

# English Filler-Gap Constructions\*

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## 1 Introduction

In the tradition of transformational grammar, the term ‘(grammatical) construction’ has been a theoretical taboo at least since the 1980s. It was then that Chomsky argued that transformations like ‘passive’ and ‘raising’, common in earlier versions of transformational grammar, should be eliminated in favor of general conditions on structures that would allow a single operation – ‘Move NP’ – to do the work of a family of such transformations. This guided the subsequent evolution of transformational theory, where one finds discussion of even more general operations, such as ‘Move  $\alpha$ ’ or simply ‘Move’. This evolution from construction-specific rules to proposals focused on general principles from which the idiosyncrasy of individual constructions are supposed to be derived is universally heralded by practitioners of GB or ‘Minimalism’ as a significant positive step in the evolution of linguistic science.

However, as noted already by McCawley (1988a), the centerpiece of Chomsky’s (1986) argument – his discussion of the passive construction – did not touch on crucial issues such as the participial verb morphology, the choice of the preposition *by*, and the role of the verb *be*. McCawley pointed out that these properties of the construction followed from nothing under the more ‘explanatory’ proposals made by Chomsky, whose analysis of passivization, when complete, was comparably stipulative to the ‘construction-based’ transformational alternative it sought to replace. Yet Chomsky (1993: 4) writes as follows, fomenting an anticonstructionist bias throughout the generative world that remains alive and well even today:

[In a Principles-and-Parameters approach,] the notion of grammatical construction is eliminated, and with it, the construction-particular rules. Constructions such as verb phrase, relative clause, and passive remain only as taxonomic artifacts,

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collections of phenomena explained through the interaction of the principles of UG, with the values of the parameters fixed.

The ‘interaction of principles’ envisaged by Chomsky to this day remains elusive. Despite often-repeated rhetoric, the proposals made within mainstream generative grammar continue to be insufficiently precise, heavily dependent upon theory-internal assumptions that cannot be independently established, and, in many cases, empirically defective once they are made precise enough to test.<sup>1</sup>

Equally problematic is the distinction Chomsky has drawn between ‘core’ phenomena and the ‘periphery’ of language. The core phenomena are meant to be ‘pure instantiations of Universal Grammar’, while the periphery consists of ‘marked exceptions (irregular verbs, etc.)’ (see Chomsky and Lasnik 1993). The move away from constructions thus leads to the study of ‘Core Grammar’ and to the systematic exclusion of other phenomena.

But how are we to know which phenomena are core and which are peripheral? The literature offers no principled criteria for distinguishing the two, despite the obvious danger that without such criteria, the distinction risks becoming either vacuous or else a legitimization of analyses that are insufficiently general or otherwise empirically flawed. There is the further danger that grammatical theories developed on the basis of ‘core’ phenomena may become disconfirmable only by examining data from the periphery – precisely the data that are ignored by researchers working under these assumptions.<sup>2</sup>

In addition, the shift to a focus on an arbitrarily delimited subset of grammatical phenomena (those that relate to the principles of UG, a notion whose particulars are seldom, if ever made precise and which have been assumed to be in considerable flux over the past few decades) has led to a loss of both precision and descriptive coverage within the practice of modern generative grammar. Indeed, since the 1960s,<sup>3</sup> no large-scale, internally consistent transformational grammar has (to my knowledge) been written for any human language. This remarkable fact is a consequence of both a general perception in the field that such large-scale descriptions are irrelevant for theoretical purposes and the research community’s lack of interest in the development of applications (e.g. linguistically precise language engineering technology), which would require that more attention be paid to matters of scale and consistency.

Even though work in ‘Construction Grammar’ is often associated with data-driven or exemplar-based models of language learning, I will demonstrate that there is in fact no inconsistency between the concern for general principles of grammar (even Universal Grammar in Chomsky’s sense) and a construction-based approach to grammatical description. While it remains true that the ‘standard theory’ transformational grammars that Chomsky disparages in the above quote failed to provide a basis for expressing generalizations over construction-specific transformations, there are nonetheless other, well-developed frameworks for the study

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<sup>1</sup>For critical discussion substantiating these defects, see, for example, Johnson and Lappin 1999, Postal 2004, and Seuren 2004.

<sup>2</sup>For further arguments that the core-periphery distinction is both unmotivated and largely inconsistent with more realistic models of language learning, see Fillmore et al. 1988, Kay and Fillmore 1999, Jackendoff 1997, Culicover 1999, and Culicover and Jackendoff 2005.

<sup>3</sup>In the 1960s, there were attempts to develop consistent fragments of transformational grammars for English. However, these efforts were of limited scope and had little or no impact on mainstream generative theory.

of grammar that have explored novel ways of expressing cross-constructive generalizations. These ideas, e.g. object typing, inheritance hierarchies, constraint inheritance, etc., are well known in computational linguistics, indeed in computer science generally. However, they have been systematically ignored in the transformational mainstream of generative grammar.

In this paper, I will draw on these resources to sketch the beginnings of a construction-based theory of English filler-gap (FG) constructions. I will touch briefly on auxiliary ‘inversion’ constructions and simple declarative clauses before focusing on FG clauses, including interrogatives, relatives, exclamatives, ‘topicalizations’, and the *the*-clauses that appear within comparative conditionals. The account sketched here (and in more detail for interrogative constructions in Ginzburg and Sag 2000) uses feature structures to model linguistic entities of all kinds. This system of feature structures, classified in terms of hierarchically organized **types**, allows constraints of varying grain to be stated naturally, reflecting the fact that the constructs of natural language come patterned into classes whose members bear a ‘family resemblance’ to one another.

The system that emerges from this perspective allows both generalization and idiosyncrasy in the construction space to be accounted for. In the process, it expands the descriptive and explanatory base of grammatical theory to include both ‘core’ and ‘peripheral’ phenomena. As will become apparent, there are pervasive grammatical generalizations that cut across this distinction, however it is drawn.

