Grammatical Constructions and Linguistic Generalizations: the *What's X doing Y?* Construction

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Abstract

The goal of this paper is to present, by means of the detailed analysis of a single grammatical problem, some of the principal commitments and mechanisms of a grammatical theory which assigns a central role to the notion of GRAMMATICAL CONSTRUCTION. To adopt a constructional approach is to undertake a commitment in principle to account for the entirety of each language. This means that the relatively general patterns of the language, such as the one licensing the ordering of a finite auxiliary verb before its subject in English, often known as SAI, and the highly idiomatic patterns, like *kick the bucket*, stand on an equal footing as data for which the grammar must account. An explicit grammar that covers the full range of constructions must represent all constructions, of whatever degree of generality or idiomaticity, in a common notation and must provide an explicit account of how each sentence of a language is licensed by a subset of the leaves of the inheritance hierarchy of constructions which constitutes the grammar of that language. Language-internal generalizations are captured by inheritance relations among constructions. Cross-language generalizations are captured by the architecture of the representation system and by the sharing of abstract constructions across languages. The particular grammatical phenomenon used here to introduce construction grammar (CG) is the construction that licenses the surprising syntactic and semantic features of a sentence like *What are they doing resuscitating constructions?*[*]

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0. Introduction. The goal of this paper is to present, by means of the detailed analysis of a single grammatical problem, some of the principal commitments and mechanisms of a grammatical theory which assigns a central role to the notion of GRAMMATICAL CONSTRUCTION.

To adopt a constructional approach is to undertake a commitment in principle to account for the entirety of each language.[1] This means that the relatively general patterns of the language, such as the one licensing the ordering of a finite auxiliary verb before its subject in English as illustrated in 1, and the more idiomatic patterns, such as those exemplified in 2, stand on an equal footing as data for which the grammar must provide an account.

(1) a. What have you done?
b. Never will I leave you.
c. So will she.
d. Long may you prosper!
e. Had I known, . . .
f. Am I tired!
g. . . . as were the others
h. Thus did the hen reward Beecher.

(2) a. by and large
b. [to] have a field day
c. [to] have to hand it to [someone]
d. (*A/*The) Fool that I was, . . .
e. in x's own right

Given such a commitment, the construction grammarian is required to develop an explicit system of representation, capable of encoding economically and without loss of generalization, all the constructions (or patterns) of the language, from the most idiomatic to the most general. This goal was advanced in the form of a promissory note in an earlier paper that dealt with the English *let alone* construction: "It appears to us that the machinery needed for describing the so-called minor or peripheral constructions of the sort which has occupied us here will have to be powerful enough to be generalized to more familiar structures, in particular those represented by individual phrase structure rules" (Fillmore, Kay and O'Connor 1988: 534).

The present paper was originally drafted as a first step toward making good on that promissory note by studying another seemingly 'non-core' construction of English, but this time with particular attention to 1) the formal system in which this and all other constructions can be represented in a grammar and 2) the relations that obtain between the construction under study and the more general, so-called core, constructions of English. Since we began working on this construction, a number of analyses and suggestions for development of the CG framework have appeared. Although diverse in detail, these proposals are all concerned with developing an explicit, non-derivational (constraint based) grammar, based on the notion of a grammatical construction as a conventional association of linguistic form and content. Among the works developing the CG approach which have influenced our thinking are Chung (in press, 1995), Chung and Gammon 1996, Filip (in press, 1993), Fried (1995), Goldberg (1996, 1995), Jurafsky (1996), Koenig (1994), Koenig and Jurafsky (1994), Koenig and Lambrecht (in press), Lambrecht (1997, 1994), Michaelis (1994), Michaelis and Lambrecht (1996), Ohara (1994), Orgun (1996a,b), Radetsky and Smith (in press), and Zwicky (1994). Recent applications of the construction concept in related frameworks include Ackerman (1998, 1995), Ackerman and Webelhuth (1998), Culicover and Jackendoff (1997), Inkelas and Orgun (1995), Kathol (1995) Jackendoff (1993, 1997), Malouf (1996), O'Connor (1995), and Sag (1997).

Section 1 introduces the notion of grammatical construction and locates it within constraint-based, non-derivational theories of grammar. Section 2 introduces the title construction and presents arguments for its status as a separate construction. Section 3 introduces some of the central ideas and mechanisms of the construction grammar (CG) framework as background to the analysis that follows. In section 4 we present a detailed account of the representation of this construction. Section 5 presents our conclusions.

1. The notion of construction and the *What's X doing Y* construction. The system for representing both CONSTRUCTIONS and the words, phrases and sentences of the language which they license – which we call CONSTRUCTS – consists of rooted trees whose nodes correspond to feature structures.[2] A construction (e.g., the subject-auxiliary inversion construction) is a set of conditions licensing a class of actual constructs of a language (e.g., the class of English inverted clauses, including all of those in 1 above).

Often a construction will specify something about a mother node and each of its daughters, including their linear order. Sometimes the construction will fail to give any information about the linear order of the daughters or will give only partial information about it (as is the case with the English verb phrase construction introduced in Figure 2 below). Other kinds of constructions are devoted primarily to expressing relations of linear order among sisters, for example the patterns by which, in English, a relatively 'light' constituent may intervene between a verb and its NP direct object (a pattern which corresponds to both 'particle movement' and 'heavy NP shift' in transformationalist frameworks).

Occasionally we find constructions that specify spans of a tree more extensive than the 'nuclear family' of mother and daughters (for example, the correlative conditional construction discussed by Fillmore 1986: 163-182 or the *may...but...* construction discussed by P. Kay 1990). At the other extreme there are lexical constructions specifying a single constituent with no daughters.

CG is a monostratal, constraint-based system in which syntactic and semantic information are represented within a single feature structure (represented by an attribute-value matrix or AVM).[3] As such it bears strong structural similarities to functional unification grammar (M. Kay 1983), generalized phrase structure grammar (Gazdar *et al.* 1985), lexical functional grammar (Bresnan 1982) and, particularly, head-driven phrase structure grammar (Pollard and Sag 1994), among several others within the broad family of so-called unification-based approaches (Shieber 1986). We will introduce the CG system of representation, mostly through illustration and informal discussion, in later sections of the paper.

The particular construction with which we are centrally concerned in this paper is the one which determines those aspects of form and meaning that are shared by each of the sentences in 3.

(3) a. What is this scratch doing on the table?
b. What do you think your name is doing in my book?
c. I wonder what the salesman will say this house is doing without a kitchen.
d. I don't suppose the police had anything to say about what their so-called detective thought the footprints were doing under the bedroom window.
e. What is it doing raining?
f. 'What's a nice girl like you doing in a place like this?'
g. What am I doing reading this paper?

We will call this the *What's X doing Y?* construction (WXDY), though we need to point out potential sources of confusion in the name.[4] The name we have given the construction has the form of a main-clause question with a single clause, but (i) the construction licenses embedded interrogative clauses as well as main-clause questions, as in example 3c, and (ii) it may accommodate a long-distance dependency between *what* and *doing*, as in 3d.

2. Arguments for the existence of a *What's X doing Y?* construction. Since many of the properties that concern us are also found in unlimitedly many sentences of English which are not instances of our construction, we need to make the case that there is a single independent construction needed for licensing the sentences in 3. There are two steps in building this argument. First, we show that there are specific semantic interpretations associated by convention with just such sentences, interpretations that are neither given by ordinary compositional processes nor derived from a literal meaning by processes of conversational reasoning. Second, we demonstrate that sentences which carry such interpretations are subject to a special array of morphosyntactic constraints.

2.1 The interpretational features of *What's X doing Y?* The question of the meaning of this special construction may be approached by considering the ambiguity underlying an old joke

(4) Diner: Waiter, what's this fly doing in my soup?
Waiter: Madam, I believe that's the backstroke.

The diner's utterance is open to two interpretations and the joke turns on the waiter's pretense of having chosen the wrong one. In the interpretation feigned by the waiter, the diner presupposes that the fly is engaged in some activity – that is, that it's DOING something – and requests that the waiter inform her regarding the nature of this activity. In the interpretation intended by the diner, she was not asking an innocent question regarding an ACTIVITY on the part of the fly in her soup but was indicating that something is INCONGRUOUS about there being a fly in her soup at all. Recognizing this interpretation, we find that the diner's utterance can be fairly paraphrased by 5a but not by 5b.

(5) a. How come there's a fly in my soup?
b. What's this fly in my soup doing?

Note that we chose to paraphrase the intended interpretation 5a with the (colloquial) interrogative *how come*. *How come* questions do more than request explanations and in this way they go further pragmatically than *why* questions. A question like 6a is an unadorned request for an explanation of the buoyancy of wood, but a question like 6b adds to this the idea that the questioner finds the buoyancy of wood to be surprising, puzzling, inappropriate, or, as we will say, *incongruous*.

(6) a. Why does wood float?
b. How come wood floats?

We will argue that, as a part of the grammar of English, the *What's X Doing Y?* construction, like the *How Come* question construction, directly encodes, in addition to a request or demand for an explanation, the pragmatic force of attributing what we call INCONGRUITY to the scene or proposition for which the explanation is required.

2.2 The interpretational source of *What's X doing Y?* sentences. It might be argued that the incongruity reading of the backstroking fly example 4 is derivable by conversational implicature from a literally intended question. Since to most people, the struggles of a fly floating on its back in a liquid are recognized as an attempt to escape, asking what the fly is 'doing' has to be seen as uncooperative and thus – or so this explanation would go – gives rise to the implicature that the diner is really drawing attention to the incongruity of the scene. And given this particular incongruity (a fly is an unwelcome ingredient in a soup), this would have to be heard as a complaint about the restaurant and its service.

The model for such reasoning might be the utterance of a sentence like 7, which in its context could conventionally implicate a judgment of disapproval on the part of the speaker.

(7) Look what your children are doing in my garden.

The sentence draws attention to the activities of the addressee's children and, if such activities – such as digging trenches – should be unwanted, may lead the addressee to conclude that the speaker wishes to express disapproval. But this is not a necessary interpretational feature of the sentence itself. In other contexts the speaker might be conveying nothing of the sort: consider example 8.

(8) Look what your children are doing in my garden. How adorable!

By contrast, the incongruity judgment arising from WXDY morphosyntax is not in the same way subject to contextual modification. Consider the interpretive chaos engendered by the following example, in which the speaker expresses in the second sentence an attitude at odds with the attitude revealed in the first.

(9) What are your children doing playing in my garden? How adorable?

Secondly, implicatures derive from a confrontation of literal interpretations with contexts, but many WXDY sentences (e.g., 3 a, b, c , d, e) have no literal reading at all. A scratch, a name, a house, etc. can not be literally said to be 'doing' anything.

A third reason for rejecting the conversational implicature account is provided by examples like the following:

(10) In a conversation between members of a criminal defense team.
"How are we going to deal with our client's confusing account of *what the photographs were doing in his brief case*?"

The italicized clause represents a WXDY construct. The problem for the interpreter is: whose judgment of incongruity (of the photographs being in the defendant's briefcase) does the sentence express. It cannot be attributed to the speaker or the addressee of the sentence, or to the defendant, all of whom need to believe, or to present themselves as believing, that there is nothing out of the ordinary in this state of affairs. The sentence recognizes that somebody – the judge or the jury – might detect an incongruity in this situation, but such a judgment is not attributable to any individual associated with the sentence itself.

