up, there are two kinds of cooccurrence frames in the lexicon. Selection is checked at the level of semantic representation, and involves matching semantic types with semantic frames. Subcategorization is checked at the syntactic level, and involves matching syntactic categories with subcategorization frames.[7]

3. Selection, Subcategorization, and Null Complement Anaphora

In this section, I will show that subcategorization and selection, as defined in section 2, interact in a way that explains certain central properties of a kind of ellipsis termed null complement anaphora by Hankamer and Sag (1976).

Consider the following discourses:

(34) a. Question: Did John leave?
Response: I don't know.

b. Question: Who left?
Response: I don't know.

How are the responses to be interpreted? Their interpretation seems to be the same as that of the examples in (35), where a *wh*-complement is present:

(35) a. I don't know whether John left.

b. I don't know who left.

In general, we find that predicates which do not allow indirect questions as overt complements cannot be used as *know* was above; the discourses below are thus ill-formed, just like the sentences in (37).[8]

(36) Question: Did John leave?
Who left?

[7] It is irrelevant whether subcategorization is checked at deep structure, or, exploiting traces, at surface structure.

[8] The combination of *Did John leave?* with *It can't be true* may be a well-formed discourse. Cf. the discussion of example (52) below.

Response: *It's too bad.
*I agree.
*I'm flabbergasted.
*I'm surprised.
*It can't be true.

(37) *It's too bad {whether John left / who left}.

*I agree {whether John left / who left}.

*I'm flabbergasted {whether John left / who left}.

*I'm surprised {whether John left / who left}.

*It can't be true {whether John left / who left}.

All the predicates in (36) can, however, be used in responses to a statement, as the discourses given in (38) demonstrate.

(38) Statement: John is telling lies again.
Response: It's too bad.
I agree.
I'm flabbergasted.
I'm surprised.
It can't be true.

In short, the restrictions imposed by a predicate on the semantic type of its overt complements carry over fully to null complement phenomena.

Of course, meeting the demands of selection is necessary but not sufficient for well-formed discourse. In particular, a discourse which violates pragmatic conditions on responses will be ill-formed even if the response itself is interpreted in a way that is consistent with selection. In such a case, a discourse involving null complement anaphora will, we expect, have more or less the same status as the corresponding discourse with an overt complement. For example, the discourse in (39) is decidedly odd, although selection is not violated:

(39) Question: Has the Mayor resigned?
Response: I know.

Equally odd, however, is (40), where an overt complement appears:

(40) Question: Has the Mayor resigned?
Response: I know whether the Mayor has resigned.

In both (39) and (40), the speaker asserts that he or she has the requisite knowledge, but does not disclose it to the questioner; this seems to be the crucial flaw. Note that the responses can be elaborated in such a way as to yield the information sought for, thus redeeming the discourse.

(41) Question: Has the Mayor resigned?
Response: I know: he handed in his resignation at noon.
I know whether the Mayor has resigned: he handed in his resignation at noon.

While complement selection by itself does not guarantee well-formedness, the prediction is that no pragmatic considerations will rescue a discourse in which selection is not met.

A rather different case in which selection is insufficient for well-formedness is illustrated by (42):

(42) Question: Has the Mayor resigned?
Who resigned?
What did the Mayor decide to do?

a. Response: I don't know.
John wouldn't tell me.
Ask Bill.
I haven't found out yet.
Guess.
I'm not sure.
It's obvious.
It's none of your business.
They haven't said yet.

b. Response: *John wouldn't divulge.
*John wouldn't disclose.
*I haven't discovered yet.
*I haven't figured out yet.
*Predict.
*We haven't learned yet.
*It's apparent.
*They haven't announced yet.
*They haven't reported yet.

The ill-formedness of the examples in (42b) cannot be attributed to failure in complement selection, for the corresponding sentences in (43) are all well-formed:

(43) a. John wouldn't divulge { whether the Mayor has resigned / who resigned / what the Mayor decided to do }.

b. John wouldn't disclose "

c.	I haven't discovered yet	"
d.	I haven't figured out yet	"
e.	Predict	"
f.	We haven't learned yet	"
g.	They haven't announced yet	"
h.	They haven't reported yet	"

Apparently the difference between the two classes of verbs lies solely in whether or not they allow discourse-governed control of their complements; that is, whether or not they take complements which are syntactically and phonologically unrealized but in some sense semantically "filled". Given that the lists in (42a) and (42b) contain predicates which are otherwise remarkably similar in their semantic and syntactic properties (e.g. *find out* and *discover, guess* and *predict*, etc.) but which nevertheless differ in respect to occurrence with null complements, it is very unlikely that the difference between the predicates allowing null complements and the predicates which require filled complements is predictable.[9] Rather, it seems to be an idiosyncratic property which must be stipulated for each predicate.

We have already seen that it is not only indirect question predicates that allow discourse-controlled null complements; the examples in (38) showed null complements corresponding to *that*-complements. These examples are interpreted as in (44), where the *that*-complement has been filled in.

(44)	a.	It's too bad	that John is telling lies again.
	b.	I agree	"
	c.	I'm flabbergasted	"
	d.	I'm surprised	"
	e.	It can't be true	"

As we would expect, predicates which take only indirect questions as complements cannot occur as responses in a discourse like (45) with interpretation like the responses in (46).

(45) John is telling lies again.
*I inquired.
*Ask Bill.

(46) *I inquired that John is telling lies again.
*Ask Bill that John is telling lies again.

Just as in the case of *wh*-complement predicates, not all predicates which take *that*-

[9] The predicates which take null complements are not the same as those which occur parenthetically; *discover, believe,* and *think* do not take null complements but appear as parentheticals.

(i) John, {I discovered / I believe / I think}, has left.

complements permit null complements controlled by statements. Contrast the examples in (47) with those in (38):

(47) Statement: John is telling lies again.
Response: *I don't believe.
*They claim.
*I think.

Many predicates of course take both indirect questions and *that*-complements. Interestingly, it turns out that these predicates behave uniformly with respect to the two complement types: if a predicate allows a null complement controlled by a question, then it also allows a null complement controlled by a statement, and vice versa. Compare the lists of responses in (48a) and (48b) with those in (42a) and (42b):

(48) Statement: Guess what, John is telling lies again.
a. Response: Oh, I didn't know.
Oh, Bill didn't tell me.
Yeah, I'd already found out.
Yeah, I'd guessed.
Oh, I wasn't sure before.
It's obvious.
It's none of your business.
Why didn't they say?
b. Response: *Oh, John wouldn't divulge.
*Oh, John wouldn't disclose.
*Yeah, I'd already discovered.
*Yeah, I'd already figured out.
*Yeah, I'd predicted.
*Oh, I hadn't learned.
*It's apparent.
*Why didn't they announce?
*Why didn't they report?

Thus, if a predicate allows null complement anaphora at all, it allows it for the full range of complement types that it selects. I will refer to this property of predicates as *lexical uniformity*.

This discussion has isolated three properties of null complements which an analysis of null complement anaphora together with a theory of complement selection can be expected to illuminate. (i) The interpretation of null complements clearly reflects restrictions on selection of overt complements. The fact that a null complement to *know* can be interpreted as a question or as a proposition is a reflex of the fact that *know* selects both questions and propositions. (ii) There is some arbitrariness as to whether

or not a given predicate allows null complement anaphora at all. (iii) Predicates display lexical uniformity with respect to null complement anaphora.

The generalizations about null complement anaphora established above are explained by the semantic theory of complement selection. Let us posit an interpretation rule for null complements, a copying rule. Williams (1977) proposes that rules of discourse grammar (such as VP Deletion and the Null Complement Rule) apply at the level of logical form, that is, to the output of the rules of sentence grammar. Thus, a sentence like *I don't know* in (34) will first be interpreted by rules of sentence grammar, being given a semantic representation in which the complement position of *know* is empty.[10] The Null Complement Rule will then apply, and copy the representation of the controlling sentence into the complement position for *know*.[11] This is in accordance with Williams's suggestion that logical form is the only level of representation to which discourse rules have access. Note that since *know* always requires a complement of some kind at the semantic level, the sentence *I don't know* will be ill-formed if no controller is available for the complement position.

With this view of the operation of the Null Complement Rule in mind, recall that only null complements to predicates taking *that*-clauses can be interpreted as if a *that*-clause were present, and that only null complements to predicates taking questions can be interpreted as if a question were present. To explain this generalization, we need only assume that at the stage where selection takes place, the necessary information about the interpretation of the null complement is available. One obvious way to obtain this result is to match semantic frames with complements after discourse rules like the Null Complement Rule have applied.

The discourses in (49) and (50) will serve as illustrations:

(49) Question: Did John leave?
Response: I don't know.

(50) Question: Did John leave?
Response: *I agree.

Recall that the null complement to *know* can be interpreted as a question and controlled by *Did John leave?* but the null complement to *agree* cannot be. The sentence *Did John leave?* will be interpreted as a question. *I don't know* and *I agree* will be interpreted as statements, with empty complement slots in semantic representation. The Null Complement Rule will copy the semantic representation of *Did John leave?* into these empty positions. Now the matching of complement type and predicate proceeds exactly as it does for nonnull complements—the complement of *agree* and the complement of *know* are both instances of Q, but, while Q does appear in the semantic frame of *know*, it

[10] Alternatively, the complement position may be occupied by a variable for which the representation of the controller is later substituted.

[11] Nothing hinges on the question of whether null complement anaphora really involves a control relationship, as assumed here, or whether the content of the missing complement is simply inferred from the discourse.

does not appear in the frame of *agree*:

(51) a. I know whether John left.
b. *I agree whether John left.

Thus, a question interpretation for the null complement will lead to a mismatch of frame and complement type in (50) just as it does in (51b). No such mismatch is found in the case of *know*, and hence interpreting the complement of *know* as a question gives a well-formed result.

Consideration of examples like (52) leads to a more exact characterization of the Null Complement Rule.[12]

(52) Question: Did John leave?
Response: It's possible.

As the theory of complement selection predicts, the response in (52) is interpreted like (53), where the complement to *possible* is a *that*-clause, and not like (54):

(53) It's possible that John left.
(54) *It's possible whether John left.

The response could not be interpreted like (54) because *possible* does not select Q; (53) is thus the only option.