## 2 Some Clausal Constructions of English

Early work in Head-Driven Phrase Structure Grammar (HPSG)<sup>4</sup> adapted multiple inheritance hierarchies, already used in computational work in knowledge representation and object-oriented programming, to express cross-classifying generalizations about words. This same general approach has subsequently been applied in various ways to the grammar of phrases by other linguists. Notable examples of such work are Hudson’s (1990, 2000) Word Grammar, the construction-based variety of HPSG developed by Sag (1997) and Ginzburg and Sag (2000), and the variety of ‘Construction Grammar’ developed around Berkeley, beginning in the 1980s (see Fillmore et al. 1988, Fillmore 1999, Kay and Fillmore 1999, and Goldberg 1995).<sup>5</sup> In all of these traditions, generalizations about constructions are expressed through the interaction of a hierarchical classification of types and the type-based inheritance of grammatical constraints.

In addition, as argued by Johnson and Lappin (1999), there are certain kinds of cross-linguistic generalizations that are difficult or impossible to state in a grammar lacking the notion of construction type. Moreover, Pollard and Sag (1994) and Ackerman and Webelhuth (1998) have observed that a type-based system of grammar can embody the claim that certain types are part of a universal inventory (making strong nativist assumptions along the lines of Chomsky’s UG). Alternatively, Ackerman and Webelhuth discuss a notion of *archetype* – a recurrent type in human languages that emerges in response to more general functional and

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<sup>4</sup>See, for example, Flickinger et al. 1985, Flickinger 1987, and Pollard and Sag 1987.

<sup>5</sup>See also Zwicky 1994, Kathol’s (1995, 2000) analysis of German clause types, as well as the proposals made in Culicover and Jackendoff 2005.

cognitive factors, yet is not ‘hard-wired’, as such.<sup>6</sup> These are significantly different views of UG, but both are compatible with the view that grammars are based on the notion of construction, explicated in terms of feature structures, types, type hierarchies, and type constraints.

## 2.1 Auxiliary-Initial Clauses

The type-based approach to constructional analysis also has the advantage that it allows generalizations of varying grain to be expressed naturally. For example, Fillmore (1999) points out<sup>7</sup> that English has various kinds of aux-initial clauses, including the exclamatives in (1), the ‘blesses, wishes and curses’ in (2), the conditionals in (3), polar interrogatives like (4), obligatorily elliptical clauses like (5), and so forth:

- (1) a. Boy, *was I stupid!*  
b. Wow, *can she sing!*
- (2) a. May they live forever!  
b. May I live long enough to see the end of this job!  
c. May your teeth fall out on your wedding night!
- (3) a. *Were they here now*, we wouldn’t have this problem.  
b. *Should there be a need*, we can always call for help.
- (4) a. Were they involved?  
b. Can she sing?
- (5) a. So *can I!*  
b. We won’t have to go, *will we?*

These examples clearly instantiate distinct constructions, each involving a language-particular correlation of aux-initial form with a particular semantic function, as well as other kinds of idiosyncrasy. Yet these constructions constitute a family, in that they exhibit a ‘family resemblance’, as described in (6):

- (6) a. The head daughter is an initial, finite, auxiliary verb.  
b. The subject is realized in the position immediately following the auxiliary.  
c. The head daughter may not be an auxiliary like *better* (*\*Better I/we do that now?*), which otherwise patterns like a finite auxiliary verb (*You better (not) (leave).*).

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<sup>6</sup>For a similar, compatible view, see Langacker 1991.

<sup>7</sup>See also Newmeyer 1998: 46–49.

- d. The head daughter may be an otherwise non-occurring finite auxiliary like first-person *aren't* (*Aren't I allowed to go?* vs. *\*I aren't allowed to go.*).

Ginzburg and Sag (2000) [henceforth GS-00], building on the discussion of Fillmore (1999), provide an analysis of these constructions in terms of a multiple-inheritance hierarchy of phrasal types. The proposal presented here simplifies the analysis of GS-00 in terms of the closely related framework of Sign-Based Construction Grammar (SBCG) outlined in Sag 2007. In SBCG, **words** and **phrases** are modeled as **signs** (*sign* is a type of feature structure reflecting a grammatically induced correspondence of sound, syntactic category, meaning, and/or contextual conditions). Signs include specifications for the features PHONOLOGY (), SYNTAX (SYN), SEMANTICS (SEM), and CONTEXT (CNTXT), whose values are as shown in (7):<sup>8</sup>

$$(7) \quad \left[ \begin{array}{ll} \textit{sign} & \\ \text{PHON} & \textit{phonological-object} \\ \text{SYN} & \textit{syntactic-object} \\ \text{SEM} & \textit{linguistic-meaning} \\ \text{CNTXT} & \textit{context-object} \end{array} \right]$$

More precisely, a sign is a function that maps each appropriate feature to an appropriate value, each of which is complex. That is, the value associated with each feature shown in (7) is another functional feature structure, which maps a different set of of features onto appropriate values (some of which may be atoms like +, −, or **accusative**).

A construction, by contrast, is a constraint defining a class of mother-daughter configurations.<sup>9</sup> These configurations are modeled as feature structures of a different type, called **construct**. A feature structure of this type is a function mapping the feature MOTHER (MTR) to a sign and the feature DAUGHTERS (DTRS) to a list of signs.<sup>10</sup> We may represent such functions in the same format we used in (7), i.e. as in (8):

$$(8) \quad \left[ \begin{array}{ll} \textit{construct} & \\ \text{MTR} & \textit{sign}_0 \\ \text{DTRS} & \langle \textit{sign}_1, \dots, \textit{sign}_n \rangle \end{array} \right]$$

While feature structures of type *sign* model conventional sound-meaning correspondences, different types of feature structures model various kinds of linguistic information that are relevant to the system of grammar that determines which signs are well-formed.