While the WXDY construction may have had its origin in conversational implicature – through situations in which an individual A is clearly up to no good and B asks what A is doing – the semantics of incongruity is now CONVENTIONALLY associated with the special morphosyntax of WXDY constructs.

2.3 Grammatical evidence for constructionality. Expressions that we take to be instances of the WXDY construction have several idiosyncratic morphosyntactic properties. First, they must contain the verb *do*. Example 11a has both the innocent question reading and the incongruity reading ('How come she was under the bed?'), but without contextual support, the incongruity interpretation is lacking in the b and c examples.

(11) a. What was she doing under the bed?
b. What activity was she engaged in under the bed?
c. What act was she performing under the bed?

Secondly, the verb *do* in such sentences always appears in the present participle form. Compare the examples in 12 with those in 3.

(12) a. *What does this scratch do on the table? (bare stem)
b. *What has your name done absent from the list of contributors? (past participle)
c. *I wonder what the salesman will say this house does without a kitchen. (simple present tense)
d. *I don't suppose the police had anything to say about what their so-called detective thought the footprints did under the bedroom window. (simple past tense)
e. *What does it do raining?
f. What does a nice girl like you do in a place like this?
g. *What do I do reading this paper?

Note that while example 12f is a grammatical sentence, it is not an instance of the WXDY construction: it does not by convention receive an incongruity reading.

Third, while in superficially similar sentences the verb form *doing* may appear as a complement to verbs other than copula *be,* this is not possible with the *What's X doing Y?* construction. Examples 13a and 13b have similar readings if they are taken as innocent questions, but only example 13b, in which *doing* appears as a complement of copula *be,* permits the constructional reading.

(13) a. What did he keep doing in the tool shed?
b. What was he still doing in the tool shed?

Fourth, although the interpretation of a present participle governed by the copula is ordinarily that of progressive aspect, this may well not be the case in the *What's X doing Y?* construction. This construction can express an attribution of incongruity to events or states whose ordinary forms of expression are notoriously resistant to simultaneous expression of progressive aspect, as in 14. Apparently, the encoding of progressive aspect is not a necessary part of WXDY sentences.

(14) a. What's he doing knowing the answer?
b. *He is knowing the answer.
c. What's that scratch doing on the table?
d. *That scratch is being on the table.
e. *The table is having a scratch on it.

Fifth, the interrogative pronoun in the *What's X doing Y?* construction does not accept *else.* Consider the examples in (15).

(15) a. Why are you eating cold pizza?
b. Why else are you eating cold pizza?
c. What are you going to tell her?
d. What else are you going to tell her?
e. What are you doing eating cold pizza?

f. *What else are you doing eating cold pizza?

Examples 15b and 15d show that *why* questions and ordinary *what* questions permit *else.* But example 15f shows that WXDY questions do not permit *else* (except under certain special conditions discussed in a later note).

Sixth, our construction does not permit negation of either *do* or *be*, as shown in 17a,b. Examples 16a,b show that an innocent question involving *What* and *doing* accepts negation. Examples 16c,d, negative *How come* questions, show that the problem of negation for WXDY cannot be attributed to the incongruity semantics.

(16) a. What wasn't I doing right?
b. What was I not doing the right way?
c. How come you are not doing it the right way?
d. How come my brushes aren't soaking in water?

(17) a. *What aren't my brushes doing soaking in water?
b. *What are my brushes not doing soaking in water?
c. What are my brushes doing not soaking in water?

In section 4, these and further morphosyntactic details will be incorporated into an explicit CG representation of our construction, along with a consideration of the interaction of WXDY with other constructions of English.

3. Construction grammar. In this section we will introduce some of the machinery of CG needed for representing this construction and relating it to the other constructions which combine with WXDY in licensing sentences like those in 3. We will set out the syntactic and semantic properties which define the WXDY construction and we will show how WXDY constructs like those in 3 are licensed by the interaction of WXDY with other constructions in the language.

Of course, most of the properties of the sentences in 3 are due, not to the WXDY construction itself, but to the other constructions which contribute to licensing those constructs. One of the advantages we wish to claim for a constructional and unificational approach is the abililty to demonstrate the smooth interaction of relatively idiomatic constructions, like WXDY, with the more familiar constructions in licensing the sentences of the language.

The first such construction we will examine is the English VP construction, the description of which will serve as an introduction to CG notation. The VP construction is one of a family of constructions for lexically headed phrases, each of whose members INHERITS the abstract head plus complements (HC) construction (see Figure 1). The HC construction specifies a phrase consisting of a lexical head daughter followed by one or more 'filler' daughters, where 'filler' is a phrasal role played equally by complements which appear as sisters to a lexical head and those that don't (e.g., subjects in a subject-predicate structure, and 'extracted' elements). The fillers in the HC construction, are however, marked local 'loc +'; so-called extracted constituents, as we will see below, are marked 'loc –'. [5]

FIGURE 1 ABOUT HERE

The VP construction adds to the information which it inherits from HC only that the syntactic category of the head is verbal ('cat v') and that none of the filler daughters bears the grammatical function (gf) subject (subj). When one construction inherits another, the first contains all the information of the second and – in the non-vacuous case – more. The VP construction can be represented as in Figure 2. The abbreviations (HC) and (VP), written above the box diagrams of Figure 1 and 2, provide the constructions with official labels which may be referred to by other constructions that inherit them.

FIGURE 2 ABOUT HERE

Note that all the information that appears in Figure 1 also appears in Figure 2. Since we wish to say anyway that VP inherits HC, it is possible to represent the VP construction in the formulation given in Figure 3.

FIGURE 3 ABOUT HERE

The notation 'INHERIT HC' looks like an attribute value pair, but it is not. The top line inside the box of Figure 3 simply indicates (compare Figures 1, 2, and 3) that all the properties of the HC construction are shared by the VP construction.[6]

3.1 Constituent structure of the VP construction. In Figures 2 and 3 we see two smaller boxes within a larger box, the latter also containing some writing at the top. The fact that there are two boxes within the large box would ordinarily indicate that the construction involves a mother constituent and exactly two daughters. Since in this case the second daughter box is followed by a Kleene plus, the diagram states that the construction involves a mother and at least two daughters. The left-hand box representing the lexical verb; the Kleene plus attached to the right-hand box indicates that this box can be iterated one or more times in any particular construct licensed by the VP construction. (This construction licenses the basic structure of such verb phrases as *slept soundly*, *wrote the epitaph*, *showed everyone his new shoes*.)

3.2 Headed constructions in CG. Headed constructions of English are of three main types: those that inherit HC, consisting of a lexical head followed by one or more complements; those that inherit XH, consisting of a not-necessarily-lexical head preceded by exactly one maximal phrase (either a specifier or a filler); and modification constructions, consisting of a head word or phrase which is either preceded or followed by a modifier.[7] We return to XH constructions briefly below.

The VP construction is one of four constructions that inherit HC. The other three license preposition phrases, adjective phrases and noun+complement (roughly multi-word 'n-bar') structures. All headed constructions[8] are constrained by the following four principles.[9]

(I) HEAD FEATURE PRINCIPLE (**head**):
The values of the synsem|intrinsic|syn|head path of a head daugher and its mother are shared.[10]

Since every lexical construction will have a 'synsem' attribute whose value has an 'intrinsic' attribute whose value has a 'syn(tax)' attribute whose value has a 'head' attribute, **head** will have the effect of percolating the value of the path ending in 'head' from a lexical item to the external structure[11] of a phrase headed by that item. All head values have cat(egory) {n, v, p, a,...} and lexical-head features.[12] Among the head attributes of verbs in particular are 'v(erbal)-infl(ection)' {finite, bare stem, present participle, ...}, voice {active, passive}, aux(iliary) {+, –}, and so on.[13] Max(imality) and lex(icality) are not head features; they are *level* features.

(II) SUBSET PRINCIPLE (**subset**):
Set values of a head daughter are subsets of corresponding values of its mother.

Sem(antics) values and val(ence) values are sets. Adjuncts are treated in CG in terms of valence augmentations. The **subset** principle allows the semantics and valence values of the phrasal mother to contain adjunct elements not present in the corresponding attributes of the head daughter, while at the same time requiring that all set values of the mother constituent include all the elements of the corresponding set values of the head daughter.[14]

(III) VALENCE PRINCIPLE (**val**):
A local filler daughter's synsem value is shared with the synsem value of a valence element of the mother.[15]

The **val** principle assures that all constituents appearing in local positions are in fact complements. This corresponds roughly to the coherence constraint on functional structures in LFG.[16] Valence members marked 'gf subj' and 'loc +' will unify with the subject daughter of the Subject Predicate construction (see section 3.3.3); those marked 'loc +' will unify with right sister fillers in the case of HC phrases (see section 3.3.1); those marked 'loc –' will unify with left-sister fillers in 'extraction' constructions (see section 3.5.2).

(IV) MAXIMALITY PRINCIPLES (**max**):
A. Heads are max –.
B. Fillers are max +.
C. Specifiers are max +.

The CG notion of maximality corresponds roughly to the notion of maximal projection in X-bar approaches. However, in CG it is possible, by judicious underspecification of the max feature, to avoid the empirically unmotivated stacking of non-branching constituents required by X-bar theory in cases like [$_{np}$ [$_{n'}$ [$_{n}$ she]]] or [$_{np}$ [$_{n'}$ [$_{n}$ Joe]]]. Certain lexical constituents (e.g., personal pronouns and proper names) are allowed to be max + because, lacking NP-internal sisters, they are not 'heads' and hence are not required to be 'max –'.

3.3 Valence. In a construct licensed by the VP construction of Figure 2 or 3, the head daughter and the external feature structure both have a valence attribute, 'val', since every lexical verb construction will introduce such a feature and **subset** will project it to the mother. The value of a valence attribute is a set of AVMs. We call this value a VALENCE SET and its members VALENCE ELEMENTS. It follows from **val** and **max** that all syntactically realized valence elements are max +.[17]

The valence set of the left or head daughter of the VP construction is a subset of the valence set of its mother, the VP, as assured by **subset**. The AVMs constituting the valence elements of a predicator (or its phrasal mother) represent syntactic and semantic co-occurrences of the kind usually referred to as subcatgorizational (in a broad sense, including semantics). The valence set of a lexical predicator in CG thus encodes much of the same information as the subcat or argument structure list in HPSG.

Valence elements are, thus, satisfied in one of two ways: either there is somewhere in the sentence a constituent whose external synsem value unifies with the element, or the element is satisfied by a null complement construction, which provides for its direct pragmatic interpretation.

3.4 Arguments and adjuncts. Arguments and adjuncts arise in distinct ways. Arguments are valence elements of the minimal lexical verb. In the case of the VP these are made part of the valence set of the VP by **subset**. In the sentence

(18) Marion gave Sidney some candy in the car this morning.

Marion, Sidney and *some candy* are each complements of the argument type. They are found in the valence set of the VP in 18 because this set is a superset of the valence set of the lexical verb *give,* which has agent, theme and recipient arguments specified as part of its minimal (lexical) construction.

Adjuncts are contributed by particular constructions which unify with a verbal structure, specifying additional information about both the valence value and the sem value. The phrases *in the car* and *this morning* in 18 are adjuncts.