However, the Null Complement Rule appears to be operating here in a new way: instead of copying the question, it is copying the corresponding statement. The most plausible hypothesis about the Null Complement Rule is that it copies well-formed sentential formulae of logical form: sentential expressions composed of a predicate and its arguments, with or without any associated sentential operators. The rule must be limited to copying sentential expressions; neither predicates by themselves nor terms alone can be copied:

[12] (52) and some earlier examples illustrate cases of null complement anaphora in which the pronoun *it* occupies the subject position in the response. According to the analysis proposed here, responses like these have the structure in (i):

(i) $_{S}[_{NP}$[it] $_{VP}$[be $_{AP}$[possible]]]

The Null Complement Rule interprets the null complement of *possible*, and selection takes place in the normal way. The *it* subject and the complement cannot be related here by an Extraposition transformation (as in Rosenbaum (1967)), for no sentential complement is present during the derivation. Thus, an interpretive rule must be posited to relate *it* and the complement position in (i), and this rule will automatically apply where there is an overt sentential complement:

(ii) It is possible that John left.

An interpretive account of Extraposition is not implausible, given that Extraposition is structure-preserving (Emonds (1976)); the "extraposed" complements appear in $\bar{S}$ positions provided independently by the base rules. Furthermore, with subject-raising predicates like *seem*, an interpretive treatment would solve the problem posed by the lack of a well-formed source for the "extraposed" versions:

(iii) a. *That John left seems.
b. It seems that John left.

Jackendoff (1977) and Bresnan (to appear) propose interpretive accounts of Extraposition.

(55) Question: Did John leave?
Response: *No, but Bill.
No, but Bill left.

(56) Question: Did John buy a book?
Response: *No, sold a book.
*No, John sold.
No, John sold a book.

In (49), what is copied is the expression in (57), consisting of the predicate *leave* with its argument *John*, and the question operator *?* of Chomsky (1973).

(57) ? (leave (John))

However, there is a subpart of this expression which also satisfies the requirements: *leave (John)* is itself a well-formed sentential formula and can therefore be copied by the Null Complement Rule. This provides the appropriate representation for the response in (52):

(58) possible (leave (John))

This copying of subformulae leads to a good result in (52) but not in (50), where the response cannot be interpreted as though *agree* had a *that*-complement. The ill-formedness of (50) under this interpretation seems to stem from conditions on question–answer pairs. The fact that the discourse in (59), which involves no null complement anaphora, is similarly ill-formed, supports this conclusion.

(59) Question: Did John leave?
Response: *I agree that he did.

Yes–no questions can be answered by *yes, no*, or an evaluation of probability; hence, *possible, likely,* and *doubtful* can all be used in responses. But a statement of agreement does not constitute an appropriate answer to a yes–no question. Although the discourse principle at work here remains to be specified precisely, it is clear that when the null complement in the discourse (50) is interpreted like a *that*-clause, the discourse is ill-formed for reasons quite independent of complement selection and null complement anaphora.

Wherever the rule copies an expression containing a variable, the operator which binds the variable must also be copied. Thus, in (60) what is copied is the expression in (61).

(60) Question: Who left?
Response: I don't know.

(61) wh$x$ (leave (x))

Contrast (60) with (62):

(62) Question: Who left?
Response: *It's possible.

If the Null Complement Rule copies the entire expression (61), the semantic frame of *possible* will not be matched because *possible* does not select Q. If the rule copies the open sentential formula (63), then the representation of the response, schematized in (64), will contain an unbound variable, and will be ruled ill-formed by the general convention on variable binding.[13]

(63) leave (x)
(64) possible (leave (x))

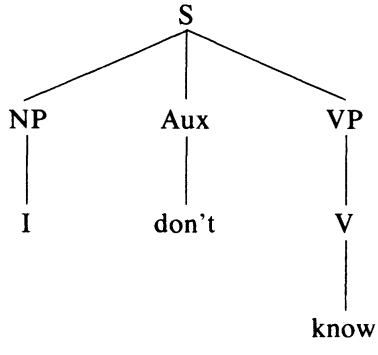
I conclude that the Null Complement Rule copies any sentential formula; among the formulae that can be copied are subformulae that are themselves sentential. Complement selection guarantees the well-formedness of the resulting predicate–complement combinations, and independent conditions on discourse and on the form of semantic representations rule out any deviant discourses which slip through the net of selection.

It is a consequence of this approach that selection for null and overt complements will have the same characteristics. It would be impossible to describe the behavior of a predicate which allowed overt complements of only one semantic type—propositions, for instance—but allowed as null complements either questions or propositions.

The next problem is to find a way to distinguish between predicates which occur with null complements (such as *find out* and *know*) and predicates which do not (such as *discover* and *figure out*). The distinction between them is evidently a syntactic, not a semantic, one. All four predicates, like *know*, must have complements at the final stage of semantic representation.

Null complements can be analyzed as being literally null syntactically—having no syntactic realization at all.[14] The structure of a response like *I don't know* is simply that in (65):

(65)



[13] I assume that it is not necessary to stipulate that the Null Complement Rule copy only closed formulae, since the result of copying an open formula will always be ruled out independently by this convention.

[14] See Shopen (1972) for interpretive analyses of ellipsis. This particular analysis of null complement anaphora was suggested in Williams (1977). A possible alternative is to treat null complements as empty $\bar{S}$s, or $\bar{S}$s dominating articulated deltas; Wasow (1972) and Williams (1977) contain examples of proposals of this kind for other discourse rules. An empty node analysis would require that parentheses in subcategorization be interpreted as indicating optionality of lexical insertion; thus, the structure of *John left* would have to be

The difference between *find out* and *know* on the one hand, and *figure out* and *discover* on the other, can now be described straightforwardly: *find out* and *know* are subcategorized for an optional $\bar{S}$ complement; *figure out* and *discover* for an obligatory $\bar{S}$.

(66) a. *find out* [___ ($\bar{S}$)]
b. *know* [___ ($\bar{S}$)]
c. *figure out* [___ $\bar{S}$]
d. *discover* [___ $\bar{S}$]

One question remains: why do predicates have the property of lexical uniformity? This is already explained: the only distinction subcategorization makes is between optional and obligatory $\bar{S}$ complements, and the only distinction the semantic selection mechanism makes is between instances of P and instances of Q. A predicate which selects both P and Q can be subcategorized either for $\bar{S}$ or for ($\bar{S}$). If the former, it must take overt complements of both kinds, and no null complements at all. If the latter, it must take null complements of both kinds. No other options are available.

This analysis of null complement anaphora, together with the theory of the lexicon presented here, explains why complement selection is uniform across null and overt complements, allows a simple account of the difference between *find out* and *discover*, and has as a consequence the fact that predicates display lexical uniformity with respect to null complement anaphora. Some further consequences of adopting this account will be explored in section 5.

4. Noun Phrase Complements

4.1. Concealed Questions and Exclamations

Baker (1968) pointed out that English has a noun phrase construction which is associated with an interpretation very much like that of indirect questions. Baker illustrated the construction with the examples in (67), and gave for them the *wh*-question paraphrases in (68):

(67) (= Baker's (6.1–6.4))
a. James figured out the plane's arrival time.
b. John refused to tell the police the fellows who had been involved.
c. Susan found out the place where the meeting was to be held.
d. Fred tried to guess the amount of the stolen money.

(i) rather than (ii):

(i) $_{S}$[John $_{VP}$[left $_{NP}$[Δ]]]
(ii) $_{S}$[John $_{VP}$[left]]

This would seem to lead to proliferation of empty nodes. The descriptive options are maximally restricted by the analysis in which null complements have no syntactic realization (cf. note 27).

(68) (= Baker's (6.5–6.8))
a. James figured out what the plane's arrival time would be.
b. John refused to tell the police which fellows had been involved.
c. Susan found out where the meeting was to be held.
d. Fred tried to guess how much money had been stolen.

Baker gave two kinds of evidence in support of his claim that the examples in (67) should be analyzed as variants of the indirect question construction. First, this question-like use of noun phrases is found only with predicates which occur with *wh*-questions—a point which will be taken up in detail below. Second, he noted that verbs like *tell, guess,* and *hear* impose a special interpretation on their complements when the complements are indirect questions, and that this interpretation is found also with "concealed questions", i.e. noun phrase complements like those in (67). This can be seen in (70) and (71):

(69) (= Baker's (6.18))
John told us that Betty had vanished, but he turned out to be mistaken.
(70) (= Baker's (6.24))
*John told us where Betty had gone, but he turned out to be mistaken.
(71) (= Baker's (6.27))
*John told us the place where Betty had gone, but he turned out to be mistaken.

(69) shows that *tell* can be nonfactive when it occurs with a *that*-complement; there is no requirement that the proposition expressed by the complement be true. With an indirect question complement it is required that what the subject said was true—that Betty did in fact go where John said she went. (70), in which this condition is violated, is ill-formed. Exactly the same holds for (71), where the complement to *tell* is a concealed question.

Elliott (1971) showed that in addition to noun phrases with interrogative interpretations, there are noun phrases with exclamative interpretations—concealed exclamations. The italicized noun phrases in (72), for example, are interpreted like the *wh*-complements in (73).

(72) a. It's amazing *the big car he bought.*
b. You'd be surprised at *the big cars he buys.*
c. You'd never believe *the fool he turned out to be.*
(73) a. It's amazing what a big car he bought.
b. You'd be surprised at what big cars he buys.
c. You'd never believe what a fool he turned out to be.

The interpretation of concealed questions and exclamations systematically parallels

the interpretation of the *wh*-forms.[15] Concealed questions display the property of indeterminacy associated with *wh*-questions, and concealed exclamations the determinacy characteristic of exclamatory complements. For example, compare (74) and (75).

(74) John asked the height of the building.
(75) John couldn't believe the height of the building.

(74) has only an interrogative interpretation, neutral with respect to the actual height of the building, but (75) has only an exclamatory interpretation, in which the building must be extremely high. The *wh* paraphrases of (74) and (75), given in (76) and (77), show the same distinction.

(76) John asked what height the building was.
(77) John couldn't believe what a height the building was.

Because concealed questions and exclamations are identical in syntactic form, with predicates like *find out* a noun phrase complement may be ambiguous between the two readings, just as a *wh*-complement may be (cf. (11)).