Sign well-formedness in SBCG is defined by the following principle:

<sup>8</sup>A complete list of the feature and type abbreviations used in this paper is provided in Appendix 2.

<sup>9</sup>Sag (2007) posits two kinds of construction: combinatory constructions (defining classes of constructs) and lexical class constructions (defining classes of lexemes or words). I will have nothing to say here about lexical class constructions.

<sup>10</sup>A list of elements can also be treated as a function whose domain is the features FIRST and REST.

(9) **Sign Principle:**

Every sign must be lexically or constructionally licensed, where:

a sign is lexically licensed only if it satisfies some entry in the lexicon, and  
a sign is constructionally licensed only if it is the mother of some construct.

The constructions of the grammar thus interact with the lexicon to impose constraints on sign well-formedness. The sentences defined by an SBCG are those well-formed signs whose category includes the specifications appropriate for a finite, root, verbal projection.<sup>11</sup> An SBCG thus defines a set of derivations that can be represented as trees, much like the derivations of a Context-Free Grammar. However, the labels on the nodes of these trees are not monadic category names (NP, S, V, etc.), but rather feature structures of type *sign*.<sup>12</sup>

As already noted, natural language generalizations typically manifest themselves along varying analytic grains. This fact is modeled precisely in a hierarchical type system, where idiosyncratic constraints can be imposed by an individual construction itself, while constraints of full generality or of intermediate grain can be stated in terms of appropriate superordinate types, e.g. *construct* or any of the subtypes of *construct* that the grammar recognizes. The types relevant to English auxiliary inversion are included in a hierarchical organization of the construct types, part of which is sketched in (10):

- (10) a. *phrasal-construct* (*phr-cxt*) and *lexical-construct* (*lex-cxt*) are immediate subtypes of *construct*.
- b. *headed-construct* (*hd-cxt*) and *nonheaded-construct* (*nhd-cxt*) are immediate subtypes of *phr-cxt*.
- c. *aux-initial-clause* (*ai-cl*), *filler-head-clause* (*filler-hd-cl*), and *head-functor-construct* (*hd-func-cxt*) are immediate subtypes of *hd-cxt*.

Each subtype of *construct* in (10) defines the domain of some grammatical property or constraint. The type *phrasal-construct* is used to pick out a class of constructs which (as opposed to lexical constructs) are used to build phrases. That is, the MTR value of any feature structures of type *phr-cxt* must be of type *phrase*. The type *hd-cxt* distinguishes headed phrasal constructs from others. This is done in terms of the feature HD-DTR, whose value (a sign) is identified with a particular member of the DTRS list. Different kinds of headed-construct, corresponding to the various subtypes of the type *hd-cxt*, correspond to a more or less traditional taxonomy of local dependency relations between the head-daughter and its sister(s).

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<sup>11</sup>This must be specified for an SBCG, just as a CFG includes a specification of the ‘start’ symbol.

<sup>12</sup>Here I forego discussion of certain points of detail. For example, I follow GS-00 in assuming that elliptical utterances (e.g. *With a spoon.*) are analyzed as a finite clause. This predicts that such expressions can be embedded in clause-embedding constructs (e.g. *I think with a spoon*), etc. For further aspects of the general framework of SBCG, see Sag 2007.

An important constraint associated with headed constructs is the Head Feature Principle (HFP), which requires the mother’s syntactic category to match that of its head daughter. This constraint, which is the ‘X’ part of ‘ $\bar{X}$  Theory’, can be formulated as follows:<sup>13</sup>

(11) **Head Feature Principle:**

$$hd\text{-}cxt \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \text{SYN} \quad \left[ \text{CAT} \quad X \right] \right] \\ \text{HD-DTR} \quad \left[ \text{SYN} \quad \left[ \text{CAT} \quad X \right] \right] \end{array} \right]$$

The HFP works in tandem with a constraint specifying the general properties of aux-initial clauses, that is the following constraint governing all feature structures of type *auxiliary-initial-clause*:

$$(12) \quad ai\text{-}cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \text{SYN} \quad \left[ \text{VAL} \quad \langle \rangle \right] \right] \\ \text{DTRS} \quad \langle X_0, X_1, \dots, X_n \rangle \\ \text{HD-DTR} \quad X_0 : \left[ \begin{array}{l} \text{word} \\ \text{SYN} \quad \left[ \text{CAT} \quad \left[ \text{INV} \quad + \right] \right] \\ \quad \quad \left[ \text{VAL} \quad \langle X_1, \dots, X_n \rangle \right] \end{array} \right] \end{array} \right]$$

In this type of construct, the head daughter must be an invertible word, i.e. a finite, auxiliary verb whose lexical entry allows resolution to [INV +]. The sisters of the head daughter are identified with the elements of the latter’s VALENCE (VAL) list. Since the mother’s VAL list is empty (i.e. the mother of an aux-initial clause must be [VAL  $\langle \rangle$ ]), the mother can select no further valents. These constraints can be thought of in terms of a ‘bottom-up’ procedure that ‘cancels off’ all the valents of the head daughter so as to ‘saturate’ its valence (i.e. subcategorization) requirements, but the static nature of the constraint ensures that it can equally well be regarded as part of a ‘top-down’ procedure that introduces valents, adding corresponding elements to the head daughter’s valence list. The static nature of constructions makes them useful for parsing and generation algorithms that blend ‘top-down’ and ‘bottom-up’ strategies with probabilistic assessments of ‘goodness of fit’ in an effort to model human sentence processing, which we know is incremental, flexible, and highly integrative (for further discussion of this point, see Sag and Wasow in press).