Adjunct licensing constructions are exemplified by the Setting construction, schematically illustrated in Figure 4.[18] In unifying with a verbal constituent whose semantics already contains the scene indexed as I, this construction adds a scene, typically a locational or temporal setting, indexed as II, which takes I as an argument and adds a valence element whose semantics corresponds to II. **Subset** assures that these new semantic and valence properties percolate up the line of verbal heads. Figure 5 shows a schematic representation of the minimal verb *arrive* and Figure 6 shows the augmented verb *arrive* resulting form the unification of the structures in Figures 4 and 5, with the minimal entry for the preposition *before* (not shown) providing the circumstantial predicate. ('{ }' indicates a set of unspecified membership, not the empty set, as in HPSG.)

FIGURE 4 ABOUT HERE

In Figure 4, the scene indexed I appears as an argument (participant) in the scene indexed II.

FIGURE 5 ABOUT HERE

FIGURE 6 ABOUT HERE

3.5 Mechanisms for the satisfaction of valence requirements. Grammatical functions are typically not assigned to semantic arguments within the construction representing a minimal lexeme (e.g., *give*), but are assigned to these arguments by unification of the minimal lexical construction with such linking constructions as passive or recipient ('dative shift'). In CG the linking constructions, which assign grammatical functions and (frequently) syntactic shapes to the semantic ('thematic') requirements of a lexical predicator, play a role analogous to that of the linking theory in LFG and the corresponding mechanisms in other frameworks (e.g., Levin 1986, Bresnan and Kanerva 1989 for LFG; Davis 1996 for HPSG; see also Grimshaw 1990, Jackendoff 1990, Kiparsky 1987, Pinker 1989, Van Valin 1990, 1993). Thus, in the several examples of (19), by unifying different combinations of the transitive (a, b), passive (c, d), caused motion (a, c) and recipient (b, d) linking constructions with the valence of the appropriate forms of the verb *give*, we get the various assignments of thematic arguments to grammatical functions illustrated.

(19) a. Sidney gave some candy to Marion. (Transitive, Caused Motion)
b. Sidney gave Marion some candy. (Transitive, Recipient)
c. Marion was given some candy (by Sidney). (Passive, Recipient)
d. Some candy was given to Marion (by Sidney). (Passive, Caused Motion)

There are, of course, predicates which provide exceptions to these alternations. For example, *contribute* does not occur in the Recipient configuration of 19c,d, the passive verb *rumored* does not have an active counterpart and *resemble* has no passive version, as illustrated in 20, 21 and 22, respectively.

(20) *She contributed the Red Cross $50.
(21) *Several disgruntled advisors rumored the President to have acted rashly.
(22) *Max is resembled by a gorilla.

In CG, facts like those illustrated in (20-22) are accounted for by specifying in the minimal lexical entries for such verbs fixed links between semantic and grammatical relations. For example, a sentence like (20) is blocked by the goal argument of *contribute* being assigned an oblique grammatical function and the syntax of a preposition phrase headed by *to* in the MINIMAL lexical entry, this specification preventing unification with the Recipient (linking) construction.[19]

3.6 Valence satisfaction continued: the subject-predicate construction. The Subject-Predicate (S-P) construction exemplifies the second large family of headed constructions, those which inherit XH. These constructions contain exactly two daughters: the second is the head and the first is either a specifier, e.g., [[*the*] [answer to my question]] or a filler, e.g., [[*which book*] [she asked for]].[20] The S-P construction is shown in Figure 7.

INSERT FIGURE 7 ABOUT HERE

As a head feature, 'cat v' will be shared by the mother and the head daughter (**head**). The feature abbreviated 'srs' may be read 'subject requirement satisfied'. It distinguishes clausal structures from those with a controlled or raised subject.[21] The semantics and valence values of the head daughter of S-P are subsets of the corresponding values of the mother (**subset**). Whether the head daughter of an S-P construct is licensed by VP or by a simple lexical verb, its subject requirement is satisfied its left sister. Thus, while the VP construction interacts with the head principle to ensure that non-subject complements can be realized as right sisters of the lexical verb, the S-P construction ensures that the subject is realized as left sister to the VP (or to a lexical verb which functions effectively as a one-word VP).[22] Since the S-P subject is realized and not extracted, it is local ('loc +').

3.7 Valence satisfaction and semantic composition. Unification variables connecting the members of a valence set with elements of semantic representations control the fit between the semantics of complement constituents and the semantic representation of the sentence. Figure 8 presents a simplified version of the minimal lexical entry for *give*.[23] The sem value is a set with four members, each an AVM representing a minimal predication, consisting of a frame plus its participants or arguments (args), and each appearing with an index (I, II, III, IV). The variables A, B, C, which denote the minimal arguments, reappear in the valence elements. When the synsem values of the valence elements are unified with the synsem values of complement constituents, via **val**, the sem values of the constituents are unified with the appropriate argument positions in the external semantics value.[24] The external semantics value of the verb will, via **subset**, become a part of that of the VP and hence of the sentence.

INSERT FIGURE 8 ABOUT HERE

3.8 Left-isolation. A wide range of phenomena collected under the common term extraction are treated in CG with the left-isolation construction and the more detailed constructions which inherit it. The left-isolation (LI) construction itself is heir to the XH construction, which dominates the part of the inheritance hierarchy that includes the S-P construction. Left-isolated constructions include clauses with fronted wh constituents, topicalization structures, and similar phenomena. This topic is too extensive to be discussed fully in the present paper; the brief remarks of this section are intended merely to show how certain left-isolation phenomena provide crucial motivation for the formulation of the valence feature and to provide background for later discussion of the *What's X doing Y* construction, which, because of some of its internal properties, always occurs in interaction with a left-isolation structure.

The conception of long distance dependency in CG differs from that of GB. Long distance dependencies are conceived in CG in a way rather like the notion of functional uncertainty in LFG (Kaplan and Zaenen 1989), in that a long distance dependency is considered as obtaining, not between a constituent and a gap (an unoccupied site in the constituent structure where the 'displaced' constituent would otherwise occur), but rather between the constituent and an element which is not part of the *constituent* structure of the sentence at all. In the functional uncertainty case the item to which the extracted constituent is related is a functional structure; in the CG case, it is a valence element. Pollard and Sag (1994: 376ff) propose a gapless approach to extraction for HPSG, which involves removing the slashed item from the valence list. In all these approaches, the left-isolated ('moved') element is interpreted as a constituent directly satisfying a complement or adjunct function, rather than as a constituent coindexed with an inaudible trace which in turn satisfies the function.

3.9 The left isolation construction: preliminaries. The left-isolation construction is defined as a verbal structure with two daughters in which the external AVM of the left daughter unifies with some valence requirement WITHIN the right daughter.[25] The valence set in question may, but need not, be the valence set in the external synsem of the right daughter. If it is not, then a long distance dependency obtains between the left-isolated constituent and the valence element (somewhere within the right daughter) with which it unifies.

To develop this idea more precisely, along with some notation to express it, it will be useful to define two simpler concepts. Recall that an AVM a_1 is a VALENCE REQUIREMENT of another AVM a_0 iff a_1 is a member of the valence set of a_0.

Suppose now we have three AVMs a_0, a_1 and a_2, where a_1 is a valence requirement of a_0 and a_2 is a valence requirement of a_1. We have in mind such sentences as

(23) What do you think she asked him to do?

Since *what* satisfies a valence requirement of *do*, it can also be seen as satisfying a valence requirement of a valence requirement of *asked* and a valence requirement of a valence requirement of a valence requirement of *think*. We would like to have a more succinct way of talking about the relation of a_2 *what* to a_0 *think*, and also to have a clear way of talking about the general case, in which there is an arbitrary sequence of AVMs intervening between a_0 and a_n, each AVM in the sequence being a valence requirement of the preceding one. In such a circumstance we will want to say that a_n is an EMBEDDED VALENCE REQUIREMENT of a_0. More precisely, an AVM a_n is an EMBEDDED VALENCE REQUIREMENT AT DEPTH N of a distinct AVM a_0 iff a_0 and a_n are members of a sequence of AVMs $<a_0, a_1, \dots, a_n>$ such that, for $1 \le i \le n$, a_i is a valence requirement of a_{i-1}.[26]

Though we will not have occasion in this paper to specify any particular numerical depth of valence embedding, we will be interested in the idea of one AVM being an embedded valence requirement of another at an arbitrary depth. In place of saying of two AVMs that 'a_n is an embedded valence requirement of a_0 at an arbitrary depth', we will just say that 'a_n is an embedded valence requirement (or element) of a_0'.

We use the concept of an embedded valence element (at an arbitrary depth) in formulating the Left Isolation construction. Intuitively, in a left isolation structure there are two daughters and the left daughter (e.g., a wh-phrase) unifies with an embedded valence requirement of the right daughter. The 'arbitrary depth' feature of valence embedding is what furnishes the arbitrary distance covered by a long distance dependency.

3.10 The left-isolation construction. We want an explicit notation for valence embedding in order to represent constructions, such as left-isolation, which incorporate this notion.[27] We first define a unary operation VAL on feature structures such that for two feature structures $[_\pi]$, $[_\alpha]$, $[_\pi]$ equals VAL$[_\alpha]$ if and only if $[_\alpha]$ is a valence requirement of $[_\pi]$.[28]

$(24)_{def}$ $[_\pi] = \mathrm{VAL}[_\alpha]$ iff $[_\pi]$ U [val $\{[_\alpha]\} \cup \{\ \}] = [_\pi]$[29]

When $[_\pi] = \mathrm{VAL}[_\alpha]$, we say equivalently that $[_\alpha]$ is valence embedded in $[_\pi]$ at depth one. An expression such as $\mathrm{VAL}^3[_\alpha]$ will denote a feature structure of which $[_\alpha]$ is a valence member of a valence member of a valence member. Using the Kleene star notation, the expression $\mathrm{VAL}^*[_\alpha]$ denotes a feature structure in which $[_\alpha]$ is valence embedded at an arbitrary depth.

To the notion of valence embedding at an arbitrary depth we add the notion of a constraint on the embedding feature structures.[30] The following definition provides us with an explicit notation for the idea of a feature structure $\mathrm{VAL}^n[_\alpha]$ in which another feature structure $[_\alpha]$ is valence embedded at depth n, where each feature structure in the sequence of valence embeddings $VAL^{n}[_{\alpha}]$, $VAL^{n-1}[_{\alpha}]$, ..., $VAL[_{\alpha}]$ satisfies the constraint $[_{\chi}]$.

(25) For n = 0, 1, ...,

$VAL^{n}_{[\chi]}[_{\alpha}]$ =df. $VAL^{n}[_{\alpha}]$ such that $VAL^{i}[_{\alpha}] = VAL^{i}[_{\alpha}] \cup [_{\chi}]$ $(1 \leq i \leq n)$

As mentioned above, the left-isolation construction unifies its left daughter with a valence element embedded at an arbitrary depth in its right daughter.[31]

INSERT FIGURE 9 ABOUT HERE

Figure 9 says that a left isolation structure is a verbal constituent with two daughters, whose left daughter satisfies an embedded valence requirement of its right daughter. The external semantics includes the semantics of the right daughter (**subset**). In the right daughter we encounter the indication of an arbitrarily deeply embedded valence requirement which is unified[32] with the left daughter of the LI construction; this notation expresses the CG formulation of the pre-theoretical idea of unbounded dependency. Turning our attention to the left daughter, we note that it is stipulated to be non-local, contrasting, for example, with the subject constituent of the S-P construction, which is 'loc +'.