(78) John found out the height of the building.

The complement in (78) can be disambiguated in favor of an exclamatory reading by the addition of an intensifying adjective like *incredible*. Recall the similar effect of *very* in *wh*-complements.

(79) John found out the incredible height of the building.

Since *incredible,* like *very* in the examples cited earlier, is incompatible with an interrogative interpretation, (74) becomes ill-formed if *incredible* is inserted. (75), containing a concealed exclamation, remains well-formed:

(80) *John asked the incredible height of the building.
(81) John couldn't believe the incredible height of the building.

Concealed exclamations, like *wh*-exclamations, cannot occur in contexts of speaker ignorance. Thus, (82) has an interrogative interpretation only, and will not tolerate the presence of *incredible*.

(82) I don't know the (*incredible) height of the building.

Although concealed questions and exclamations are so close in interpretation to

[15] There may be some slight differences in interpretation between concealed questions and *wh*-questions. For instance, (i) may seem less natural than (ii). (These examples are due to Joan Bresnan.)

(i) I can't remember the kind of beer John drinks, if any.
(ii) I can't remember what kind of beer John drinks, if any.

For some dialects, these differences may affect the ability of concealed questions to control null complement anaphora in examples like (114) and (116) below.

wh-questions and exclamations, they diverge widely in their syntactic form. *Wh*-questions and exclamations are sentences, with the expected internal structure: NP Aux VP. Concealed questions are noun phrases.[16] Note that in all the examples cited so far they occur in NP positions.[17] (83) is an example of a concealed question in subject position; it can be paraphrased by (84), in which the related *wh*-question appears:[18]

(83) The height of the building wasn't clear.
(84) What the height of the building was wasn't clear.

Concealed forms not only have NP distribution, they also have the internal structure of noun phrases: a determiner, optionally an adjective such as *big* in (72) or *incredible* in (79), the head noun, and optionally a relative clause (e.g. (72)) or a PP complement (e.g. (79)). Thus, with respect to both their internal structure and their external distribution, concealed questions and exclamations show NP behavior.

To express the syntactic and semantic properties of concealed forms, the grammar must include two rules of interpretation. The Concealed Question Rule interprets noun phrases as interrogative—it assigns to them representations of the same form as those assigned to *wh*-questions. The Concealed Exclamation Rule interprets noun phrases as exclamative. This analysis of concealed forms is the basis of the explanation for their combinatorial properties, which are described in the following section.

[16] It has been suggested (see e.g. Baker (1968)) that concealed questions are underlyingly sentential. This analysis is discussed in section 6.

[17] The only exceptions to this generalization are concealed exclamations like those in (i) and (ii):

(i) It's amazing the kind of beer he drinks.
(ii) It's surprising the amount of money he earns.

Elliott (1971) observed that Right Dislocation cannot be responsible for these examples; Right Dislocation requires that the pronoun agree in number and gender with the displaced noun phrase:

(iii) a. They're long, the books Bill is reading.
b. *It's long, the books Bill is reading.

No agreement is exhibited by the subject pronoun where the displaced noun phrase is a concealed exclamation:

(iv) a. It's amazing the long books Bill reads.
b. *They're amazing the long books Bill reads.

Elliott further noted that concealed questions do not occur in this configuration (v) and that not all exclamation predicates participate in it (vi):

(v) *It's not clear the kind of beer John drinks.
(vi) a. It's irrelevant what a big car he drives.
b. *It's irrelevant the big car he drives.

Elliott concluded that the examples in (i) must be derived by a noun phrase extraposition rule, which applies only with a subset of the exclamatory predicates. Thus, the fact that at the surface the concealed exclamations in (i) are not in NP positions does not impugn the generalization that they occupy NP positions at underlying structure.

[18] Neither concealed exclamations nor *wh*-exclamations occur readily in subject position:

(i) a. *What an incredible size his shoes are is amazing.
b. *The incredible size of his shoes is amazing.

4.2. *The Distribution of Concealed Questions and Exclamations*

Reviewing the discussion in section 4.1, it is apparent that noun phrases are interpreted as interrogative or exclamative only when they are complements to predicates which take the corresponding *wh*-forms. *Ask* takes concealed questions and not concealed exclamations (compare (5) and (6)); *believe* takes concealed exclamations and not concealed questions (compare (77) and (85)).

(85) *John couldn't believe whether Bill lived in a large house.

Find out occurs with both concealed questions and exclamations (compare (11)). In short, concealed exclamations occur only with predicates which allow *wh*-exclamations, and concealed questions occur only with predicates that take *wh*-questions.

This generalization was observed for questions by Baker (1968) and for exclamations by Elliott (1971). Baker contrasted predicates like *know, find out,* and *remember* with *believe, assert,* and *deny*, which take neither concealed questions nor *wh*-questions:

(86) (= Baker's (6.9–6.14))
- a. Only Harold knew the kind of candy that Jill likes.
- b. Only Harold ever found out the kind of candy that Jill likes.
- c. Harold couldn't remember the kind of candy that Jill likes.
- d. *Harold firmly believed the kind of candy that Jill likes.
- e. *Harold asserted the kind of candy that Jill likes.
- f. *Harold denied the kind of candy that Jill likes.

Compare with (86) the examples in (87), in which a *wh*-question complement appears in each case:

(87)
- a. Only Harold knew what kind of candy Jill likes.
- b. Only Harold ever found out what kind of candy Jill likes.
- c. Harold couldn't remember what kind of candy Jill likes.
- d. *Harold firmly believed what kind of candy Jill likes.
- e. *Harold asserted what kind of candy Jill likes.
- f. *Harold denied what kind of candy Jill likes.

The generalization extends even to rather idiosyncratic cases; the verb *find* contrasts with the semantically and syntactically similar *find out* and *discover* in not allowing *wh*-questions:[19]

(88) *Harold finally found what kind of candy Jill likes.

In accord with Baker's generalization, *find* does not take concealed questions; the italicized noun phrase in (89) cannot be interpreted as a question.

(89) Harold finally found *the kind of candy Jill likes*.

[19] These idiosyncratic predicates and the implications of their existence are discussed in the appendix.

With concealed exclamations too, even idiosyncratic predicates follow the rule. *Concede* contrasts with *admit* in not allowing *wh*-exclamations, and, as expected, *concede* does not take concealed exclamations either.

(90) a. John refused to admit what an outrageous size his salary was.
b. *John refused to concede what an outrageous size his salary was.
(91) a. John refused to admit the outrageous size of his salary.
b. *John refused to concede the outrageous size of his salary.

Up to this point, the concealed forms of questions and exclamations show remarkable similarity in distribution to the corresponding *wh*-forms. But, as striking as these similarities are, certain differences are illustrated by the contrast between (92) and (93) and between (94) and (95):

(92) a. I wonder what answer he gave.
b. John inquired what the number of students in the class was.
c. I don't care what height the plants grow to.
d. I don't give a damn what pseudonyms he was using.
(93) a. *I wonder the answer he gave.
b. *John inquired the number of students in the class.
c. *I don't care the height the plants grow to.
d. *I don't give a damn the pseudonyms he was using.
(94) a. John isn't certain what kind of food Jill likes.
b. I'm not sure what beer John drinks.
(95) a. *John isn't certain the kind of food Jill likes.
b. *I'm not sure the beer John drinks.

Note also (96) and (97):

(96) a. I don't care what an incredible height the building is.
b. I don't give a damn what an outrageous size his salary is.
(97) a. *I don't care the incredible height of the building.
b. *I don't give a damn the outrageous size of his salary.

These examples show that even when concealed forms occur with predicates which take the corresponding *wh*-forms, the result is not always well-formed.

The ungrammaticality of the examples in (95) is easily accounted for, given that concealed questions are analyzed as noun phrases (cf. section 4.1). Here the concealed questions follow adjectives (*certain, sure*) within the VP. But this is not a possible NP position for English—there are no phrase structure rules like (98) and (99) in the grammar.

(98) VP → V AP NP
(99) AP → A NP

In (94), on the other hand, the adjective precedes not an NP but an $\bar{S}$. There is of course a base expansion of the required form, exploited by the *that*-complements in (100):

(100) a. John isn't certain that Jill likes that kind of food.
b. I'm sure that John drinks that kind of beer.

Thus, the fact that the sentences in (95) are ungrammatical while those in (94) are grammatical is a consequence of the phrase structure of English, and the syntactic structure of concealed questions. (92) and (93) pose a different problem, to be dealt with below.

One further point emerges from the cited examples. *Lexical uniformity* like that found in connection with null complement anaphora is found here too. Predicates which take *wh*-questions and *wh*-exclamations *either* occur with both concealed questions and concealed exclamations (e.g. *know, remember, find out*) *or* occur with neither (e.g. *care, give a damn*). Lexical uniformity with respect to null complements was explained by the interaction of selection and subcategorization; lexical uniformity with respect to questions and exclamations can be explained in the same way, as we will see below.

4.3. Subcategorization, Selection, and Concealed Forms

Note first that the concealed questions in (93) and exclamations in (97) all occur in legitimate NP positions, provided by the base rule in (101):

(101) VP $\rightarrow$ V (NP) (NP)

Thus, their ill-formedness cannot be attributed to the structural configurations in which they appear. However, concealed forms generated by way of this base rule fall within the domain of verbal subcategorization, just like any object NP does. It is predicted, then, that concealed forms will occur only with verbs that are subcategorized for NP complements.

This is exactly what is needed to explain the ungrammaticality of (93) and (97).[20] None of the relevant predicates is subcategorized to take NP; the combinations in (102) are impossible.