The constraint in (12) predicts the common properties of aux-initial clauses given in (6), assuming that (1) the grammar of words ensures that [INV +] elements are all [AUX +] and finite [VFORM *finite*], (2) finite auxiliaries like *better* are lexically specified as [INV –], and (3) auxiliaries like first-person *aren’t* are lexically specified as [INV +], rendering them compatible with aux-initial clauses, but incompatible with, for example, the Subject-Predicate

<sup>13</sup>Variables such as  $X, X_1$ , and  $Y$  range over feature structures in the constructions and other constraints that are formulated here.  $\Sigma$ -variables and  $L$ -variables range over sets and lists of feature structures, respectively. A colon indicates that the immediately following constraint must be satisfied by all values of the immediately preceding variable, i.e. it introduces a restriction on a variable.

Construction, discussed below. For further discussion of such idiosyncrasies, see Sag to appear and the references cited there.

Against this background of construct types, we can now introduce the the Polar Interrogative Clause construction into the grammar:

(13) **Polar Interrogative Clause:**

$$pol-int-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} \text{SYN} \quad \left[ \text{CAT} \quad \left[ \text{IC} \quad + \right] \right] \\ \text{SEM} \quad \lambda \{ \} [\mathbf{FR}_p(X_1, \dots, X_n)] \end{array} \right] \\ \text{DTRS} \quad \left\langle [\text{SEM } X_1], \dots, [\text{SEM } X_n] \right\rangle \end{array} \right]$$

Here  $\mathbf{FR}_p$  is a function that maps a set of meanings (some of which are functional) into a proposition (a semantic object of type  $p$ ). The functional realization  $\mathbf{FR}_\alpha$  of a set of meanings  $\Sigma$  is obtained by applying a unary functor expression in  $\Sigma$  to some other member of  $\Sigma$  and then applying the resulting function to a distinct member of  $\Sigma$ , and so forth, until all remaining members of  $\Sigma$  have become arguments and the resulting function is of type  $\alpha$ . This sometimes gives more than one result and is sometimes undefined.<sup>14</sup>

I assume, following GS-00,<sup>15</sup> that the meaning of a question is a propositional abstract, i.e. a function from sets of entities to propositions, representable via lambda abstraction over sets of entities of various kinds. I will refer to these entities, which can be individuals, times, places, properties, or higher order entities (depending on the interrogative *wh*-word involved) as ‘parameters’. A *wh*-interrogative clause like *Who left?* denotes a function from singleton sets of individuals to propositions ( $\lambda \{x\}.\mathbf{left}(x)$ ), while a multiple *wh*-interrogative like *Who saw who?* denotes a function from doubleton sets of individuals to propositions ( $\lambda \{x, y\}.\mathbf{saw}(x, y)$ ). Polar interrogatives are the limiting case, where no parameter is abstracted. Hence a polar interrogative like *Did Kim get the job?* denotes a function from the empty set to the proposition that Kim got the job. What (13) says then is that the meaning of the mother in a construct of the type licensed by this construction is defined as a 0-ary abstract on the proposition built from the meanings of the daughters.

The positive specification for the feature INDEPENDENT-CLAUSE (IC) in (13) ensures that phrases licensed by this construction are never subordinate clauses. For further discussion of this analysis, taking into account embedded instances of ‘main clause phenomena’, see GS-00 (ch. 2). A derivation licensing an inverted polar interrogative is shown in attribute-value matrix (AVM) notation in Figure 1 and in familiar tree notation in Figure 2. Here,  $I_P$  denotes the identity function on properties, which is assigned as the lexical meaning of auxiliary *did*, ignoring tense.<sup>16</sup>

<sup>14</sup>See Klein and Sag 1985 for further discussion. I assume here that verbal meanings are functions to propositions, not truth values. For ease of exposition, I will speak loosely of ‘meanings’ where Klein and Sag carefully distinguish between senses (intensions) and denotations (extensions).

<sup>15</sup>See also Keenan and Hull 1973, Hull 1975.

<sup>16</sup>Here and throughout, boxed numbers or letters (‘tags’ in the terminology of Shieber 1986) are used to indicate pieces of a feature structure that are equated by some grammatical constraint. However, the linguistic models assumed here are simple functions, rather than the reentrant graphs that are usually assumed within HPSG.