3.11 Inversion and non-subject wh-questions.[33] The WXDY examples of 3 contain VPs licensed by the VP construction, clauses licensed by the S-P construction and left isolated structures (e.g. wh-questions) which instantiate the LI construction and which are directly licensed by more specific constructions that inherit the LI construction.

The *be* of WXDY must head some kind of verb-headable phrase in order to occur in a sentence. When the *what* element of the WXDY construction occurs as the left-isolated element of an embedded question, as in 3c, the *be* of WXDY heads a VP (*is doing without a kitchen*). When, however, the *what* element is left-isolated in a main clause question and WXDY-*be* is the main verb, as in 3a, the *be* element heads an inverted clause (*is this scratch doing* ...). (When, the *what* element is left-isolated in a main clause question and WXDY-*be* is not the main verb, as in 3b, then there will be subject-aux inversion, but not involving WXDY-*be*.) The inverted structures will be of a single type: a main clause, non-subject wh-question. Thus, WXDY-*be* always occurs either as the head of a VP or in a non-subject wh-question (in which WXDY-*be* may or may not be the inverted verb).

Non-subject wh-questions, such as 26, involve both left isolation and inversion.

(26) [What] [did you put there]?

The overall structure of 26 is licensed by the Left Isolation construction and that of its right daughter by the Inversion (SAI) construction, in which the first element is a finite auxiliary and the second element is the subject. LI structures need not be questions, however, nor are the right daughters of LI structures necessarily inverted; both facts are illustrated in 27a. Furthermore, inversion may occur in clauses which do not express questions, as in 27b, and questions – in fact main clause, wh-questions – need not exhibit inversion, as in 27c.

(27) a. That much pizza I find it hard to believe even you would eat.
b. Had you told me, ...
c. Who phoned?

To summarize, non-subject wh-questions exhibit both inversion and left isolation, but each of those patterns exists independently of the other and of this kind of question. We will need to postulate a construction for the inverted clause pattern as we have done for the left-isolation pattern. Then we must represent the way in which the non-subject wh-question construction inherits the two more general constructions.

We assume a main verb analysis for English auxiliaries, according to which the complement is a verb phrase headed by a verb whose inflectional form is determined by the auxiliary (bare stem in the case of modals, etc.), and the CG equivalent of a subject-to-subject-raising interpretation of the VP's subject.[34] From this assumption and our treatment of valence satisfaction, as represented in the VP construction and the surrounding text, the most natural treatment of inverted clauses gives them a flat structure in which a finite auxiliary is the left daughter, its subject is the second daughter, and any further complements of the auxiliary – followed by clausal adjuncts – occur as subsequent daughters. It is possible, as in 28, for an auxiliary verb's sole non-subject complement to be left-isolated leaving the inverted clause with no daughters beyond the finite auxiliary and its subject.[35]

(28) [Where] [is he]?

The SAI construction, like the VP construction, inherits HC. The main features of SAI are given in Figure 10. It shows substantial similarities to the VP construction.

INSERT FIGURE 10 ABOUT HERE

The construction in Figure 10 is headed by a finite auxiliary verb, its left daughter, followed by the subject of that auxiliary and possibly other constituents (if required to meet valence needs). The external semantics includes that of the head daughter and the external valence set subsumes the valence set of the head daughter, by **subset**. (Compare the VP construction.) The external valence set also contains a subject requirement and unifies this with the second daughter – unlike the VP construction. It also provides for the possibility of additional valence requirements, the lot to be unified one by one with the rightmost Kleene expansion of daughters (**valence**). This Kleene expansion may be zero, as in 28, or may represent arguments only as in 29a, adjuncts only as in 29b, or both as in 29c.

(29) a. Is he ready ?

b. Did she really?
c. Have you learned anything interesting today?

The SAI construction, like S-P and unlike VP, is marked 'srs +', reflecting the fact that the subject is internally realized.

Leaving aside for the moment the many issues involved in the semantics of questions, almost nothing needs to be stipulated about the non-subject wh-question construction beyond the facts already noted: that its outer structure is that of LI and its right daughter's that of SAI. We need only add to this that the left-isolated element is a wh-phrase.[36] These observations are summarized in Figure 9.

INSERT FIGURE 11 ABOUT HERE

In CG the LI construction is inherited by a number of more specific constructions: interrogative-word clauses, relative clauses of several varieties, topicalization-type structures, and so on. The left-isolation construction comprises the properties that are common to many if not all long-distance dependency structures in English and as such may be thought of as constituting a theory of distant instantiation ('long distance dependency', 'extraction'). A universal or cross-linguistic 'theory of extraction' might then consist of a yet more abstract construction, which the Left-Isolation construction of English (and similar languages) would inherit.

4. Representation of the *What's X doing Y?* construction. We are now prepared to present the WXDY construction in fuller detail and to discuss its principal properties, including the way it interacts with core constructions of the grammar.

Since the WXDY construction cannot be represented as an object with fixed phrase structure, we need a more abstract representation, showing merely the governing relations that hold among its elements: (1) *be*, (2) *doing*, and (3) *what*, and the semantically contentful elements (4) *X* and (5) *Y*. In particular, *X* is the subject of *be*, *doing* is the lexical head of a complement of *be*, and *what* and *Y* are the complements of *doing*, *what* being its direct object and *Y* serving as a subject-controlled secondary predicate. By marking *what* as [loc –] we guarantee that it cannot appear in the VP headed by *doing* but only in the LI position. (Recall that VP non-head daughters are [loc +] and that the left-daughter of the LI construction is [loc –].) The relative position of *be* and *X* cannot be specified for the construction, since WXDY appears in both inverted and non-inverted (main-clause) forms. WXDY-*what* can be related to *doing* at a distance because of the potentially unbounded nature of the dependency expressed in the LI construction. In our formulation of the WXDY construction, these relationships are expressed within the valence set of an abstract phrase whose lexical head is specified as *be*.

The WXDY construction is presented in Figure 12, where recurring reference to the *Y* of "What's X doing Y?" is indicated with the unification index #1[ ] and the *X* is indicated as #2[ ].

INSERT FIGURE 12 ABOUT HERE

The construction diagrammed in Figure 12 resembles a minimal lexical construction in identifying a lexical head and semantic and valence features. However, it is not a lexical construction, not bearing the marking 'lex +'. (Recall that the lexical-head feature is a head feature, copied by **head** from lexical heads to their phrasal projections.) Treating our construction as a lexical entry for *be* – which is what we originally proposed – would in fact technically give us the same result, but it would lend itself to misleading and unnecessary locutions about a 'sense' of *be* having the incongruity meaning and 'selecting' everything else that defines the construction.[37] Rather, we see the WXDY construction as an idiomatic abstract phrase which uses the lexeme *be* and which displays the valence properties discussed above and depicted in Figure 2. The meaning of the construction is associated with the whole pattern and not with any particular lexical item within it. The fact that phrases bear valences in CG (not only lexical items) is a formal feature of the CG approach which facilititates uncomplicated representation of this kind of abstract phrasal construction.

4.1 Semantics of WXDY. In this section we trace how the representation of the WXDY construction given in Figure 12 encodes the informal semantic description of the construction which has already been sketched. In broad outline, that description is as follows. In the *What's X doing Y* formula *X* is a noun phrase, *Y* is a predicate expression and a sentence licensed by the WXDY construction expresses the idea that someone finds the proposition roughly paraphrasable as 'X is Y' as incongruous in its context. 'Roughly paraphrasable' because the form *is* is replaceable, of course, by *am*, *are*, *was* or *were*, depending on the tense of the copula and the person-and-number of the subject in the original sentence, but also because some of the predicate forms of Y do not combine with *be* but yield to paraphrases with *have*. (*You ... with that hat on*: 'You have that hat on', *You ... without shoes on*: 'You have no shoes on').

There is of course a detailed syntactic and semantic structure to the construction. In the current section we will not be concerned with justifying our analysis of this structure but merely with explaining the functioning of the notation in composing the semantics, given the assumed analysis. Subsequent sections will provide the evidence for the analysis.

On the syntactic side we take *doing Y* to be a constituent, hence a VP complement of *be*, and we reject an alternative analysis which would hold that *doing* and the *Y*-phrase are separate complements of *be*.

In Figure 12, the very large pair of curly braces encloses the valence set that controls the whole construction. At the highest level, this valence set has two elements, separated vertically within the braces. The small, upper one, standing for the *X* in our formula, is the subject of *be*.

The remainder of the symbols within the valence set of WXDY are within the second highest-level valence element, enclosed in the large pair of square brackets. This element encodes the stipulation that WXDY *be* governs a VP headed by the lexeme *doing*. (Within the syn value of this AVM the category is specified as verbal and its lexical head as *doing*). The sem value of the *doing* complement of WXDY is unified with the second arg of *be* (via #1). What this means is discussed further below. The grammatical function of the *doing* element is specified as comp(lement).

The val set of the *doing* complement (enclosed in a smaller set of curly braces) contains three elements, with grammatical functions subject, object, and complement. The first specifies a subject requirement (for *doing*) and the second specifies that the object of *doing* is *what.* (We will later discuss each of these in more detail.)

The third element of the valence set of *doing* is the *Y* element of the *What's X doing Y?* formula. It has an unspecified semantic frame, whose substance will be furnished by whatever construct instantiates this valence element. The semantic frame of this element has at least one argument, which is unified, via '#2', with the subject requirement of this same (*Y*) element (appearing in the valence set just below).

The external sem value of the *Y* element is unified (via #1) with the external sem value of the *doing* element. We noted above that the latter is also unified, via #1, with an argument in the external semantics of the construction. We will see that this is the state-of-affairs participant that is judged to be incongruous in the external semantics of the construction. So, the *Y* element furnishes the predicate of the predication which is judged incongruous. On our analysis, WXDY-*doing* functions as what we might think of as a pure copula; it absorbs and passes along the semantics of its complement (*Y*) without adding any new information such as tense, aspect or modality.

We have not yet explained how the meaning of the *X* element comes to be understood as the subject of the *Y* predicate and hence of the predication to which the WXDY construction attributes a judgment of incongruity. That story is told in section 4.2.

We turn now to the external sem value of Figure 12. The AVM constituting the unique element of this set contains a frame attribute whose value is a scene or state of affairs involving a judgment of incongruity. A frame introduced by a predicator may be thought of as a conceptual unit which is evoked (or denoted) by the predicator and which gives the overall structure to the conceptual object expressed by a clause headed by that predicator (Fillmore 1982, 1985a). The value of the arg attribute is a set whose members are the participants of the frame, often called slots in the AI literature and for most practical purposes equivalent to the arguments of a predicate.

In the WXDY construction we have an overall scene (frame) in which a JUDGMENT OF INCONGRUITY is attributed by a JUDGE (prag) to some STATE OF AFFAIRS (1#[ ]). The question of the identity of the judge is discussed below. The state-of-affairs participant is exemplified in 3a (repeated below) as something like 'There is a scratch on the table' and in 3b as something like 'Your name is in my book'.

(3) a What's this scratch doing on the table?
b What's your name doing in my book?