(102) a. *wonder NP
b. *inquire NP
c. *care NP
d. *give a damn NP

The predicates which *do* occur with concealed forms must all be subcategorized for NP,

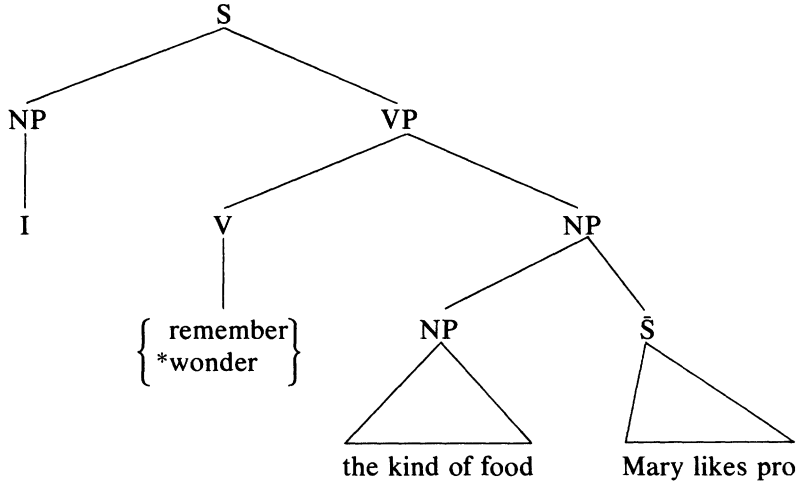
[20] A *Linguistic Inquiry* reviewer has suggested that these verbs and the adjectives in (95) might be subcategorized for PP (e.g. *about* NP), the preposition being deleted before sentential complements but not before NP. This would not fundamentally affect the point at issue, since the difference between, for example, *know* and *wonder* must still be described (both take $\bar{S}$ and PP, but only *know* takes NP). Surface subcategorization would provide the best description of these differences.

as (103) shows:[21]

(103) a. They figured out a solution.
b. John told Bill a story.
c. Mary asked (the guide) a question.
d. I'll always remember John.
e. Bill knows an entire scene from *Hamlet*.
f. I was surprised at Mary.
g. They found out many things.

Thus, while a verb like *remember* which is subcategorized for NP can be inserted under the V node in (104), *wonder*, for example, cannot be, unless its subcategorization is violated.

(104)



Since (92) and (96) are well-formed, we can infer that *wonder, inquire, care*, and *give a damn* are all subcategorized for S̄; that *care* and *give a damn* appear with *that*-complements provides confirmation for this subcategorization:

(105) I don't care that he is a murderer.
I don't give a damn that he has decided to leave.

The differential distribution of concealed forms and *wh*-forms follows in this way from the interaction of their syntactic category membership with the subcategorization frames of predicates.

Selection for Q and E completes the picture of the distribution of concealed ques-

[21] Although there is independent motivation for NP subcategorization for these cases, it is not really necessary that there always be independent evidence. If a predicate took concealed questions and no other NP complements, the best description would still give the predicate NP subcategorization. The prediction is, however, that any predicate which selects Q or E, and is independently subcategorized for NP, will take concealed questions or exclamations.

tions and exclamations. Consider examples (86) and (87). There is no difference in subcategorization between the predicates in the two cases—all are subcategorized for NP and for $\bar{S}$.[22] But while *know, remember,* and *find out* all select Q, *believe, assert,* and *deny* do not.

It will be recalled that interpretive rules assign interrogative and exclamative interpretations to concealed questions and exclamations. It follows that concealed questions will count as instances of Q, and concealed exclamations as instances of E. Therefore, concealed questions will occur with predicates that select Q, like *know, remember,* and *find out*, but not with predicates like *believe, assert,* and *deny*, which do not select Q. (The same holds, of course, mutatis mutandis, for concealed exclamations.)

The point can be illustrated with respect to two of Baker's examples, repeated here:

(106) a. Harold couldn't remember what kind of candy Jill likes.
b. Harold couldn't remember *the kind of candy Jill likes.*
(107) a. *Harold denied what kind of candy Jill likes.
b. *Harold denied *the kind of candy Jill likes.*

The Concealed Question Rule can of course apply to the italicized NPs in both (106) and (107). For (106b), the result will be an interpretation like that given to (106a), the complements in both cases being instances of Q. Thus, when selection is checked the concealed questions and *wh*-questions each match the semantic frame of *remember* with equal success. When the Concealed Question Rule applies to (107b), the complement will again be interpreted like a *wh*-question, but this time the semantic type of the complement does not match the semantic frame of the predicate, *deny*, which takes P and not Q. (107b) is thus ill-formed for the same reason as (107a).

There remains the property of lexical uniformity, noted in section 4.2. A predicate which takes *wh*-exclamations and *wh*-questions must have the semantic frame in (108):

(108) $\left[\_\_\_ \left\{ \begin{matrix} Q \\ E \end{matrix} \right\} \right]$

As for subcategorization, either the predicate is subcategorized for NP or it is not. If it does take NP, then it must take concealed questions *and* concealed exclamations; if it does not take NP, then it will take neither. It is impossible to subcategorize a predicate with the semantic frame in (108) to take concealed forms of one type and not of the other.[23]

In general, then, concealed questions occur with predicates that select Q and are subcategorized for NP, and concealed exclamations occur with predicates that are

[22] E.g. *John denied it, John believed the story, John asserted his innocence.*

[23] Note that it is important to distinguish between the case of one predicate selecting both Q and E and a case of two homonymous predicates, one selecting Q and the other E. In the latter circumstance, the predicates might differ in subcategorization, giving the appearance of violating lexical uniformity.

subcategorized for NP and select E.[24] The nature of subcategorization and selection guarantees that this is the only possible distribution—because concealed forms are noun phrases, they behave syntactically like noun phrases; and because of their interpretation, they pattern semantically with other interrogatives and exclamatives.

These basic generalizations about concealed questions and exclamations can be expressed only by a theory in which subcategorization and selection are independent and are checked at different levels of representation. There is no single level of representation at which both subcategorization and selection can be checked: at the syntactic level, information about the interpretation of noun phrases is not available, so selection cannot be implemented. At the semantic level, the concealed forms are represented like the *wh*-forms, and the syntactic distinction between them, crucial for subcategorization, is not accessible. The distribution of concealed forms can be explained only as resulting from the interaction of two autonomous sets of cooccurrence restrictions, each imposing its own conditions on well-formedness.

5. Concealed Questions and Null Complement Anaphora

In section 3 I suggested that the Null Complement Rule copies sentential formulae—expressions composed of a predicate with its arguments, and associated operators. According to the analysis proposed in section 4, concealed questions and exclamations satisfy this description, since at the level of logical form they are represented like the *wh*-forms. The theory outlined here therefore predicts that concealed questions can act as controllers for null complement anaphora.[25] This prediction is correct, and in addition the theory explains two unexpected and rather subtle properties of this case of null complement anaphora.

The examples in (110) show control by concealed questions, parallel to that exhibited by *wh*-questions in (109):

(109) a. Bill asked me what the time was, but I didn't know.
b. Bill claimed to want to know what the reasons for my decision were, but I didn't tell him.
c. Bill desperately tried to discover what the name of the person who had abducted him was, but he couldn't find out.
d. Bill wanted to know what the cost of a ticket to Chicago was, so he phoned Greyhound and asked them.

(110) a. Bill asked me the time, but I didn't know.
b. Bill claimed to want to know the reasons for my decision, but I didn't tell him.

[24] In Grimshaw (1977) I gave evidence that the NP proform *that* when interpreted as an interrogative (e.g. *Did John leave? I'm afraid I can't tell you that*) has the same distribution as concealed questions—it occurs with predicates which select Q and are subcategorized for NP.

[25] Thus, examples like those in (110) below do not, contrary to the claim made by Ross (1977), provide evidence that concealed questions must be analyzed as sentences in underlying structure. It is the logical form of a complement, not its syntactic representation, that determines whether it can be copied by the Null Complement Rule.

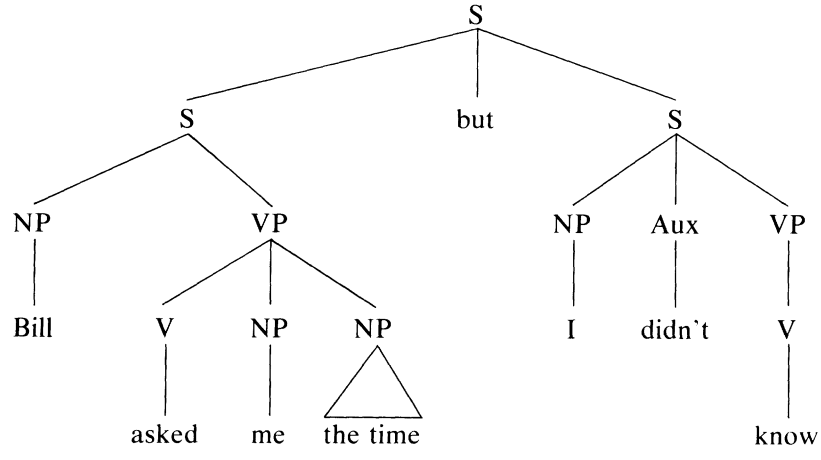
c. Bill desperately tried to discover the name of the person who had abducted him, but he couldn't find out.
d. Bill wanted to know the cost of a ticket to Chicago, so he phoned Greyhound and asked them.

These two sets of examples are interpreted essentially like those in (111):

(111) a. Bill asked me what the time was, but I didn't know what the time was.
b. Bill claimed to want to know what the reasons for my decision were, but I didn't tell him what the reasons for my decision were.
c. Bill desperately tried to discover what the name of the person who had abducted him was, but he couldn't find out what the name of the person who had abducted him was.
d. Bill wanted to know what the cost of a ticket to Chicago was, so he phoned Greyhound and asked them what the cost of a ticket to Chicago was.

The analysis of null complement anaphora proposed in section 3 generalizes to this kind of null complement anaphora straightforwardly. The underlying structure of the first example in (110) will be (112), in which the complement to *know* is literally absent:

(112)



The Concealed Question Rule will interpret the noun phrase *the time* in (112) as a question, and the Null Complement Rule will then fill in the interpreted noun phrase as the complement of *know*, giving a semantic representation in which *know* has a question complement.