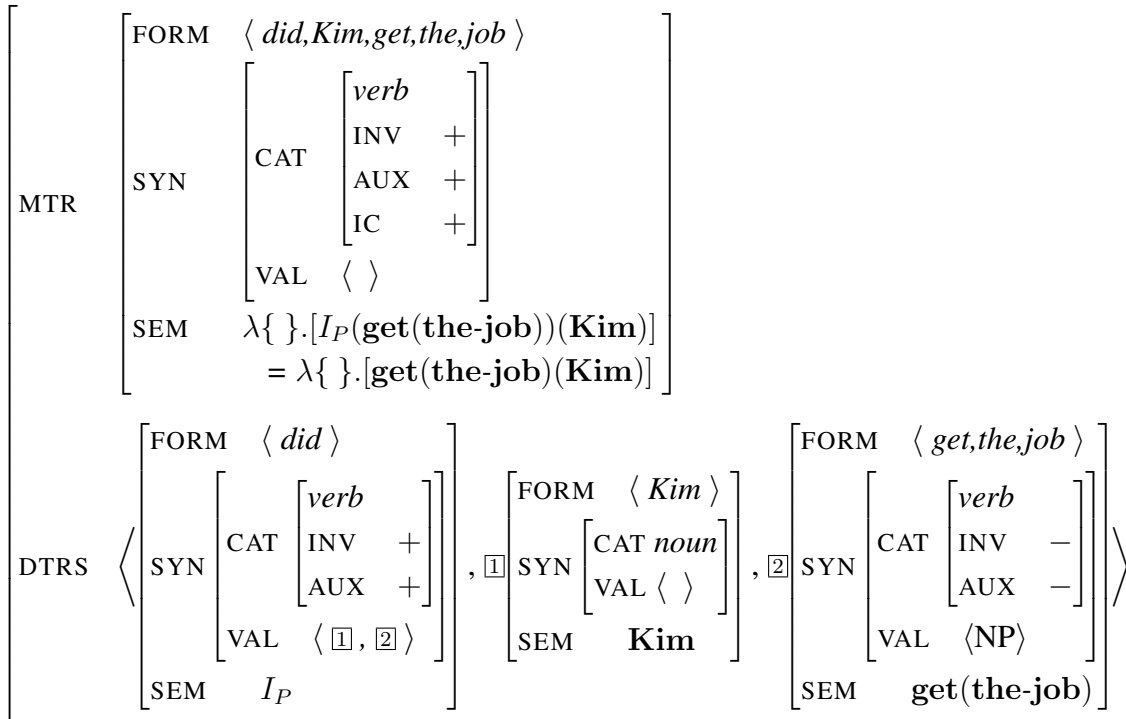


Figure 1: A Construct Licensed by the Polar Interrogative Construction (AVM Notation)

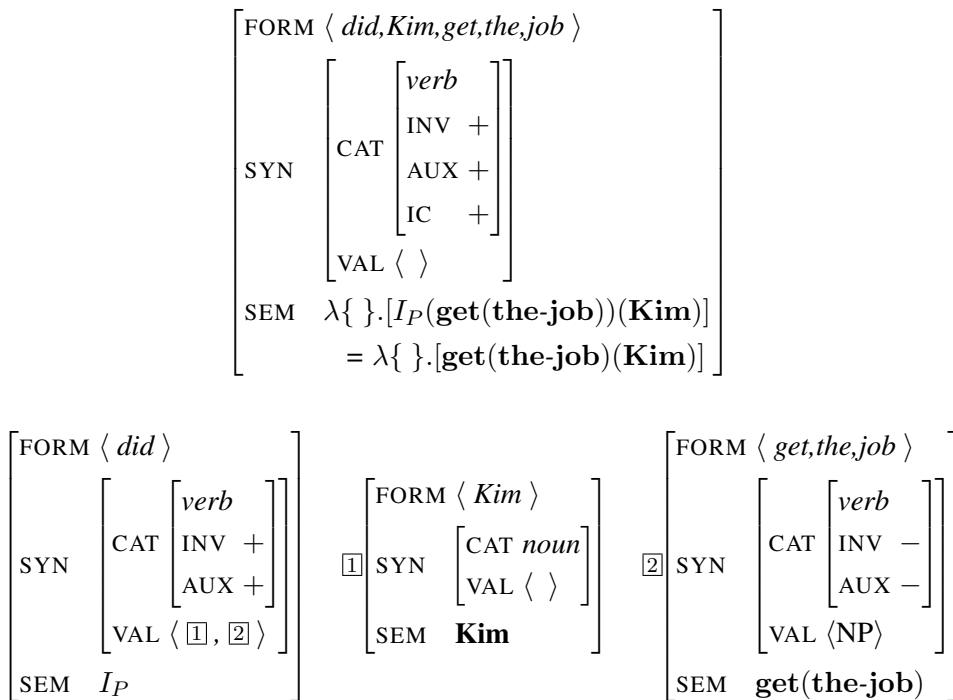


Figure 2: A Construct Licensed by the Polar Interrogative Construction (Tree Notation)

This analysis presupposes the existence of further, familiar constructions, such as the Head-Complement Construction, used to build the auxiliary verb's VP complement (*get the job*) in Figures 1 and 2:

(14) **Head-Complement:**

$$hd-comp-cxt \Rightarrow \left[ \begin{array}{l} hd-cxt \\ MTR \left[ \begin{array}{l} SYN \left[ VAL \langle Z \rangle \right] \\ SEM \mathbf{FR}_{\langle NP, p \rangle}(X_0, \dots, X_n) \end{array} \right] \\ DTRS \langle H, Y_1:[SEM X_1], \dots, Y_n:[SEM X_n] \rangle \\ HD-DTR \begin{array}{l} H: \left[ \begin{array}{l} word \\ SYN \left[ VAL \langle Z, Y_1, \dots, Y_n \rangle \right] \\ SEM X_0 \end{array} \right] \end{array} \end{array} \right]$$

Here  $\langle NP, p \rangle$  is the semantic type of functions from NP denotations to propositions. The signs licensed by the constructs that satisfy this Head-Complement construction all have a singleton valence list.

I assume, following Fillmore 1999 and GS-00, that English grammar also includes a few more aux-initial constructions. These license constructs that instantiate three further subtypes of *ai-cxt* (see (12) above), as shown in (15)–(17):

(15) **Inverted Exclamative Clause:**

$$inv-excl-cl \Rightarrow \left[ \begin{array}{l} MTR \left[ \begin{array}{l} SYN \left[ CAT \left[ IC \ + \right] \right] \\ SEM fact(\mathbf{FR}_p(X_1, \dots, X_n)) \end{array} \right] \\ DTRS \langle [SEM X_1], \dots, [SEM X_n] \rangle \end{array} \right]$$

(16) **Inverted Conditional Clause:**

$$inv-cond-cl \Rightarrow \left[ \begin{array}{l} MTR \left[ \begin{array}{l} SYN \left[ CAT \left[ \begin{array}{l} IC \quad - \\ SELECT \quad S \end{array} \right] \right] \\ SEM \lambda q. [\mathbf{FR}_p(X_1, \dots, X_n) \Rightarrow_{\kappa} q] \end{array} \right] \\ DTRS \langle [SEM X_1], \dots, [SEM X_n] \rangle \end{array} \right]$$

(17) **Inverted Propositional Clause:**

$$inv-prop-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \text{IC} \ + \right] \right] \\ \text{GAP} \quad \textit{nelist} \\ \text{SEM} \quad \mathbf{FR}_p(X_1, \dots, X_n) \end{array} \right] \\ \text{DTRS} \left\langle [\text{SEM } X_1], \dots, [\text{SEM } X_n] \right\rangle \end{array} \right]$$