The unification variable #1, which denotes the state-of-affairs participant, shows up again in two other places in Figure 12. As we have seen, by this means the semantics of the *Y* element comes to furnish the organizing frame (predicate) of the full scene (state of affairs) judged incongruous in the external semantics. For example, in 3a the *Y* element is realized as the phrase *on the table* (and the *X* element, which furnishes the logical subject of this predicate, as the phrase *the scratch*.)

As previously mentioned the judge may, but need not, be interpreted as the speaker of the WXDY sentence. The holder of the judgment of incongruity in simple unembedded cases is the speaker, as in 30a, but when a *What's X doing Y?* construct appears in a context of reported speech or thought it may be attributed to the author of that context, as in 30b.

(30) a. What are you doing here?
[judge = speaker]
b. She had the effrontery to ask what I was doing there.
[judge = 'she']

It was observed in connection with example 10 that the source of the incongruity judgment need not even be a participant in the speech event or anyone explicitly mentioned in the text. In Figure 12, the judge argument is indicated as 'prag' (for pragmatic resolution). This means that the WXDY construction does not tell the interpreter how to identify the source of the judgment of incongruity but, in effect, contains an instruction that this is something one should be able to figure out for oneself.[38]

The *X* element, the subject of WXDY-*be*, will furnish the semantics for the '#2[ ]' participant of the *Y* complement, as discussed in section 4.2 below.

We have noted that the *doing* element contributes nothing to the semantics of the construction, but simply serves as a way-station between the semantics of its complement, the *Y* element, and the semantics of the state-of-affairs participant of the external semantics. In this connection, we have already mentioned that (i) utterance of a WXDY sentence does not commit the speaker to the idea that anything *does* anything – e.g., that the scratch in 3a is doing something and (ii) the *ing* ending on *doing* does not appear to carry progressive meaning, although there is no reason to supose that WXDY-*doing* is morphologically anything other than the present participle of *do*.[39]

The *what* element, which appears in Figure 12 as a syntactic requirement of *doing*, is also devoid of reference. Once we have the judgment of incongruity, the judge, and the state of affairs so judged, there is nothing left for *what* or *doing* to pick out.[40]

4.2 The subject requirements of the *Doing* and *Y* complements. In the CG analysis of English there is a coinstantiation construction which accounts for the phenomena of both raising and control by permitting unification of the 'intrinsic' value[41] of some valence requirement of a predicator p with the corresponding value of the subject requirement of a controlled complement of p.[42] This construction is given in Figure 13.

INSERT FIGURE 13 ABOUT HERE

The construction shown in Figure 13 can unify with any predicator governing a controlled complement ('gf comp', 'srs –'). It will have to be so unified because otherwise the subject requirement of the complement will remain unsatisfied.[43]

In every WXDY clause the coinstantiation construction (see Figure 13) will figure twice. Within the outer valence set coinstantiation will unify the subject, i.e., the *X* element, with the subject of the verbal complement, the *doing* VP. Within the *doing* valence set, coinstantiation will unify the subject of the complement of *doing* (the *Y* element) with the subject of *doing*. When thus unified with the subject requirement of the *Y* complement, the semantics of the *X* constituent becomes the logical subject argument of the predication, Y(X), about whose corresponding state of affairs a judgment of incongruity is conveyed by the WXDY sentence.

The two instances of coinstantiation (raising variety) in each WXDY construct do not represent a stipulation of the WXDY construction (or of anything else). A valid construct simply cannot be licensed using the WXDY construction unless coinstantiation is also used (twice) to provide for satisfaction of the subject requirements of the *doing* and *Y* elements. Raising thus operates in the VPs or inverted clauses headed by WXDY-*be* exactly as it does in sentences not involving non-core constructions. The VP, SAI and various LI constructions also operate in WXDY sentences just as they operate in sentences not involving non-core constructions. The formulation of the WXDY construction in Figure 12 does not stipulate the identity of the subjects of *be*, *doing*, and *Y*, or the syntactic position of *what*, since all of that is determined by other constructions.

4.3 The *Y* complement. The range of structures which can consitute the *Y* element is the same, or nearly the same, as the range of structures sometimes called 'secondary predicates' (*He arrived* WITHOUT THE MONEY, *She left him* GASPING FOR BREATH).

The range of syntactic categories available for this constituent is wide. Some of the possiblities are illustrated by the following.

(31) a. What is this sociologist doing in my living room?
(locative preposition)
b. What is that kid doing with my shoes on?
(absolutive preposition)
c. What are you doing without any shoes on?
(absolutive preposition [negative])
d. What are you doing with all that money?
(*with* meaning 'having')
e. What are you doing without the money?
(*without* meaning 'not having')
f. What is it doing raining on my birthday?
(verb: present participle)
g. What is she doing covered with mud?
(verb: passive participle [stative])
h. What are you doing naked?
(adjective)
i. What is she doing the winner?
(noun)

There are some fine semantic distinctions implied by these examples which are not covered by the summary labels (in parentheses). This is especially true of the *with* and *without* cases. Note for example that in a non-*What's X doing Y?* sentence like 32, *with all that money* need not mean 'having all that money' as it must in the incongruity interpretation of 31d; it may also be understood as an instrumental phrase 'using all that money', which reading is possible in example 31d, but not in the incongruity (WXDY) interpretation.

(32) What did you do with all that money?

Lakoff (1987: 498-503) discusses the semantic constraints on the secondary predicates (what he calls *final phrases*) that can occur in sentences that begin in the manner of those in (33), illustrating what he calls the "deictic *there*-construction."

(33) a. Here is Sidney ...
b. Here comes Sidney...
c. There goes Sidney...

The class of secondary predicates possible in these sentences is at least largely overlapping, perhaps identical, to those possible as the *Y* element in a *What's X doing Y?* construct. Without attempting to put too fine a point on the comparison, it is clear that the selection of comp phrases in neither construction is constrained by syntactic category.

4.4 The *doing* complement. Having argued that the properties of WXDY clauses can be accounted for by the semantic and valence properties of a complex structure headed by *be*, we have assumed that in each WXDY utterance the *doing* and *Y* parts of the *What's X doing Y?* formula constitute a single phrase which is headed by *doing* and which realizes a single element of the topmost valence of our construction. It is now time to defend this assumption, particularly against the alternative that the *doing* and *Y* phrases each realize a separate valence requirement of WXDY-*be*. For convenience we dub the (rejected) hypothesis that *doing* and *Y* are both complements of *be* as H_0 and the (accepted) hypothesis that *doing* heads a complement of *be* within which *Y* figures as a complement of *doing* H_1.

If we were to accept H_0, we would have to attribute to the *doing* element a number of unusual properties. We can avoid these stipulations with the assumption that WXDY-*doing* heads a VP. In particular, under the rejected assumption we would have to suppose that WXDY-*doing* is stipulated to be a single word VP – or else abandon the generalization that all complements are maximal. Also we would either have to propose that the semantics of *doing* was null and unify the semantics of *Y* with that of the second argument of *be* by stipulation or we would have to unify the semantics of *doing* with that of its sister *Y* by stipulation. Either way we would lose the automatic raising effect discussed in section 4.2.1. Nothing else in the grammar tells us that two sisters can share semantics, but the absorption of the semantics of a complement by a governing auxiliary or copulative verb is a well established generalization, which applies straightforwardly under H_1. Also under H_0 we have a one-word VP with a direct object that by fortunate accident has to be left-isolated. Even if there were no empirical evidence bearing on the matter, we would for these reasons prefer H_1 to H_0. H_1 allows us to simplify the WXDY construction in the sense of reducing the amount of information in it – and relying on other constructions or principles to supply that information.

The placement of focus-taking adverbial elements provides empirical evidence in favor of H_1. It has been shown that, by and large, such adverbs must appear as left sister to some constituent which contains its focus (McCawley 1987, Brugman 1986). The sentences in 34, all have a focus-taking adverb appearing to the left of WXDY *doing* while focussing the *Y* element, as does example (14)b, repeated.

(34) a. What were they even doing in the neighborhood?
b. I wonder what the key was still doing under the mat.
c. What were you only doing with one shoe on?

(14) b. What was he still doing in the tool shed?

If McCawley's generalization about focus into a right sister from a left sister is to be maintained, the *doing* and *Y* phrases must be contained in a single constituent. Therefore the *doing* and *Y* phrases cannot represent independent complements of WXDY-*be*, as posited by H_0. According to H_1, *doing* and *Y* are both daughters of a VP complement of WXDY, agreeing with the data of (34).

4.5 The *What* element. In Figure 12, the direct object of *doing*, the *what* element, cannot be realized within the VP headed by *doing* because it is marked 'loc –'. This means that *what* must occur left-isolated. Since it is a wh-type element, it fits nicely as the left-isolated element of either a main clause or embedded non-subject wh-question.

This *what* possesses the syntactic 'wh-ness' property of ordinary interrogative *what*. We can see that it is interrogative because it allows for the peculiar exclamations following left-isolated interrogative wh-items.

(35) a. I wonder what in blue blazes you wore to the opera.
b. *I saw what in blue blazes you wore to the opera.
c. *You wore what in blue blazes to the opera?
d. What in blue blazes are you doing wearing that?

Since we also want WXDY-*what* to have the semantic property of being a question indicator, we let the WXDY construction call for the independently existing lexical item (lexical construction) defining the interrogative word *what*. All the WXDY construction adds to the information coming from this inherited construction is that this constituent satifies the direct object requirement of WXDY-*doing* and that semantically it is not an operator (in the sense of binding the reference of something else). We will indicate the last property with the notation 'sem [ref ø]'. We do not have a general theory of the semantics of interrogation to propose, and this notation is not intended to suggest such a theory. It records the facts noted: that WXDY-*what* (1) has the syntax of a normal wh-item, (2) indicates a question (in a broad sense which includes embedded questions), and (3) serves no variable-binding or other referential function.

The non-referentiality of WXDY-*what* explains the resistance of WXDY clauses to *else*, noted in section 2.3.[44] The expression *what else* requests identification of an entity (*what*) in addition to or instead of (*else*) a given entity. But WXDY-*what* can't point to an entity whose identification is requested since it is non-referential.[45]

4.6 Negation. As we remarked in section 2.3, the *Y* constituent of a WXDY construct can be negated but the *doing* and *be* constituents can't.

(36) a. What are you doing not paying attention?
b. What is your homework doing not on my desk?

(37) a. *What are you not doing paying attention?
b. *What is your homework not doing on my desk?

(38) a. *What aren't you doing paying attention?
b. *What isn't your homework doing on my desk?

We have seen that the semantic frame of the WXDY construction specifies a judgment of incongruity on the part of some 'judge' and that the meaning of this frame is contextually anchored as regards the identity of the judge. That is, *What's X doing Y?* means approximately what is expressed in 39.

(39) 'Someone – you can figure out who – judges Y(X) to be incongruous'

Now what, we may ask, might the negation of such a semantic object be? Perhaps one of the following?

(40) a. 'No one judges Y(X) to be incongruous'
b. 'Someone – you can't figure out who – judges Y(X) to be incongruous'
c. 'Someone – you can figure out who – doesn't judge Y(X) to be incongruous'
d. 'Someone – you can figure out who – judges Y(X) not to be incongruous'

Of course, in our rough gloss given in 39, *judge* is the matrix verb, and if we were to take this as a serious indication of the form of a proposition expressed by a WXDY sentence that would point to 40c as the 'correct' negation of that proposition. But that is just wrong. Example 38a does not mean 41; example 38a doesn't mean anything.