However, consider the nature of this analysis. At the level of logical form, concealed questions and *wh*-questions are represented in the same way. The input to the Null Complement Rule is logical form; it follows that the rule does not have access to the syntactic distinction between concealed forms and *wh*-forms. The Null Complement Rule will apply in the same way, whatever the syntactic form of the question acting as

controller. Therefore, a concealed question should be able to control the complement to a predicate *which does not occur with noun phrases*.[26]

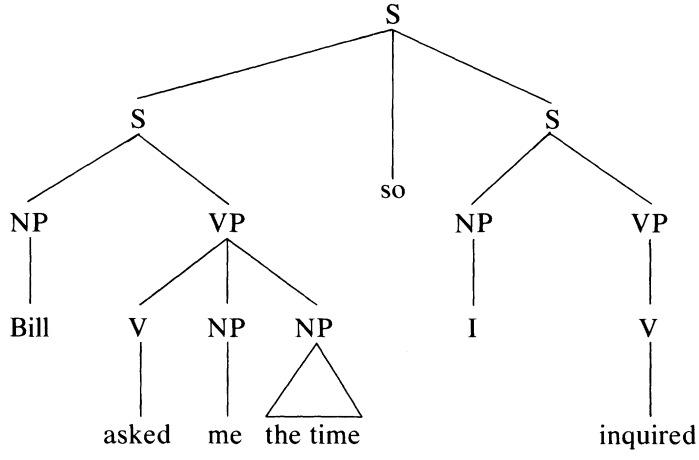
We find exactly the expected contrast: the examples in (113) are ill-formed because none of the predicates *care, give a damn,* and *inquire* is subcategorized for NP, and yet in (114) null complements to these predicates are controlled by noun phrases:

(113) a. *Bill asked me the time, so I inquired the time.
b. *Bill claimed to want to know the reasons for my decision, but he didn't really care the reasons for my decision.
c. *Bill desperately tried to discover the name of the person who had abducted him, but the police didn't give a damn the name of the person who had abducted him.

(114) a. Bill asked me the time, so I inquired.
b. Bill claimed to want to know the reasons for my decision, but he didn't really care.
c. Bill desperately tried to discover the name of the person who had abducted him, but the police didn't give a damn.

To clarify this point, consider the derivation of the sentence with the underlying structure in (115).

(115)



The time is interpreted as a question, and given the same representation at logical form as *what the time was*. The representation of *the time* is then copied into the complement slot for *inquire*. Since the complement is an instance of Q and *inquire* allows Q complements, the result is well-formed. It is completely irrelevant that *inquire* is not subcategorized for a noun phrase complement, because it never does occur with a noun phrase in syntactic structure.

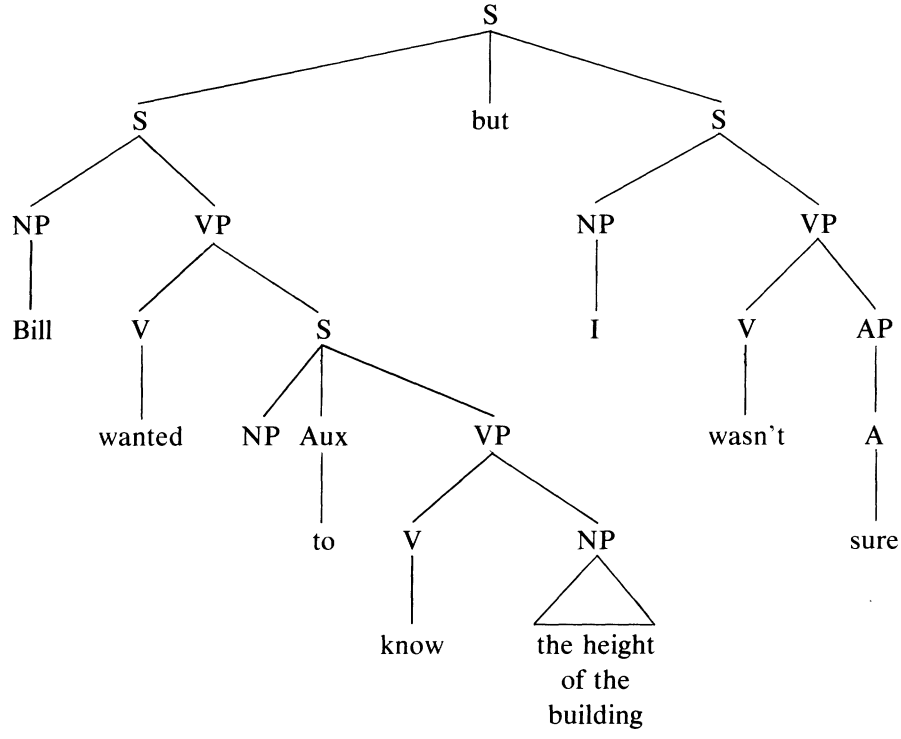
[26] Equally, we expect to find cases of null complement anaphora where a *wh*-question controls the complement of a predicate which is subcategorized for noun phrases and not sentences. Since there are no such indirect question predicates, the prediction cannot be tested.

Similarly, consider (116):

(116) a. *Bill wanted to know the height of the building, but I wasn't sure the height of the building.
b. Bill wanted to know the height of the building, but I wasn't sure.

(116a) is ungrammatical because the PS rules of English do not allow NP to follow an adjective. (116b) is nevertheless grammatical, even though the null complement to *sure* is controlled by a noun phrase. The source of (116b), given in (117), is completely well-formed—it does not involve an illegitimate PS expansion:

(117)



It is thus a consequence of the theory that the syntactic difference between predicates which cooccur with NP and those which cooccur only with $\bar{S}$ plays no role in affecting the control relationship between concealed questions and null complements.[27]

[27] More generally, the theory predicts that the same predicates will allow null complements controlled by concealed questions as will allow null complements with *wh*-question controllers. All such predicates will select Q, and will be subcategorized for either (optional) $\bar{S}$ only, or for both $\bar{S}$ and NP. In the former case, the predicate will, as we saw above, allow anaphora with both kinds of controller. In the latter case, the same will obtain. A predicate which allows null complements and cooccurs with both NP and $\bar{S}$ has three possible subcategorizations, depending on which elements are parenthesized:

[___ NP, ___$\bar{S}$], [___(NP), ___$\bar{S}$], [___(NP), ___($\bar{S}$)]

However, these are syntactically equivalent, since they all allow the predicate to appear in the same range of

The theory also makes a prediction of a complementary kind: syntactically identical noun phrases will not always be equally successful as controllers for null complements with question interpretation.

Consider the examples in (118) and (119):

(118) a. Bill had reported being amazed at the size of the building and John was surprised when he found out.
b. John wanted to know the size of the building and so he decided to ask the guide.

(119) *Bill had reported being amazed at the size of the building, and so John decided to ask the guide.

The sentences in (118) are interpreted like (120), with an exclamation as a complement to *find out* and a question as a complement to *ask*, but (119) has no good interpretation, and certainly cannot be interpreted like (121).

(120) a. John wanted to know the size of the building and so he decided to ask the guide what size the building was.
b. Bill had reported being amazed at the size of the building and John was surprised when he found out what size the building was.

(121) Bill had reported being amazed at the size of the building, and so John decided to ask the guide what size the building was.

(119) contrasts with (122), where the noun phrase complement to *ask* is actually present.

(122) Bill had reported being amazed at the size of the building, and so John decided to ask the guide the size of the building.

What explains these facts? In (118b), the controlling noun phrase can be interpreted as a question; when its interpretation is copied into the complement slot of *ask*, the result is well-formed, because *ask* takes questions. But the controlling noun phrases in (118a) and (119) can be interpreted only as exclamations, for *be amazed at* does not allow question complements. If the Concealed Question Rule applies to these noun phrases, the resulting semantic representation will be ill-formed. Suppose the Concealed Exclamation Rule applies instead. Then, in (118a), the interpreted noun phrase can fill in for the empty complement with a good result, because *find out* allows exclamations. In (119), on the other hand, when the Null Complement Rule copies the interpreted noun phrase into the complement slot of *ask*, the output is ill-formed, since the complement is an instance of E, and *ask* does not occur with E:

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structures:

$_{VP}$[V NP], $_{VP}$[V $\bar{S}$], $_{VP}$[V]

Thus, the interaction of subcategorization and the analysis of null complements radically limits the descriptive options available, and in exactly the required way.

(123) *John decided to ask the guide what a size the building was.

In (122), there is no control relationship between the complement of *be amazed at* and the complement of *ask*, so it is irrelevant that *ask* takes questions while *be amazed at* takes exclamations.

Despite the fact that the would-be controller is the same noun phrase in each case, namely *the size of the building*, null complement anaphora with the null complement interpreted as a question occurs where the controlling noun phrase is a concealed question, but not where the controlling noun phrase is a concealed exclamation. On similar grounds, we can explain the ill-formedness of the examples in (124):

(124) a. *Bill tried to buy the kind of food Mary likes but he didn't know.
b. *Bill wanted to type the answer to the question so he asked Mary.

In these sentences, it is impossible to interpret the null complement as a question—the sentences cannot be construed as synonymous with the examples in (125):

(125) a. Bill tried to find the kind of food Mary likes but he didn't know what kind of food Mary likes.
b. Bill wanted to type the answer to the question so he asked Mary what the answer to the question was.

Suppose we try to construct a derivation for (124a). The Concealed Question Rule interprets *the kind of food Mary likes* as a question, and then the Null Complement Rule copies the semantic representation of the noun phrase into the complement slot of *know*. However, the interpretation of the sentence will be ill-formed, because *the kind of food Mary likes* has been interpreted as a question and is therefore incompatible with *buy*, which does not select questions:

(126) *Bill buys $\left\{\begin{matrix}\text{what kind of food Mary likes}\\ \text{whether Mary left}\end{matrix}\right\}$.

Of course, the examples in (127) (where there is no control between the objects of *buy* and *type* and the complements of *know* and *ask*) are well-formed, if repetitious.

(127) a. Bill tried to buy the kind of food Mary likes but he didn't know the kind of food Mary likes.
b. Bill wanted to type the answer to the question, so he asked Mary the answer to the question.

Similarly, the example in (128) is well-formed because the controlling noun phrase can be interpreted as a question—*find out* takes questions.

(128) Bill tried to find out the kind of food Mary likes but no one knew.

In general, a noun phrase will be able to control a null complement with a question interpretation only if it is itself a concealed question. With respect to noun phrase

controllers, then, we find that syntactic identity alone does not ensure unity of control possibilities; the interpretation of the noun phrase plays a critical role, just as the theory predicts.