In (15), I follow GS-00, who argue that the semantics of exclamative clauses is a **fact** (roughly in the sense of Vendler (1968, 1972)). The function *fact* maps a proposition to the corresponding Vendlerian fact. I return briefly to the evidence supporting this claim in section 4.2 below. Note, however, that the constructional analysis presented here is consistent with a broad range of semantic alternatives. (16) licenses subordinate clauses that modify another clause.<sup>17</sup> Here,  $\Rightarrow_\kappa$  denotes whatever conditional relation is appropriate for the semantic analysis of examples like (3) above. Finally, the Inverted Propositional Construction in (17) allows an independent aux-initial clause to have a propositional meaning, but only when the GAP value is a non-empty list (*nelist*). This permits such clauses only at the top of FG dependencies, as discussed below. In addition to its role in the analysis of matrix *wh*-interrogatives, this construction is also used to license the head daughter of negative-adverb-initial sentences like (18), though here the extraction dependency is bounded:

(18) Seldom/Never in my life [*have I seen such beauty*].

## 2.2 The Subject-Predicate Construction

GS-00 provides an account of a number of (both ‘core’ and ‘peripheral’) declarative clauses in terms of a hierarchy of clausal types. My approach here is similar, though somewhat streamlined:

- (19) a. *clause* and *non-clause* are immediate subtypes of the type *phr-cxt*.  
b. *declarative-clause* (*decl-cl*), *interrogative-clause* (*int-cl*), *imperative-clause* (*imp-cl*), and *exclamative-clause* (*excl-cl*), and *relative-clause* (*rel-cl*) are immediate subtypes of the type *clause*.

The constraints specific to the type *decl-cl* require that the mother’s semantics is propositional (a proposition or outcome - see below) and that the clause’s VFORM value is either *finite* or *infinitival* (*inf*). We may thus streamline the formulation of the following Subject-Predicate

<sup>17</sup>Following Van Eynde (1998), who builds directly on Allegranza 1998, the features MOD and SPR of Pollard and Sag 1994 are replaced by the single feature SELECT (SEL). The values of this feature indicate properties of the phrasal head that are selected by a given modifier or specifier. See also Van Eynde 2006, 2007 and Allegranza 2007.

Construction (SPC) by assuming that the type *subject-predicate-clause* *sp-cl* is a subtype of *decl-cl*:

(20) **Subject-Predicate Construction:**

$$sp-cl \Rightarrow \left[ \begin{array}{l} hd\text{-}cxt \\ MTR \left[ \begin{array}{l} SYN \left[ \begin{array}{l} CAT \left[ \begin{array}{l} VFORM \textit{fin} \\ INV - \end{array} \right] \\ VAL \langle \rangle \end{array} \right] \\ SEM \mathbf{FR}(X_1, X_2) \end{array} \right] \\ DTRS \left\langle Y: [SEM X_1] , H: \left[ \begin{array}{l} SYN [VAL \langle Y \rangle ] \\ SEM X_2 \end{array} \right] \right\rangle \\ HD\text{-}DTR \quad H \end{array} \right]$$

That is, subject-predicate clauses involve exactly two daughters: the first is the subject daughter (typically an NP); the second is the head daughter. The head daughter, which selects the first daughter as its only valent, need not be lexical. The fact that the semantics of the mother must be propositional follows from the fact that constructs licensed by this construction must also be declarative clauses, and hence must obey the constraints that apply to constructs of type *decl-cl* in addition to the constraints in (20).

Following GS-00, I assume there are a number of similar constructions, including the one that licenses ‘Mad Magazine’ sentences like (21a) and the construction responsible for absolute clauses like the one italicized in (21b):<sup>18</sup>

- (21) a. (What,) Me, worry?
- b. (With) *My friend in jail*, I’m sunk.

According to GS-00, The SPC exists independently of these, licensing simple declarative clauses like (22a), ‘present subjunctive clauses like (22b), and ‘imperative clauses’ like (22c):

- (22) a. Sandy reads Proust.
- b. (I insist that) Sandy read Proust.
- c. You/Everyone read Proust!

In GS-00, the semantic differences here follow from the lexical differences between indicative and base-homophonous, subjunctive lexical forms. Note that SPC requires that the mother be specified as [VFORM *fin*] and [INV –]. Given the HFP, this requires that the VP head daughter also be so specified, correctly ruling out both non-finite clauses like (23a,b) and clauses containing [INV +] lexical heads like (23c), as well as a host of other examples discussed more fully in GS-00 and in Sag to appear :

<sup>18</sup>See, for example, Akmajian 1984 and, for a somewhat different analysis, Lambrecht 1990.

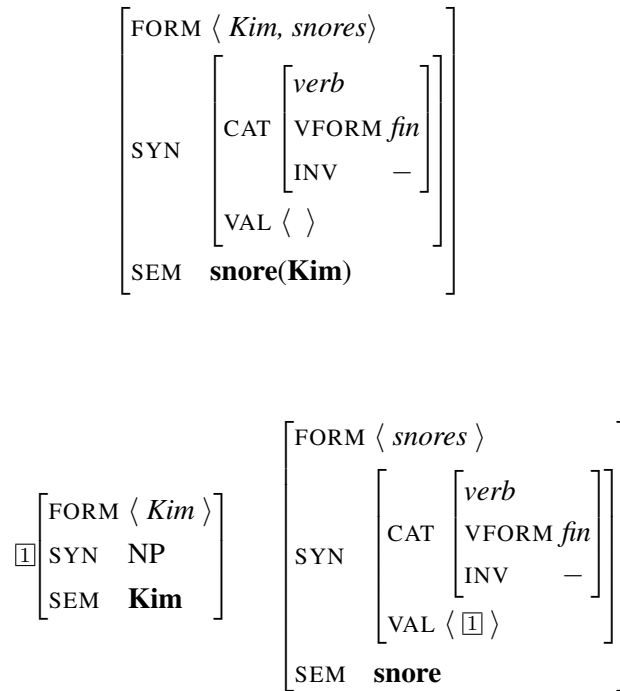


Figure 3: A Construct Licensed by the Subject-Predicate Construction

- (23) a. \*Kim to go home.  
 b. \*Pat standing on my foot.  
 c. \*I aren't coming to the party

In virtue of the SPC, taken together with our theory of feature structures, clauses, constraints, and constraint inheritance, it follows that subject-predicate clauses have the properties sketched in Figure 3, where **snore(Kim)** is simply the proposition derived from applying the indicative verb's semantics to that of the subject NP.