(41) Someone – you can figure out who – doesn't judge it incongruous that you are paying attention.

Ordinary negation (i.e., leaving aside metalinguistic negation, which seems irrelevant here) is a function whose domain is a set of propositions. But it seems that the kind of semantic object which is conveyed by a WXDY utterance is simply not a proposition and for this reason it doesn't make any sense to attempt to negate it.

With regard to the non-negatability of the *doing* VP, we have encoded this in the WXDY construction depicted in Figure 12 by the stipulation 'neg –' in the syn value of the *doing* valence element. We have not been able to think of a way to deduce the non-negatability of WXDY-*doing* from anything else. If such a deduction were to be discovered, the WXDY construction could be improved by removing this stipulation.

4.7 Referentiality of *X*. The *X* element in a WXDY construct cannot consist of a truly expletive element 42b, a fully opaque idiom chunk 43b, a presentational introducer 44b, or a negative noun phrase 45b.

(42) a. How come we had a blizzard in August?
b. *What was there doing being a blizzard in August?

(43) a. I wonder why my leg is being pulled.
b. *I wonder what my leg is doing being pulled.

(44) a. I'll bet that's the teacher.
b. *What's that doing being the teacher?

(45) a. How come there's no milk in the fridge?
b. *What's no milk doing in the fridge?

Our formulation of WXDY in Figure 12 accounts for these observations by providing for the *Y* element to be a predicate (e.g., not a semantically empty, predicate-like expression) and making the *X* element a referential argument of that predicate.

The reason we have to say 'truly' expletive element and 'meaningless' idiom part is that there are unclear cases. For example, 'expletive' *it* in 46 sounds quite natural.

(46) What was it doing snowing in August?

This observation might be taken as evidence either for Bolinger's contention (1977: 66-88) that weather *it* is simply not expletive or as evidence for some kind of conventionalized trope according to which we can at will create AGENTIVE variants of the basic zero-adic weather predicates.

(47) a. It's trying to snow.
b. I hope it will hold off snowing until we get there.
c. I'm sure it decided to rain just to ruin our picnic.

Whereas a relatively opaque idiom such as *pulling x's leg* resists ocurrence of one of its parts as the *X*-subject in WXDY, an idiom more easily parsed semantically such as *keep tabs on* is more generous. Thus, 48 seems better than 43b.

(48) ?What were such careful tabs doing being kept on the butler?

It appears that the more readily an expletive or idiom chunk accepts a semantic construal, the more acceptable it is as the *X* element in a WXDY construct.[46] This observation is accounted for under our analysis by the fact that the *Y* part of WXDY is a genuine predicate and the *X* part is referential.

4.8 Alternative analyses. So far as we know, no detailed analysis of this construction has appeared in print. As mentioned in note 5, Pullum (1973) calls attention to the existence of the construction and points out several of its more interesting features. Stimulated by an earlier version of the present paper, Ivan Sag and Susanne Riehemann have each done an unpublished analysis in HPSG similar to the one presented here.

Two anonymous referees for Language have provided sketches of analyes in the principles and parameters tradition. Some proponents of that tradition, to judge from the remarks of these two referees, might suppose that providing a thorough analysis of the WXDY facts within that framework is a simple matter. We do not wish to claim that a complete p&p analysis of the WXDY facts is impossible in principle, if only because one can always add theoretical machinery – in any framework. We will, however, briefly discuss the analyses proposed by these two referees to make the point that attaining a satisfying p&p analysis of WXDY may not be trivial.

The first p&p analysis proposes to translate our valence analysis, which is not specified for lexical, phrasal or clausal level, into the subcategorizational properties of a special lexical item *be*. No attempt is made, however, to specify how the semantics comes about. This in itself might present an interesting challenge to the p&p analyst. Nothing is said about the unusual step of *be* subcategorizing for *doing*, which in turn subcategorizes for the Y constitutent and, possibly, for the *what*. Whereas this kind of two-level subcategorization is possible in CG, it is not possible in HPSG, for example, because of the locality principle of HPSG which limits subcategorization to synsem objects rather than signs. (Since constituency is represented outside of synsem, HPSG does not permit subcategorization for overt dependents of dependents.) Our knowledge of the p&p literature is far from perfect, but we have been able to find in it no answer to the question of how p&p might come down on the issue of permitted depth of subcategorization. Finally, the proponent of this analysis acknowledges that since WXDY *what* appears to be neither a complement of *be* nor an adjunct, it presents a problem. How does the construction license *what* if the construction is WXDY-*be* and WXDY-*be* does not license *what?*

The second p&p analysis, proposed by a different referee, is even more problematical. Rejecting the special *be* analysis of the first referee, the second proposes that the WXDY construction consists of a special lexical item *doing*. Realizing that this causes a problem in explaining the necessary presence of *be*, this referee writes, 'A form of "be" necessarily occurs as the auxiliary because main verb "doing" is only licensed by progressive "be".' Consider the following:

(49) a. He stopped/started/continued/etc. doing it.
b. She imagined/rehearsed/etc. doing it.
c. What did she propose/deny/advocate/etc. doing?

The factual claim that main verb *doing* is only licensed by progressive *be* is unfounded, as shown by 49 – as well as by 13b above. This claim is also contraverted by our argument in connection with examples 14 that WXDY-*be* is not progressive *be*. Moreover, this special WXDY-*doing* on the one hand carries the special incredulity semantics and licenses the peculiar WXDY-*what,* and on the other behaves in all other respects as ordinary, vanilla *doing*. That is, this WXDY-*doing* has special properties when needed and elsewhere has the properties of ordinary main verb *doing*. But no theory of lexical inheritance within the p&p tradition is cited by the advocate of this p&p analysis. Perhaps one exists or could be developed, but again this is not something that simply is there to be taken for granted.

We have argued in this section, not that the p&p tradition could never produce an analysis of WXDY which captures all the facts at a comparable level of explicitness to that presented here, but more modestly that (a) this would be a non-trivial undertaking and (b) the two attempts at hand are not promising. The two most obvious approches have been proposed, special *be* and special *doing*, and each is so far unsatisfactory. The first is hardly more than a promise. The p&p special *be* analysis proposed by the first referee says nothing about either the semantics of the construction or the theory of subcategorization (or other theoretical mechanism) employed in licensing *what*. The second is based empirically on the flamboyant non-fact that only progressive *be* licenses main verb *doing*. Additionally, it is not clear what could be the p&p mechanism that allows WXDY-*doing* to have just the properties of vanilla *doing* it needs and also just the constructionally special properties it needs. We do not wish to argue that the p&p approach could not in principle be expanded to deal with constructions like WXDY, only that as currently constituted the p&p framework does not appear well suited to such non-core constructions as WXDY.[47]

5. Conclusion. We began by noting that WXDY sentences, such as those illustrated in 3, display a collection of peculiarities of form and meaning that force us to posit a special grammatical object. That is, sentences like those in 3 require the grammar of English to contain some particular convention (rule, template, construction, call it what you will) which is called into play for this kind, and only this kind of sentence. Without a special convention dedicated to WXDY phenomena, there is no way to account for the fact that we can say 49 at all, much less that in saying 49 we convey that we find the uneaten state of the pizza surprising and/or undesirable.

(49) What is the pizza doing still uneaten?

Once we recognize that we need a separate construction for this and countless similar cases (Fillmore, Kay and O'Connor 1988), the question arises how a speaker constructs and interprets sentences which contain, in addition to the 'idiomatic' constructions like WXDY, all the familiar grammatical structures, such as verb phrases, relative clauses, passives, and so on. When we view the data with this problem in mind, we begin to glimpse the outlines of a grammar which allows us to extract the generalizations that most grammarians, regardless of framework, would admit are presented by the data of each language, while still being able to account for the relatively non-core phenomena like WXDY.

In the case of the interaction of the WXDY construction with the more general grammar of English, we may observe the following:

The WXDY construction itself is given in the form of an abstract phrase with a complex valence. The constituent structure of this phrase is not fixed. It is headed by the lexeme *be*. The construction depicted in Figure 12 looks rather like the depiction of a verbal lexical entry in CG, except that (1) it is marked neither for lex nor for max and so is underspecified for both lexicality and maximality (phrasehood), (2) no phonology is assigned, and (3) several of the details of the valence set are unlike those of garden variety lexical items.

The *X* member of the valence set is assigned the subject function. The constituent satisfying this requirement thus occurs wherever the subject of *be* would ordinarily occur, depending on whether *be* heads a VP or an inverted clause. The ordinary grammar of VPs, inverted clauses and subject-predicate clauses will determine this distribution. That is, once the WXDY construction designates the *X* element 'gf subj', other constructions of English take over in deciding the rest of the relevant facts of a WXDY sentence.

As we have seen, since the other two valence members are predicative complements, each will need to have its subject requirement satisfied in some way. Raising ('coinstantiation') will automatically apply twice, unifying the subject requirement of *be* with the subject requirement of its *doing* complement and unifying the latter with the subject requirement of its complement, the *Y* element. Coinstantiation (raising and control) operates in these cases in just the same way it does anywhere else. Again, the relevant aspects of WXDY sentences are seen to arise from the interaction of both exotic and non-exotic aspects of this construction with core phenomena.

WXDY-*be* always occurs in either a main clause or an embedded question. This disjunction need not be and is not mentioned in the WXDY construction. Specifying the valence requirements of WXDY as we have done in Figure 12 and simply allowing these to be satisfied by those core constructions that shape ordinary VPs and clauses accounts for all the constituent structure configurations in which WXDY is realized.

One might have supposed that the roster of idiosyncracies of the WXDY construction included the constituent structure(s) of the clauses exemplifying WXDY. Indeed, at the earliest stage of our analysis, we supposed exactly that. But further study revealed that the constituent structures of WXDY-clauses are dictated by the ordinary core constructions which license familiar subject-predicate structures, verb phrases and inverted clauses. The valence properties of WXDY are such that co-occurrence of WXDY with these core constructions produces the observed constituent structures.

We have seen that while the lexical entry *doing* which occurs in WXDY constructs is idiosyncratic, WXDY-*what* is just the ordinary interrogative *what* deprived of referential function. In general, as we study a 'special' construction such as WXDY to discover all AND ONLY the information contained in this construction, we find that we must investigate all the other constructions that are illustrated in the actual phrases and sentences which express the idiomatic construction. We must then factor out those properties of the data which are due to constructions other than the (relatively idiomatic) one under direct study and assign each of these to its appropriate construction. The investigation of the idiomatic thus involves the analyst directly in the study of the most general constructions of the grammar. One cannot analyze an idiomatic construction without simultaneously discovering and setting aside all the aspects of the data that are NOT licensed by the construction one is studying. To know what is idiomatic about a phrase one has to know what is non-general and to identify something as non-general one has to be able to identify the general. In grammar, the investigation of the idiomatic and of the general are the same; the study of the periphery is the study of the core – and vice versa.