This explanation for the behavior of noun phrase controllers supports the claim (cf. section 3) that logical form is the (only) input to the Null Complement Rule, logical form being a level at which concealed questions are represented like *wh*-questions, but differently from other kinds of noun phrases. By way of contrast, consider the hypothesis that the Null Complement Rule is a syntactic rule which deletes a complement under identity to a controlling sentence in the discourse, the input to the rule being syntactic structure rather than logical form. As Hankamer and Sag (1976) note, this analysis seems to be incompatible with the basic properties of null complement anaphora.

Recall first from section 3 the generalization governing the Null Complement Rule: it copies closed sentential formulae of logical form. This generalization cannot be expressed in terms of the syntactic configuration that would constitute the input to a null complement deletion rule, but it is easily stated in terms of the representation that is the input to the interpretive Null Complement Rule proposed here.

Next, consider the examples in (114) and (116), in which a noun phrase controls the null complement of a predicate which does not occur with noun phrases. Under the deletion analysis, the superficially null complement must be present in underlying structure, but what form does it have? If the null complements are taken to be noun phrases at the underlying level, examples like (116b) cannot be generated, since (cf. section 4.2) there is no base structure in which a noun phrase follows an adjective. The structure which would underlie (116b) is thus ill-formed. Similarly, the subcategorization of *care, give a damn,* and *inquire* will be violated if they are assigned underlying noun phrase complements for the discourses in (114).

If, alternatively, the complement is taken to be a *wh*-question, (116b) will be generated, since $\bar{S}$ can follow an adjective in the VP, and *care, give a damn*, and *inquire* are all subcategorized for $\bar{S}$.

(129) a. Bill wanted to know the height of the building, but I wasn't sure $_{\bar{S}}$[the height of the building was what]
b. Bill asked me the time, so I inquired $_{\bar{S}}$[the time was what]

Now however, the deletion rule must allow the noun phrase *the time* to induce deletion under "identity" of the *wh*-question *what the time was*.

Moreover, how can the ill-formedness of the examples in (119) and (124) be accounted for? Regardless of which underlying structure is chosen, if a *wh*-question or a concealed question can be deleted under "identity" to the noun phrase *the size of the building* in (118), or *the kind of food Mary likes* in (128), why can they not be deleted under identity to the same noun phrases in (119) and (124)?

The deletion analysis will have to be complicated in one way or another to accom-

modate these problems, but no matter how this is done the deletion rule that must be posited displays some rather strange properties.

In the first case, a supposedly syntactic rule appears to be ignoring a distinction that we know to be a syntactically relevant one: the difference between a noun phrase and a sentence. In the second case, the supposedly syntactic rule is showing sensitivity to semantic information; the fact that there are semantic differences among concealed questions, concealed exclamations, and other noun phrases is more important in determining the applicability of the rule than the fact that they are syntactically identical.

Surely in general it is expected that a syntactic rule will be sensitive to syntactic distinctness but not to semantic distinctness, rather than as here, independent of syntactic distinctions and sensitive to semantic ones. On the other hand, from a semantic rule such as the interpretive Null Complement Rule posited in section 3 we expect precisely what we find—that syntactic information is irrelevant to the operation of the rule, but semantic information plays a crucial role. This, it seems to me, constitutes very good evidence that the interpretive theory of null complement anaphora is correct.

To sum up, concealed questions can control complements to predicates that select questions, regardless of whether or not the predicates themselves cooccur with noun phrases. Furthermore, concealed questions are the *only* noun phrases that can control complements interpreted as questions. Both of these characteristics of control by noun phrases are direct consequences of the analyses of null complement anaphora and concealed forms proposed above. This provides additional evidence for these analyses, and therefore for the theory of complement selection on which they are founded.

6. Alternatives

It is appropriate at this point to examine the syntactic theory of complement selection in more detail, and to see how it might account for the properties of selection discussed in the last few sections. The hypothesis that selection is a matter of subcategorization for complementizers (adopted in Bresnan (1972) and Chomsky (1973))[28] in fact embodies two partially independent claims. One claim is that selection is syntactic in the sense outlined in the introduction: that selectional relationships can be expressed in terms of syntactic configurations. The second claim is that selection is a subcase of subcategorization. It is quite possible for the first claim to be true without the second one also being so: if complement selection were syntactic but separate from subcategorization.

When the syntactic theory is tested against selection in null complement anaphora and in concealed questions and exclamations, it emerges that the stronger claim, that complement selection is a case of subcategorization, is simply false. In this theory, just as in the semantic theory, complement selection and subcategorization must act inde-

[28] A rather different kind of syntactic account is proposed in Ransom (1977). She gives an analysis of selection for finite and infinitival complements in terms of abstract semantic predicates such as BE TRUE and DO, which appear in the syntactic representation of the complements. The lexicon specifies which abstract predicate may occur in the complement of each lexical item.

pendently. As for the hypothesis that selection is syntactic at all, this turns out to require theoretically undesirable and otherwise unnecessary complications in the grammar, in the form of abstract markers and complex transformational rules.

Let us return briefly to the basic problem posed in section 1: how to describe the distribution of exclamatory and interrogative complements. It emerged from the discussion there that questions and exclamations, despite the fact that they do not differ syntactically in any identifiable way, are selected by different predicates. If this fact is to be described by the syntactic theory of complement selection, it is necessary to posit some syntactic difference between the two complement types to which subcategorization (or some other syntactic selection mechanism) can make reference. In Bresnan (1972) it was proposed that predicates which take indirect questions are subcategorized for the abstract complementizer *wh*, which occurs in the underlying structure of interrogatives. This allows subcategorization for *that*- and *for-to*-complements, where a complementizer is overtly present, to be generalized to account for indirect questions also. The suggestion could be extended to exclamations if an abstract complementizer *ex* occupies the underlying Complementizer position for exclamations. Questions and exclamations would then have distinct syntactic representations, and predicates which select exclamations could be subcategorized for *ex*, and thus be separated from those which select questions.[29]

Only if questions and exclamations are assigned nonidentical syntactic representations in this (or some parallel) way can subcategorization be extended to the entire complement system. This solution to the problem is plausible only to the extent that *wh* and *ex* can be shown to play some further role in the grammar. *Wh* has received a considerable amount of discussion, but a review of the literature reveals that the apparent motivation for *wh* rests on the assumption that questions are interpreted at deep structure and not at surface structure as suggested by Jackendoff (1972) and Chomsky (1973).

Katz and Postal (1964) pointed out that positing a sentence-initial question particle, which they called "Q", in the deep structure of questions, would make it possible to assign the appropriate interpretations to the examples in (130) and (131); these sentences would otherwise have the same underlying structures, and it would be impossible to determine where a question interpretation should be given and where a declarative interpretation was called for.

(130) Is John leaving?
(131) John is leaving.

[29] Note that complement selection differs from subcategorization in some respects which might militate against this analysis. Predicates are not (Chomsky (1965)) subcategorized for subject NPs—every predicate of English takes a subject. Selection for complement types, however, extends to subjects, as the examples in (i) and (ii) show:

(i) a. Who was shot in the fight last night is still unclear.
b. *Who was shot in the fight last night is unusual.
(ii) a. *For a man to be shot in a fight is unclear.
b. For a man to be shot in a fight is unusual.

Baker (1970) showed that similar reasons hold for positing Q in indirect questions. He gave the examples in (132) and (133):

(132) We discovered that the police know who Clyde shot.
(133) We discovered who the police know that Clyde shot.

The underlying structures of (132) and (133) would be identical if no Q were exploited:

(134) $\bar{S}$[we discovered $\bar{S}$[that the police know $\bar{S}$[that Clyde shot who]]]

If (134) is the input to semantic interpretation, there is no way for the interpretation rules to assign the appropriate readings to (132) and (133). Introducing Q allows (132) and (133) to be assigned different underlying structures, as in (135) and (136), and the interpretation rules can now apply correctly.

(135) $\bar{S}$[we discovered $\bar{S}$[that the police know $\bar{S}$[Q Clyde shot who]]]
(136) $\bar{S}$[we discovered $\bar{S}$[Q the police know $\bar{S}$[that Clyde shot who]]]

This summary of the evidence is enough to show that *wh* or something like it is needed in a theory which requires that all semantic interpretation take place at deep structure. If surface and not deep structure provides the input to the interpretation rules, the problems which motivated *wh* disappear. Distinguishing between questions and declaratives is not problematic. By the time the interpretation rules apply, Subject-Auxiliary Inversion has applied in yes–no questions, and in *wh*-questions *Wh* Fronting has also applied. The surface differences between matrix declaratives and questions are thus entirely adequate for appropriate interpretation to take place. Similarly, the difference between (132) and (133) is transparent at the surface: in (132) the *wh*-complement is embedded under *know* and in (133) it is embedded under *discover*. The surface position of the *wh*-phrase uniquely determines the correct interpretation.[30]

It is interesting to note that, as Jackendoff (1972) and Williams (1976) point out, the elimination of abstract complementizers from the grammar leads to simplification in the transformational component. A reflex of the analysis in which questions are interpreted at deep structure is that both *Wh* Fronting and Subject-Auxiliary Inversion must mention *wh* in their structural descriptions—otherwise, for example, the subject and auxiliary could be inverted in a sentence with a declarative interpretation. Similarly, *Wh* Fronting must mention *ex* and *wh* if *wh*-phrases are to be moved only to the appropriate positions. The theory in which questions are interpreted at the surface can dispense with abstract complementizers, as elements in deep structure and as factors in the structural descriptions of transformations.

The problem for the syntactic theory of complement selection is clear: *wh* and *ex* are crucial for selection, but have no independent motivation.

Even if *wh* and *ex* are posited, the syntactic theory can give no account of the distribution of concealed questions and exclamations, which are just noun phrases, with

[30] For further discussion of abstract complementizers, see Bresnan (1970; 1972), Kuno and Robinson (1972), Hankamer (1974), Langacker (1974), Grimshaw (1977), and Williams (1976).

no complementizer at all. Nevertheless, predicates select for them just as they do for sentential complements. The claim that selection is syntactic can be maintained only if concealed forms and *wh*-forms are considered to be syntactically related, sharing the same underlying structure. Analyzing concealed questions as deriving from the structure underlying *wh*-questions, rather than as base-generated noun phrases, has been proposed by Baker (1968) and Ross (1977).[31] This analysis would allow concealed questions to be introduced by *wh*-complementizers in underlying structure; subcategorization for *wh* would generalize to the concealed forms, accounting for the fact that concealed questions occur only with question predicates.