Finally, it should be noted that the Head Feature Principle in (11), in identifying the CAT value of the mother and the head daughter, ensures that the feature specifications of the lexical head daughter are 'percolated up' to the clause itself. This information is fundamental – this is what allows finite clauses to be identified as such under subcategorization or inverted clauses to be required by some superordinate construction. For example, the Negative Adverb Preposing Construction, which licenses sentences like (18) above, requires that its head daughter be a clause ([CAT *verb*, VAL ⟨ ⟩]) specified as [INV +]. In SBCG, constructions cannot make reference to other constructions. This follows directly from the fact that (1) constructions

license constructs and (2) constructs are configurations of signs, not other constructs.<sup>19</sup>

### 3 The Diversity of FG Constructions

Modern discussions of constructions involving FG dependencies emphasize the properties they have in common, e.g. the relatively uniform unbounded nature of the dependencies, modulo ‘island’ effects. These basic patterns are reasonably well-established, though considerable uncertainty remains about the role of processing in accounting for island effects (add refs). In addition to the numerous transformational discussions of the English data, there are also a number of precisely formulated, constraint-based analyses that have now been developed in a number of frameworks, including Generalized Phrase Structure Grammar (GPSG; see Gazdar et al. 1985), Categorical Grammar (see Steedman 1996, 2000), LFG (see Kaplan and Zaenen 1989), Tree-Adjoining Grammar (TAG; see Kroch 1987, 1989), the ‘Simpler Syntax’ hypothesis (see Culicover and Jackendoff 2005, Ch. 9), and HPSG (see Bouma et al. 2001; Levine and Hukari 2006). What is systematically left out of such analyses, however, is the fact that individual FG constructions exhibit considerable variation with respect to many diverse syntactic and semantic properties.

#### 3.1 Parameters of Variation

This section outlines the relevant differences among *wh*-interrogative, *wh*-exclamative, topicalized, *wh*-relative, and *the*-clauses. These constructions are illustrated in (24)–(28):

(24) ***Wh*-Interrogative Clause:**

- a. How foolish is he?
- b. (I wonder) *how foolish he is*.

(25) ***Wh*-Exclamative Clause:**

- a. What a fool he is!
- b. (It’s amazing) *how odd it is*.

(26) **Topicalized Clause:**

The bagels, I like.

(27) ***Wh*-Relative Clause:**

---

<sup>19</sup>Again, this is analogous to Context-Free Grammars, where the daughter of one rule can make reference to the category of the mother that is expanded by some other rule to build the daughter’s substructure, but no CFG rule makes reference to another CFG rule. No descriptive power is lost, however, since constructions are constraints whose antecedent is a type name and the type hierarchy allows all necessary cross-constructural relations to be derived.

- a. (I met the person) *who they nominated*.
- b. (I'm looking for a bank) *in which to place my trust*

(28) **The-Clause:**

- a. (The more people I met), *the happier I became*.
- b. *The more people I met*, (the happier I became.)

All five kinds of clause exhibit an extraction dependency between a clause-initial filler phrase and a gap located within the sentential head daughter. However there are several parameters of variation that distinguish these types of clause from one another, including the following:

(29) **Parameters of Variation in FG Clauses:**

- a. Is there a distinguished *wh* element in the filler daughter, and if so, what kind?
- b. What are the possible syntactic categories of the filler daughter?
- c. What are the possible syntactic categories of the head daughter?
- d. Can the head daughter be inverted/finite? Must it be?
- e. What is the semantics and/or syntactic category of the mother?
- f. What is the semantics and/or syntactic category of the head daughter?
- g. Is the clause an island? Must it be an 'independent clause'?

Let us consider these in turn. The five types of FG clause each impose a distinct condition: the filler daughter of a topicalized clause must contain no distinguished element (*wh*-phrase or *the*-phrase); *wh*-interrogative, *wh*-relative, and *wh*-exclamative clauses each require the filler daughter to contain a distinct type of *wh*-element; and the filler of a *the*-clause must contain the definite degree marker *the*. These requirements are illustrated in (30):

(30) **Distinguished Elements within the Filler Daughter:**

- a. [My bagels], she likes. (topicalization)
- b. [*What* (books)] do they like? (*wh*-interrogative)
- c. (the person) [*who*(*se* book)] they like . . . (*wh*-relative)
- d. [*What* a play] he wrote! (*wh*-exclamative)
- e. [*the more* books] they read . . . (*the*-clause)

When these requirements are not met, ungrammatical sentences like the following result:

<i>wh</i> -WORD	INTERROGATIVE	EXCLAMATIVE	RELATIVE	EXAMPLE
<i>who</i> (Noun)	+	–	+	<i>who</i>
<i>whose</i> (Det)	+	–	+	<i>whose book</i>
<i>what</i> (Noun)	+	%	–	<i>what</i>
<i>what</i> (Det <sub>sing</sub> )	+	–	–	<i>what book</i>
<i>what</i> (Det <sub>pl</sub> )	+	+	–	<i>what stories</i>
<i>which</i> (Noun)	–	–	+	<i>which</i>
<i>which</i> (Det)	+	–	+	<i>which book</i>
<i>how</i> (Adv <sub>manner</sub> )	+	–	%	<i>how</i>
<i>how</i> (Degree word)	+	+	–	<i>how tall</i>
<i>when</i> (Adv <sub>time</sub> )	+	–	%	<i>when</i>
<i>where</i> (Adv <sub>place</sub> )	+	–	+	<i>where</i>
<i>why</i> (Adv <sub>reason</sub> )	+	–	+	<i>why</i>