The picture that emerges from the consideration of 'special' constructions such as WXDY is of a grammar in which the particular and the general are knit together seamlessly. The architecture of valence sets and the principles of valence satisfaction together with the inheritance of more abstract constructions by less abstract ones provide for the expression of the relevant linguistic generalizations. Constructions do not wither away[48], but many of them can be expressed as inheriting, and thus as providing restricted instances of, more general constructions.

Proceeding in this somewhat inductive fashion from the empirical particularities and patterns whose existence cannot be denied to the broader generalizations and principles that order these patterns, a construction-based approach appears to provide promise of accounting both for the relatively idiomatic and for the abstract and more fully productive aspects of a language. One advantage of such an approach to grammar is that it does not force the student of linguistic structure to ignore that large portion of language which consists of relatively local phenomena. For example, within such an approach, the idiosyncratic phenomena of WXDY and the general phenomena of raising, extraction, head-complement structures, and so on are explicitly related.

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[1] In practice, of course, there is not enough time to study all the phenomena of any single language. The point here is that the construction grammarian does not have the luxury of setting aside any specific piece of problematical data as irrelevant to grammatical theory.

[2] We use the term 'tree' here to denote a kind of mathematical object, not a particular system of visual representation of such an object. In our representations of both constructions (pieces of the grammar) and constructs (utterance-types of the language: words, phrases or sentences), we will use box diagrams in place of the more familiar labelled bracketings or branching-arc diagrams, to represent constituent structure. This is purely a matter of visual convenience, the three diagramming conventions being equivalent notations for the same abstract, graph-theoretic entity, a rooted tree. The more complex the feature structures occupying the nodes of a tree, the more the box-diagram representation promotes ease of reading.

[3] Technically, constructs have feature structures at their nodes. Strictly speaking, feature structures do not admit of unspecified values (Fillmore and Kay 1995, ch. 2, Kay in press). Consequently there are no unspecified values in the representations of constructs. Constructions, on the other hand, do permit unspecified values. We will speak of the feature-structure-like objects, possibly containing unspecified values, which occur in constructions – but not in constructs – as AVMs. This is innacurate, since an AVM is not a kind of mathematical object but a kind of representation of a mathematical object. But we think this slight inaccuracy will occasion no confusion and by accepting it we avoid having to coin or appropriate a new piece of terminology.

[4] Pullum (1973) provides the first discussion of this construction of which we are aware. That squib points out several of the unusual syntactic features of the construction and also, by implication, its non-compositional semantics.

[5] By convention AVMs are enclosed in square brackets except for the 'outer' AVM of a constituent.

[6] Superficially, it might appear that the Kleene plus in Figure 3 could be omitted, since it can be 'inherited' from HC. Technically, however, the notation with the Kleene plus has to be seen as simpler and more general than the notation without it: the former means 'one or more'; the latter means 'exactly one'. (See section 3.1.)

[7] We will have nothing to say here about modification constructions.
[8]The most obvious 'non-headed' constructions to which these principles by definition do not apply are coordinating constructions. The mechanisms for characterizing the external features of coordinating phrases are not treated in this paper.
[9]The 'principles' in the usage here can be thought of informally as obligatory constructions. Thus, the construction which unifies the head features of a mother and a head daughter is obligatory, i.e., the relationship characterizes all headed phrases.
[10]For a full treatment of CG feature geometry, see Fillmore 1996, Fillmore and Kay To Appear, ch. 5. For present purposes, the following sketch of the feature geometry of head predicators should suffice. (It differs in minor detail from the sources just cited.)

INSERT "FIGURE FOR FN. 10" ABOUT HERE

[11] We speak of the feature structure associated with the node dominating a phrase as the 'external structure' of that phrase.
[12] The value of the lexical-head feature is the name of the head lexeme. This feature is useful for identifying governed constituents in terms of their lexical heads. For example, the verb *rely* requires a PP headed by *on*; a certain collocational construction uses the verb *take* governing a NP headed by *advantage*. The latter collocation allows intervening modifiers between *take* and *advantage*, as in *take unfair advantage*.
[13] We adopt here the practice of suppressing the left ends of path expressions when no confusion can arise. Thus, 'cat v' stands unequivocally for 'synsem|intrinsic|syn|head|cat v'.

[14] The set-valued semantics for CG, sketched in P. Kay (1996a), may be a notational variant of the Minimal Recursion Semantics (MRS) for HPSG proposed in Copestake et al. 1995. The major idea of both approaches is that a semantic value is a set of feature structures, each representing a minimal predication. Every minimal predication feature structure bears an index, or HANDEL, that may occur as an argument in other minimal predication feature structures. The resulting embedding encodes scope relations. The set representation permits the notion of

'inclusion' of one semantic object within another, in particular the inclusion of the verb's semantics in that of the verb phrase and of the latter in that of the clause.

15 A *local* member of a valence set is one whose realization is neither extracted nor null. Local valence members are marked 'loc +', non-local valence members are marked 'loc –'.

16 The completeness criterion of LFG – in CG terms: the requirement that all valence requirements are satisfied – is assured by the fact that valence elements contain unspecified phon(ology), and normally also sem, values, which must be specified either by unifying with the synsem of a filler constituent or by unification with a null instantiation construction (such as the ones that supply existential quantification for the patient arguments of verbs like *eat* and *drink* in English or the one that permits non-expression of a generically interpreted object in French). CG CONSTRUCTS do not, by definition, contain unspecified values.

17 As suggested in the preceding note, there are valence requirements which are not syntactically realized, such as the missing theme and goal arguments in i.

(i) We have already contributed.

In i the theme argument is understood as existentially quantified, that is, as an indefinite null complement. The goal argument on the other hand must be definitely interpreted. Null complement constructions do not introduce traces; they obviate the need for a valence element to be syntactically and phonologically realized by furnishing the value 'null' to its syn and phon attributes.
See Fillmore 1985b, Fillmore and Kay 1995, ch. 7 for discussion for these and other types of null complement constructions.

18 The indexing of frames in the setting construction show that the head frame of the original predication is a part of the setting predication. Other adjuncts might have a 'frame elaborating' function, serving to provide details of the head frame. Thus, in addition to the setting construction as a means of augmenting a valence with adjuncts, there are several manner constructions, introducing manner adverbs, differing from each other according to whether they predicate some attitude on the part of an agent (*voluntarily*), a time-occupying act or process (*slowly*), or the like.

[19] See Fillmore and Kay (1995, ch. 8), P. Kay (1996a), Koenig (1993) for further discussion of the linking constructions of CG. The null instantiation constructions discussed in notes 17 and 18 also represent a kind of linking construction.
[20] Included in the XH hierarchy, in addition to the S-P construction, are constructions for NPs of various kinds and a wide variety of Left Isolation (extraction) structures, among others. See P. Kay (1996b). We will not show here the full network of inheritance relations for this family, nor will we show which properties of S-P are inherited and which idiosyncratic, as we did for VP. In contrasting fillers and specifiers absolutely, we have oversimplified the factored treatment of role values presented in P. Kay (1996b), in which 'specifier' and 'filler' occur as independent, possibly cooccuring, features.
[21] Structures containing 'Arbitrary PRO' subjects, such those italicized in i and ii are also 'srs +', since the subject requirement is satisfied, although not realized.

(i) It is easy *to please John.*
(ii) *To win the race* is my dream.

Srs is a level feature, that is, it occurs in the value of the level attribute. See note 11.

[22] In a sentence like i, the *swim* constituent is licensed by the lexical construction for *swim* unifying with the right daugher of the S-P construction. The VP construction is not involved in licensing any part of i, whose structure is represented by in iia, rather than iib.

(i) Tadpoles swim.
(ii) a [[Tadpoles] [swim]]
b *[[Tadpoles][[swim]]]

[23] What is given in Figure 8 as the sem value would, in a less abbreviated version, be the value of a scenes attribute. There would be other semantic attributes for entailments and presuppositions, also with set values. The scenes value is roughly analogous to the HPSG-MRS LIZST value (Copestake et al. 1995).
[24] Since Figure 5 represents a minimal lexical entry, no grammatical functions or syntactic stuctures are assigned to arguments. These assignments are achieved by unification with linking constructions.

[25] Henceforth, when we have in mind that the synsem value of the external AVM of a constituent c unifies with the synsem value of an AVM a, we will often just say that c unifies with a. This shorthand will be useful for talking about left-isolated constituents and the valence elements (which are AVMs) with whose synsem values the synsem values of the external AVMs of the former unify. For example, in a sentence like

(i) Which game did you say you saw?

we will talk about the left-isolated constituent *which game* as unifying with the object requirement of *saw*, whereas if we spoke carefully we would have to say that the synsem value of the external AVM of the constituent *which game* unifies with the synsem value of the object requirement of *saw*.

[26] Evidently, a valence requirement is also an embedded valence requirement, constituting the special case for which n = 1. That is, a valence requirement is an embedded valence requirement for which the depth of embedding is unity: the sequence of AVMs referred to in the definition is just $<a_0, a_1>$.

[27] Valence embedding is also systematically involved in the CG treatment of anaphora (see P. Kay 1994). The asymmetry condition obtaining between antecedents and anaphors, which is recognized in all grammatical frameworks, depends crucially in CG upon the notion of valence command (v-command). A feature structure α v-commands a distinct feature structure β iff there exists a feature structure γ such that α is a valence element of γ and β is valence embedded in γ. V-command is equivalent to the original version of c-command amended by the substitution of the relation is-a-valence-element-of for the relation is-a-daughter-of.

[28] We are indebted to Andreas Kathol for the formulation of valence embedding presented in this section.

[29] In definition (24), the symbol U denotes unification, a binary operation on feature structures, the symbol $\cup$ denotes union, a binary operation on sets. As previously mentioned, the symbol { } denotes a set of unspecified membership, i.e., a variable over sets. The expression $\{[\alpha]\} \cup \{\ \}$ thus denotes any set containing $[\alpha]$, equivalently, a variable over sets which contain the element $[\alpha]$. In words, (24) says that $[\pi]$ = VAL$[\alpha]$ iff the result of unifying $[\pi]$ with a feature structure whose valence set contains $[\alpha]$ is $[\pi]$, that is, iff $[\alpha]$ is a valence element of $[\pi]$.

[30]For example, in the case of an anaphor we will need to specify the domain in which it is bound (and/or free) in terms of constraints on the embedding feature structures (P. Kay 1994). The intution is the same as that of 'off-path' constraints on functional uncertainty in LFG (Kaplan, et al. 1992, Dalrymple 1993: 128f).
[31] The 'sealed' feature, a level feature (see note 11), has to do with the expression of certain island constraints. We do not discuss island constraints further here, except to draw attention to the fact that the target valence element in the LI relation cannot be in a sealed constituent, and that the LI construction itself has the value sealed +.
[32] As indicated by the two tokens of "#1".
[33]Regarding the term 'non-subject' in the name of this question type, it should be pointed out that the fronted wh-expression is not the subject of the sentence's main verb. It may be a subject of an embedded verb, however, as in *Who did you say left first?*
[34] Along the general lines of that proposed by Gazdar, Pullum and Sag (1982), based on the original insights of Ross (1969). Nothing in our analysis of WXDY turns on this assumption.
[35] Ellipsis and Tag Question can produce the same result:

(i) Is he?
(ii) He isn't home, is he?