It is of course extremely difficult to formulate the relevant rule, and it is clear that a rule of this kind, which must derive a noun phrase such as *the time* or *the kind of food Mary likes* from the corresponding sentential forms (presumably *wh the time was what*, and *wh Mary likes what kind of food*), lies well beyond the limits of transformational operations in any restrictive theory of grammar.

A consequence of the analysis in which concealed questions and exclamations are base-generated noun phrases is that they have the internal structure of noun phrases, occupy noun phrase positions in constituent structure, and act as noun phrases with respect to subcategorization. If concealed forms are derived from sentences, these generalizations are not captured; there is no particular reason to expect that they will pattern as noun phrases in all these respects. At best, the facts can be *described,* given a sufficiently complex transformational rule.

Finally, subcategorization and complement selection cannot in fact be unified in this theory, any more than in the semantic theory. Under the assumption that complement selection is a case of subcategorization, which is syntactic and is checked at deep structure, the analysis will correctly predict that only the predicates which allow indirect questions will occur with concealed questions. But there is no way to account for the fact that only predicates which take NP will have concealed question complements. At deep structure, overt and concealed questions have the same representation, and the rule converting a *wh*-question form to a noun phrase structure will apply regardless of the subcategorization of the predicate to which the question is a complement, generating the ill-formed sentences of (93) and (97). Selection for complementizers must be checked at underlying structure and subcategorization for NP at surface structure, if the ungrammatical predicate–complement combinations are to be ruled out.

Null complement anaphora can be treated similarly if null complements are analyzed as being fully specified at underlying structure (with selection for complementizers being checked at this point) and the complements are later deleted. Subcategorization for $\bar{S}$ and ($\bar{S}$) could then be checked at the surface, after the complement deletion rule has applied.

Thus, the fundamental distinction between complement selection and subcategori-

[31] Ross points out that concealed questions act like sentences in their ability to control null complements. But this is explained given an interpretive account of the Null Complement Rule—see section 5 and n. 25.

zation reemerges: while in the semantic theory restrictions on complement selection are met by the semantic level and subcategorization is met by syntactic representation, in the syntactic theory complement selection would be checked at deep structure and subcategorization at the surface.

In essence, treating complement selection syntactically is possible only if the relevant aspects of semantic interpretation are built into syntactic structure. In this way, syntactically identical complements (e.g. interrogatives and exclamatives) can be differentiated, and syntactically disparate complements can be unified (e.g. concealed questions and *wh*-questions). Thus, the syntax has to duplicate information which is already present at the semantic level.[32] The semantic theory instead simply makes use of the information given by the semantics, without requiring that it be repeated in the syntax. These considerations weigh against the hypothesis that complement selection is syntactic, but fully support the semantic theory of selection.

7. Conclusion

I have presented evidence here that the lexicon must contain both subcategorization and selection frames, operating independently to explain the combinatorial properties of predicates and complements.[33] Expressing selectional relationships in terms of semantic types explains why interrogative and exclamatory complements, despite their syntactic uniformity, are selected by different predicates. It explains why null complements observe selection even though they are not syntactically realized, and why concealed questions and exclamations occur with predicates that select the *wh*-forms. The interaction of subcategorization and selection allows a simple description of the difference between predicates that take null complements and those that do not, predicts the distribution of concealed questions and exclamations, and explains lexical uniformity with respect to null complement anaphora and concealed questions and exclamations.

The semantic types which appear in selection frames and the syntactic categories which appear in subcategorization frames are not in one-to-one correspondence: NP and $\bar{S}$ each correspond to more than one semantic type, Q and E each correspond to more than one syntactic category. Thus, it is impossible to reduce the syntactic categories to the semantic types or the semantic types to the syntactic categories. Matching of categories with subcategorization frames must take place in the syntax; matching of types with semantic frames must take place at the level of semantic representation.

[32] The argument here is essentially similar to the one given in McCawley (1968) for stating selectional restrictions over semantic representations.

[33] The theory predicts that there could be a predicate which allowed null complements but never overt complements (it would not be subcategorized for $\bar{S}$, but would select P, Q, or E), or a predicate which took concealed questions or exclamations but not the *wh* kind (it would be subcategorized for NP only, and select Q or E). Predicates like this do not seem to exist. Note that exactly the same issue arises in the syntactic theory of complement selection discussed in section 6. A predicate could select the *wh*-complementizer but be subcategorized only for NP, for example. It is a simple matter to *describe* this situation by a lexical redundancy rule stating that, if a predicate selects P, Q, or E, it must be subcategorized for $\bar{S}$. However, I assume there is some independent explanation to be found, though I have no specific proposal at this point.

Subcategorization cannot be reduced to selection, nor selection to subcategorization. It is only by positing these two autonomous sets of cooccurrence restrictions that the generalizations governing complement selection can be explained.

Appendix: Complement Selection and Predictability

A question which inevitably arises in the context of complement selection is that of predictability: to what extent is it possible to determine from independent properties of a predicate whether it does or does not occur with a particular complement type? Of course, if complement selection were in fact predictable, then there would be no need to posit selection of any kind, syntactic or semantic.

It is clear that complement selection is not predictable on the basis of syntactic characteristics of predicates. For example, there is no syntactic reason why *wonder* and *inquire* should not allow *that*-complements, or why *believe* should not allow interrogative complements. Whatever the degree of predictability that may exist, it is to be found in the semantic, and not the syntactic, domain.

The distribution of interrogatives has received a certain amount of attention. Baker (1968) suggested that all the predicates which take indirect questions are synonymous with, or can be defined in terms of, the four predicates *know, decide, matter,* and *depend.*[34] While this does seem to be a necessary condition for a predicate to select interrogatives, we will see below that it is not a sufficient one. Furthermore, to explain the distribution of indirect questions it would be necessary to show that their interpretation is consistent with the semantics of all predicates pertaining to knowledge, decision, import, or dependency, but inconsistent with all other predicates.

While such an account is not yet available for interrogatives, the distribution of exclamatory complements does seem to be predictable to a large extent. Elliott (1971; 1974) noted the generalization governing exclamatory complements (mentioned in section 1 above) that only factive predicates in the sense of Kiparsky and Kiparsky (1970) take exclamations. (137) and (138) illustrate this.

(137) a. It's amazing what a fool Bill is.
b. John realized what a big mistake he had made.
c. Bill knew how I suffered.
d. It's a pity what a small salary he earns.

[34] Karttunen (1977) gives a similar list of question predicates but divides them into nine classes as opposed to Baker's four:

(i)	verbs of	retaining knowledge	e.g. *know*
(ii)	"	acquiring knowledge	e.g. *learn*
(iii)	"	communication	e.g. *tell*
(iv)	"	decision	e.g. *decide*
(v)	"	conjecture	e.g. *guess*
(vi)	"	opinion	e.g. *be certain about*
(vii)	"	inquisition	e.g. *ask*
(viii)	"	relevance	e.g. *matter*
(ix)	"	dependency	e.g. *depend on*

e. I found out what a rat he was.
f. John was appalled by what a lot of work he had to do.

(138) a. *It's possible what a fool Bill is.
b. *John thought what a big mistake he had made.
c. *Bill assumed how I suffered.
d. *It seems what a small salary he earns.
e. *I hoped what a rat he was.
f. *John expected what a lot of work he had to do.

This generalization holds absolutely: there are no cases of exclamations embedded under nonfactive predicates. Even examples like (139) conform to this claim:

(139) I can't believe $\left\{\begin{array}{l}\text{how stupidly he's behaving}\\ \text{what a rat he turned out to be}\end{array}\right\}$.

A predicate like *believe* might seem to be a prime example of a nonfactive, and yet in fact this is an idiosyncratic use of *believe*, and is found with *that*-complements also, associated with both a factive and a nonfactive reading:

(140) I can't believe that he really did it.

In the factive reading, *I can't believe* expresses surprise at the content of the complement rather than disbelief. In the nonfactive reading, it is disbelief that is expressed. This use of *believe* is found only in limited contexts; there is no factive reading for the complement of *believe* in (141):

(141) a. Bill believed that John really did it.
b. Bill believes that John really did it.

As expected, in contexts where *believe* acts solely as a nonfactive, exclamatory complements are impossible:

(142) a. *Bill believed how stupidly John was behaving.
b. *Bill believes how stupidly John is behaving.

The correlation between nonfactivity and lack of exclamatory complements is obviously real, but how can it be explained? First of all, note that nonfactive predicates are not merely neutral with respect to presupposition—the difference between factives and nonfactives is not merely that while factives require that their complements are presupposed to be true, nonfactives are indifferent to presuppositions about the truth of their complements. The difference is that nonfactives *do not allow* their complements to be presupposed, and in the examples in (143) it is therefore impossible to extract a reading where the complements are presupposed:[35]

[35] It is important here to distinguish nonfactive predicates from ambiguous predicates, such as *predict* and *anticipate*, which occur with presupposed and nonpresupposed complements indifferently, as Kiparsky and Kiparsky noted. As expected, neutral predicates can take exclamatory complements:

(i) a. John predicted what high marks Bill would get on the exam.
b. I hadn't anticipated what a fool Bill would turn out to be.

(143) a. Bill hoped that Fred had left.
b. Bill claimed that Fred had left.

This is what explains the observation made by Kiparsky and Kiparsky that nonfactive predicates do not allow complements introduced by *the fact that*. (The examples in (144) and (145) are from Kiparsky and Kiparsky (1970).)

(144) a. I want to make clear the fact that I don't intend to participate.
b. You have to keep in mind the fact of his having proposed several alternatives.
(145) a. *I assert the fact that I don't intend to participate.
b. *We may conclude the fact of his having proposed several alternatives.

The issue here is slightly confused because it is not obvious that *assert* and *conclude* take NP objects anyway, and the ill-formedness of (145) might be attributed to this. But *propose* and *presuppose* both take NPs (as in (146)), yet cannot occur with *the fact that*:

(146) a. John proposed a trip to the movies.
b. That argument presupposes the existence of God.
(147) a. *John proposed the fact that $\left\{\begin{matrix}\text{they had gone}\\ \text{should go}\end{matrix}\right\}$ to the movies.
b. *That argument presupposes the fact that God exists.

If nonfactive predicates were neutral, then the imposition of a truth presupposition resulting from the presence of *the fact that* would not lead to anomaly. It is only if nonfactives are viewed as being inconsistent with presupposition of their complements that the ill-formedness of (147) can be explained. Since *that*-complements occur with both factive and nonfactive contexts, i.e. both where their propositional content is presupposed and where it is not, there is nothing inherent to *that*-clauses that dictates whether or not they can be presupposed. The claim that I want to make here is that in exclamations, what can be termed the "propositional content" is *inherently presupposed*. For an exclamation to be used appropriately, it must always be true that the corresponding proposition is presupposed to be true. The exclamation *How tall John is!* presupposes that John is tall, and an exclamation like *What big ears John has!* presupposes that John has big ears. If this can be demonstrated, then the incompatibility of nonfactive predicates and exclamations will be explained, for while the propositional content of exclamations is presupposed, nonfactives do not allow the proposition expressed by their complements to be presupposed. Thus, the conditions governing nonfactive complements and exclamations cannot *both* be met, and combinations of nonfactives and exclamations will be anomalous.

It is not simple to establish that the propositional content of an exclamation is presupposed; in all embedded exclamations, it will be difficult to distinguish the effect of the predicate (which will of course always be factive) on the interpretation of the

complement, from the "inherent" interpretation of the exclamatory complement. Consider the case in (148), for example. That (148) presupposes that John is a fool is suggested by the constancy of the interpretation under negation:

(148) It's surprising $\left\{\begin{matrix}\text{what a fool John is}\\ \text{that John is such a fool}\end{matrix}\right\}$.

(149) It's not surprising $\left\{\begin{matrix}\text{what a fool John is}\\ \text{that John is such a fool}\end{matrix}\right\}$.

However, this might be attributed to the factivity of *surprising,* rather than to any property of exclamations—*that*-clauses behave in the same way as exclamations when they are embedded under factive predicates.

For matrix exclamations, however, I think the point can be made. Consider the following discourses, which are deviant.

(150) Question: How tall is John?
Response: How tall John is!

(151) Question: Did John buy a big car?
Response: What a big car John bought!

(152) Question: Did you have fun?
Response: What fun we had!

The deviance cannot be attributed to lack of sufficient information in the reply, for from the exclamation in (150), for instance, it can be deduced that John is extremely tall, and this certainly constitutes a reasonable answer to the question. If the exclamation *asserts* that John is extremely tall, then there is no reason for the discourse in (150) to be any less well-formed than the one in (153):[36]

(153) Question: How tall is John?
Response: John is extremely tall.

Suppose, on the other hand, that it is correct to claim that the truth of the proposition that John is extremely tall is presupposed, and not asserted, by the exclamation in (150). Then the ill-formedness of the discourse in (150) can be attributed to a general principle that the response to a question cannot presuppose the answer to it. This claim is easily tested. For instance, consider the discourses in (154) and (155). ((155) was contributed by Greg Carlson.)

(154) Question: Did Bill leave?
Response: It's odd that he did.
I'd forgotten that he did.

(155) Question: Is there a king of France?
Response: The king of France was sitting next to me.

[36] The well-formedness of the discourse in (153) shows that it cannot be the repetition involved in (150) which makes the response unacceptable. The response in (153) has just as much repeated material.

(154) and (155) are deviant just as (150), (151), and (152) are. In (154), the responses presuppose the truth of the proposition that Bill left, which is exactly what the question is asking about. Similarly, in (155), the question is about the existence of an entity whose existence is presupposed by the response.[37] Note that once again it is not lack of information that is the problem, for from the responses in (154) the questioner can deduce the answer to his question, and similarly for (155); rather, there seems to be a discourse principle working here, that one cannot reply to a question with a response which presupposes the answer. Of course, if what is presupposed in the responses in (154) and (155) is instead asserted, perfectly well-formed discourses result:

(156) Question: Did Bill leave?
Response: Yes.
He did.

(157) Question: Is there a king of France?
Response: Yes.
There is.

There is, then, a condition on question–response pairs, that the response may not presuppose the answer to the question.[38] Violation of this condition leads to the ill-formedness of the discourses in (154) and (155), and the hypothesis that the propositional

[37] Note that these responses are crucially distinct from the response in (i), pointed out to me by Tom Roeper:

(i) Question: Did you see the Queen?
Response: She was sitting right next to me.

Here the response does not presuppose the answer to the question; in fact, it is quite consistent with *either* of the two possible answers. The strong implication that the answer is positive is due to pragmatics and not logic, and stems from the fact that it is unlikely that one would be sitting next to someone and not see them (together with the assumption that the response is relevant to the question). (i) shows that it is not necessary that the answer to a question be asserted by the response; rather, it just cannot be presupposed.

[38] The class of factive predicates which are concerned with knowledge can, under limited circumstances, occur in well-formed responses:

(i) Question: Did John leave?
Response: Well, I just found out that he did.
I happen to know that in fact he did.

For these examples to be acceptable, the main stress must be on *did* in each case, i.e. on the complement and not on the factive predicate.

(ii) Response: I just found that he díd.
*I just found oút that he did.

With other factive predicates the position of the main stress makes no difference:

(iii) Response: *It's odd that he díd.
*It's ódd that he did.

In addition, examples like (iv) are a little less easy to interpret than the examples in (i) where the subject is first person, although (iv) is well-formed if the speaker is stating how he or she came by the information.

(iv) Response: Bill just found out that he díd.

It seems that the complement to a factive verb of knowledge can sometimes be interpreted as containing new information. Where this interpretation is possible, the factivity of the predicate does not lead to ill-formedness in the response.

content of an exclamation is presupposed allows the discourses in (150), (151), and (152) to be assimilated to the generalization governing these cases. This strongly suggests that the hypothesis is correct, and, if so, the incompatibility of nonfactive predicates and exclamatory complements is explained. Nonfactives do not allow the propositional content of their complements to be presupposed, and the propositional content of an exclamation is always presupposed; combining a nonfactive predicate and an exclamation will necessarily violate one of these conditions, and ill-formedness will be the result.

It would be pointless to use any selection mechanism to represent the generalizations about exclamations discussed here, even to posit a redundancy rule to the effect that, if a predicate is nonfactive, it will never take exclamatory complements. The semantic and pragmatic characteristics of exclamations and of the factive/nonfactive distinction automatically guarantee that the ill-formed combinations will not be generated.

The above instances of complement selection are either demonstrably predictable (exclamations and nonfactives) or at least conceivably so (question predicates). The question remains whether there are any cases which are not predictable. It is, of course, impossible to *prove* that a phenomenon is idiosyncratic—that there could never be an analysis which would explain it. All one can do is show that there are examples of selection for which it is very hard even to imagine what such an explanation might be. Examples like this can be found within the very domains we have been considering.

Among the examples of factive predicates listed by Kiparsky and Kiparsky are *be sufficient, make sense,* and *count*. Unlike the factives mentioned above, none of these occurs readily with exclamations:

(158) a. It's sufficient (for our purposes) that John makes a lot of money.
b. *It's sufficient (for our purposes) what a lot of money John makes.
c. It makes sense that they sent John a big bill.
d. *It makes sense what a big bill they sent John.
e. It doesn't count that John earns a small salary.
f. *It doesn't count what a small salary John earns.

Concede (mentioned in section 4.2) is another example. It is factive and yet does not allow exclamatory complements:

(159) a. Bill will never concede that he makes a big salary.
b. *Bill will never concede what a big salary he makes.

In this respect, *concede* contrasts with *admit*, which is very similar in meaning and yet allows exclamations:

(160) a. Bill will never admit that he makes a big salary.
b. Bill will never admit what a big salary he makes.

It seems that while it is possible to predict the ill-formedness of exclamations with nonfactives, the behavior of factives is to some extent idiosyncratic. The same situation obtains with indirect question predicates; while it seems to be true that no predicate that does not belong to one of Baker's four classes can take indirect questions (and let us assume that this can ultimately be explained), it is not true that every predicate which *does* belong to one of the classes will take a question complement.

Consider the verb *inform*. *Inform* takes *that*-complements and is very similar in interpretation to *tell*:

(161) a. John informed me that he was leaving for Paris.
b. John told me that he was leaving for Paris.

Nevertheless, although *tell* takes indirect questions as complements, *inform* does not:

(162) a. *John informed me what he had been doing.
b. John told me what he had been doing.

Similarly, *find* (mentioned in section 4.2) takes *that*-complements and is closely related in interpretation to predicates like *find out* and *discover*:

(163) a. John found that he had to leave for Paris on Tuesday.
b. John {found out / discovered} that he had to leave for Paris on Tuesday.

With indirect question complements, *discover* and *find out* give well-formed results, but *find* does not:

(164) a. *John found {when / why / whether} he had to leave for Paris.
b. John {found out / discovered} {when / why / whether} he had to leave for Paris.

Both *inform* and *find* fall into the class of predicates that can, in Baker's system, be defined in terms of *know; inform* meaning something like *cause to come to know*, and *find* meaning something like *come to know*.

Another instance is *conclude*, which is presumably a member of the class of decision predicates. Sentences containing *conclude* with an indirect question complement are nevertheless ill-formed, contrasting with examples using *decide*:

(165) a. John decided what he should do.
b. John hasn't decided whether Bill is right.
(166) a. *John concluded what he should do.
b. *John hasn't concluded whether Bill is right.

The picture that emerges is that, for any complement type, it may be possible to predict

that the type is incompatible with some class or classes of predicates, where by "predict" I mean that the incompatibility will be explicable on independent semantic or pragmatic grounds. However, it will not be possible to predict which of the remaining predicates will allow the complement type. The fact that idiosyncratic behavior is found within the class of factive predicates, and among knowledge, decision, import, and dependency predicates, means that selection of the kind proposed in this article must play a real role in the grammar. Thus, for a predicate–complement pair to be well-formed, three conditions must be satisfied. The predicate and its complement must be semantically compatible; the complement must meet the idiosyncratic selectional conditions encoded in the semantic frame of the predicate; and the complement must meet the (also idiosyncratic) syntactic conditions encoded in the subcategorization frame of the predicate.

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