[36]Constituents with the syntactic feature [wh +] will include interrogative words which are assigned the feature in the lexicon (*why, how, who*), NPs with interrogative determiners (*which book, whose friends*), and oblique phrases with interrogative complements (*for whom, with whose friends*), etc.
[37] An unpublished proposal of Susanne Riehemann's for representing the WXDY construction in HPSG has influenced our thinking in this regard.
[38] Much in the way that a definite determiner 'instructs' the interpreter that he or she should be able to identify the intended referent or that scalar triggers such as *let alone* and *even* 'instruct' the interpreter that the proposition(s) expressed are elements of a presupposed, contextually relevant scalar model that the addressee is in a position to identify (Fillmore, Kay and O'Connor 1988, P. Kay 1990).
[39] The careful reader may have noticed that the members of the valence set of a minimal lexical item need not all be arguments, in the sense of SEMANTIC requirements. There are indeed many idioms such as *pull x's leg* or *trip the light*

fantastic for which there appears to be no rational way to parse the meaning so that the required non-verbal elements of the VP can be construed as expressing semantic arguments of the verb. Also, for verbs like *expect* or *consider*, the CG representation of the minimal (i.e., grammatical-function-unspecified) form of these predicators will specify a member of the valence set which plays no semantic role in the governing predicator (and which will receive the object grammatical function in a transitive sentence and the subject function in a passive sentence, through unification with one or another linking construction).

[40] We prefer, however, to think of WXDY-*what* as inheriting from ordinary *what* the general semantics of 'question' – whatever that may be exactly – recalling that the semantics of a WXDY sentence must express either a main clause question or an embedded question. This requires in turn that we assume an abstract interrogative *what* lexical construction, inherited by both ordinary variable-binding interrogative *what* and the special non-referential interrogative *what* that appears in WXDY, the construction exemplified in i and ii, and perhaps others.

(i) What will become of me?
(ii) I wonder what became of June Jones?
(iii) *I want to become of a rock star.
(iv) *I want to become of it that I marry a movie star.

[41] That is, the non-relational synsem information. See fn. 11.

[42] If one of the upstairs requirements has no semantic role in the governing predicator – i.e. if its sem value is not unified with the value of any argument in the external semantics of the predicator – this argument will have to serve as the controller of the downstairs subject in order to have its semantics integrated into the semantics of the sentence. This is the case of raising. In the control case, the controlling element will play a semantic role with respect to both predicators (governor and comp) and so the correct upstairs element to serve as controller will have to be chosen in some way (if there is more than one possibility). We assume that this choice is effected according to semantic criteria, such as those suggested by Sag and Pollard (1991).

[43] Coinstantiation is unlike left-isolation in that the former unifies only intrinsic syntactic and semantic information. Relational information such as grammatical function, semantic role and morphological case are not unified in coinstantiation

but are unified in left isolation. Coinstantiation can also be modeled by specifying the unification of referential indices, rather than unification of intrinsic semantics and syntax. We do not examine that issue here.

44 Ordinarily, when querying the object of *do*, *what* has an unusual semantics anyway, asking for a VP intension rather than the expectable NP intension.

(i) What was he doing?
– Cutting the lawn
??– The lawn

But the *what* of WXDY is not in this line of work, either.

45 There are special conditions under which *else* can in fact occur in a WXDY sentence, as illustrated in

(i) A: The flags are all at half mast; someone important must have died.
B: I doubt it. I didn't hear anything like that.
A: What else could the flags be doing at half mast?

Semantically, A's response in i is similar to

(ii) Why else would the flags be at half mast?

In ii, *else* modifies (if that is the word) *why.* That is, *else* here signals an alternative reason for the flags being at half mast. The token of *else* in i has a similar semantic function: to call for an alternative justification of the flags being at half mast. In neither i nor ii does *else* signal an alternative to a participant in the event Y(X), which is what *else* would call for if it modified a referential *what.* Hence, the existence of examples like i does not undermine the argument that the inability of WXDY-*what* to be modified by *else* attests to the non-referentiality of WXDY-*what*.

46 See Nunberg, Sag and Wasow (1993) for a recent investigation of varying degrees of syntactic mutability and semantic compositionality of idioms.

47 Neither increased empirical coverage nor greater formal precision appear to be the dominant goals of current research in this tradition (Chomsky 1992, 1994).

[48] As Chomsky (1992) proposes: '... the notion of grammatical construction is eliminated ... Constructions such as verb phrase, relative clause, passive, etc., are ... taxonomic artifacts ... explained through the interaction of the principles of UG ...'

<table><tr><td><table><tr><td>role</td><td>head</td></tr><tr><td>lex</td><td>+</td></tr></table></td><td><table><tr><td>role</td><td>filler</td></tr><tr><td>loc</td><td>+</td></tr></table></td><td>+</td></tr></table>

Figure 1. Head Plus Complements (HC) Construction

cat v

role	head
lex	+

role	filler
loc	+
gf	¬subj

+

Figure 2. Verb Phrase (VP) Construction

INHERIT HC
cat v
[ ] [gf ¬subj]+

Figure 3. Verb Phrase (VP) Construction (alternative formulation)

$$
\boxed{\begin{array}{ll}
\text{cat} & \text{v} \\
\text{sem} & \left\{ \begin{bmatrix} {}^{\mathrm{I}}\ \text{frame} & [\,] \\ \text{args} & \{\,\} \end{bmatrix}, \begin{bmatrix} {}^{\mathrm{II}}\ \text{frame} & [\,] \\ \text{args} & \{\mathrm{I}\} \end{bmatrix} \right\} \\
\text{val} & \{[\text{sem } \{[^{\mathrm{II}}\ \ ]\}]\}
\end{array}}
$$

Figure 4. Setting Construction

$$\boxed{\begin{array}{ll} \text{cat} & \text{v} \\ \text{sem} & \left\{ \left[\begin{array}{ll} {}^{\text{I}}\,\text{frame} & \text{ARRIVE} \\ \text{args} & \{\text{A}\} \end{array} \right] \right\} \\ \text{val} & \{[\text{sem } \{\text{A}\}]\} \end{array}}$$

Figure 5. Minimal Entry for verb *arrive*

Unification of Figures 4 and 5 (with *before*):

$$\begin{array}{ll}
\text{cat} & \text{v}\\
\text{sem} & \left\{ {}^{\text{I}}\left[\begin{array}{ll}\text{frame} & \text{ARRIVE}\\ \text{args} & \{\text{A}\}\end{array}\right], {}^{\text{II}}\left[\begin{array}{ll}\text{frame} & \text{BEFORE}\\ \text{args} & \{\text{I, E}\}\end{array}\right]\right\}\\
\text{val} & \left\{[\text{sem } \{\text{A}\}], \left[\begin{array}{ll}\text{cat} & \text{p}\\ \text{lexical-head} & \textbf{before}\\ \text{val} & \left\{\left[\begin{array}{ll}\text{gf} & \text{obj}\\ \text{sem} & \text{E}\end{array}\right]\right\}\end{array}\right]\right\}
\end{array}$$

Figure 6. 'A ARRIVE BEFORE E'

<table>
<tr><td colspan="2">cat v
srs +</td></tr>
<tr><td>role filler
gf subj
loc +</td><td>role head

srs –</td></tr>
</table>

Figure 7. Subject-Predicate (S-P) Construction

$$
\begin{array}{ll}
\text{phon} & \text{GIVE} \\
\text{cat} & \text{v} \\
\text{lex} & + \\
\text{lexical-head} & \textbf{give} \\
\text{sem} & \left\{ \begin{array}{l} \begin{bmatrix} \text{I frame} & [\text{act} +] \\ \text{args} & \{\text{A}\} \end{bmatrix}, \begin{bmatrix} \text{II frame} & \text{RECEIVE} \\ \text{args} & \{\text{B, C}\} \end{bmatrix}, \\ \begin{bmatrix} \text{III frame} & \text{CAUSE} \\ \text{args} & \{\text{I, II}\} \end{bmatrix}, \begin{bmatrix} \text{IV frame} & \text{INTEND} \\ \text{args} & \{\text{A, III}\} \end{bmatrix} \end{array} \right\} \\
\text{val} & \left\{ \begin{bmatrix} \theta & \text{agt} \\ \text{DA} & + \\ \text{sem} & \text{A} \end{bmatrix}, \begin{bmatrix} \theta & \text{rec} \\ \text{sem} & \text{B} \end{bmatrix}, \begin{bmatrix} \theta & \text{thm} \\ \text{sem} & \text{C} \end{bmatrix} \right\}
\end{array}
$$

Figure 8. *Give* Construction (Minimal Lexical Entry)

sealed +

role	filler
synsem	#1[loc –]

role	head
sealed	–
cat	v
val	$\left\{ \mathrm{VAL}^{*}_{[\mathrm{sealed}\ -]}[\mathrm{synsem}\ \#1[\ ]] \right\} \cup \{\ \}$

Figure 9. Left Isolation (LI) Construction

inherit HC
srs +

cat v
aux +
vinfl fin

gf subj

*

Figure 10. Inverted Clause (SAI) Construction

```
INHERIT LI
[wh +]   [INHERIT SAI]
```

Figure 11. Non-Subject Wh-Question

```
syn  [cat           v ]
     [lexical-head  be]

sem  {[frame  incongruity-judgment]}
     {[args   {prag, #1[ ]}       ]}

val  { [rel [gf subj]],
       [ syn  [cat           v      ]
              [neg           –      ]
              [lexical-head  doing] ]
         sem  {#1[ ]}
         rel  [gf comp]
         val  { [rel [gf subj]],
                [rel      [gf obj]  ]
                [syn      [loc –]   ]
                [sem      {[ref ø]} ] ,
                [inherit  what      ]
                [rel  [gf comp]                      ]
                [sem  {#1[frame  []         ]}       ]
                [     {  [args   {#2[ ]}]   ]}       ]
                [val  {[rel  [gf subj]]}             ]
                [     {[sem  {#2[ ]}  ]}             ] } ] }
```

Figure 12. The WXDY Construction

$$\begin{array}{ll} \text{syn} & [\text{lex} +] \\ \text{val} & \left\{ [\text{intrinsic } \#1[\ ]], \begin{bmatrix} \text{srs} & - \\ \text{gf} & \text{comp} \\ \text{val} & \left\{\begin{bmatrix}\text{gf} & \text{subj}\\ \text{intrinsic} & \#1[\ ]\end{bmatrix}\right\}\end{bmatrix}\right\}\end{array}$$

Figure 13. Coinstantiation Construction

$$\begin{array}{ll} \text{role} & \text{head} \\ \text{synsem} & \left[\begin{array}{ll} \text{rel(ational)} & \left[\begin{array}{ll} \text{g(rammatical) f(unction)} & [\,] \\ \theta & [\,] \\ \text{case} & [\,] \end{array}\right] \\ \text{intrinsic} & \left[\begin{array}{ll} \text{syn} & \left[\begin{array}{ll} \text{head} & \left[\begin{array}{ll} \text{lexical-head} & [\,] \\ \text{cat} & [\,] \\ \ldots & \end{array}\right] \\ \text{level} & \left[\begin{array}{ll} \text{max} & [\,] \\ \text{lex} & [\,] \\ \ldots & \end{array}\right] \end{array}\right] \\ \text{sem} & [\,] \end{array}\right] \end{array}\right] \\ \text{val} & \{\,\} \\ \text{phon} & \langle\,\rangle \end{array}$$

(Figure for **Fn. 11**)