Figure 4: So-Called ‘*Wh*’-Words and their Functions

(31) **Mismatches of Distinguished Element**

- a. \**[Which bagels]/\*[Who]*, she likes. (topicalization)
- b. \**[What a book]* do they like? (*wh*-interrogative)
- c. \*the thing [*[what]* they like ] . . . (*wh*-relative)
- d. \**[Which bagels]/\*[What]* she likes! (*wh*-exclamative)
- e. \**[which books]* they read,  
the more they learn. (*the*-clause)

The variation in *wh*-forms is in part the residue of historical processes. The ancient Indo-European pattern, involving distinct paradigms for interrogative, relative, and (‘proximate’ and ‘remote’) demonstrative forms has been largely leveled in modern IE languages. The relevant inventory of English *wh*-forms is shown in Figure 4.<sup>20</sup> The data motivating these fine-grained distinctions include the following:<sup>21</sup>

(32) a. Who did they visit?

<sup>20</sup>This sixth entry in Figure 4 is restricted to non-elliptical uses of *which*. I am regarding an interrogative *wh*-phrase like the one in *Which did you read?* as an elliptical NP containing the determiner *which*.

<sup>21</sup>I am assuming, following GS-00, that predicates like *amazing* allow both exclamative and interrogative clause complements. Thus, apparent examples of embedded exclamatives like (i) and (ii) are in fact embedded interrogatives:

- (i) It’s amazing *what she read*.
- (ii) It’s amazing *who all she visited*.

- b.\*Who they visited!
- c. The person who they visited . . .
- (33) a. Whose book did she read?
- b.\*Whose book she read!
- c. The person whose book she read . . .
- (34) a. What did she read?
- b.\*What she read!
- c.\*The only one what she read . . .
- (35) a. What book did she read?
- b.\*What book she read!
- c.\*The only one what book she read . . .
- (36) a. Which book did she read?
- b.\*Which book she read!
- c.\*The only one which book she read . . .
- (37) a. How did they do that?
- b.\*How they did that!
- c.%The way how they did that . . .
- (38) a. How tall did they get?
- b.\*How tall they got!
- c.\*The extent how tall they got . . .
- (39) a. When did they do that?
- b.\*When they did that!
- c. The time when they did that . . .
- (40) a. Where did they do that?
- b.\*Where they did that!
- c. The place where they did that . . .

- (41) a. Why did they do that?  
 b. \*Why they did that!  
 c. The reason why they did that . . .

Moreover, there are differences in where the *wh*-word can be positioned within the filler daughter (differences in so-called ‘pied piping’ environments):<sup>22</sup>

- (42) a. Those dignitaries [[*pictures of whom*] the newspaper had already published] . . . (*wh*-relative)  
 b. \*I wonder [[*pictures of whom*] the newspaper had already published]. (*wh*-interrogative)  
 c. \*[*pictures of what a liar*] the newspaper published! (*wh*-exclamative)

Given these differences in form and in pied piping patterns in Present-Day English, it is plain that there is no morphological or syntactic unity underlying the concept of an English ‘*wh*-expression’. Recall also that overt *wh*-expressions are entirely absent from many such constructions. The very notion of ‘*wh*-movement’ is suspect, at best a crude and misleading rubric for the discussion of FG constructions.

The five types of FG clauses also differ with respect to the constraints they impose on the syntactic category of the filler daughter:<sup>23</sup>

(43) **Syntactic Category of the Filler Daughter:**

- a. Topicalization/*Wh*-interrogative: NP, PP, AP, AdvP  
 b. Finite relative: NP, PP  
 c. Infinitival relative: PP  
 d. *Wh*-exclamative/*The*-clause: NP, AP, AdvP

A grammar that provides no mechanism for imposing such category restrictions will overgenerate, allowing ungrammatical examples like the following:

(44) **Mismatched Filler Categories:**

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<sup>22</sup>There is further constructional variation with respect to pied piping. For example, free relatives are impossible with a PP-internal *wh*-element:

- (i) Whoever you gave the firecracker to is angry.  
 (ii) \*To who(m)ever you gave the firecracker is angry.

This may be treated as a construction-specific constraint on the category of the filler daughter, rather than as a constraint on pied piping.

<sup>23</sup>It is of course possible that adverb-initial or adjective-initial independent clause involve a construction distinct from topicalization. In this case, the cross-constructional variation is even greater than that indicated below. The possible categorial distinctness of Quantifier Phrases (QPs) is a further issue not addressed here.

- a. \*the person [[*happy with whom*] Kim is]...
- b. \*the people [*who(m)*] to confer with]...
- c. \*[*In what a mansion*] they were living!
- d. \*[*To the more people*] I talk (, the more people listen).

Another parameter of variation concerns the syntactic category of the head daughter:

(45) **Syntactic Category of the Head Daughter:**

- a. Topicalization/Interrogative/Relative/Exclamative Clauses: *S*
  - \*Bagels, [that I like]
  - \*who [that we like]. (*wh*-interrogative/relative or exclamative)
- b. *The*-Clause: *S* or *CP*
  - The more [(that) you see](, the more (that) you like.)

Moreover, there is variation with regard to the position (or requirement) of an auxiliary verb within the head daughter (see the discussion of inverted clauses in section 2.1 above):

(46) **Must/Can the head daughter be an inverted clause?**

- a. Topicalization: *never inverted*
- b. *Wh*-interrogative: *inverted only in independent clause*.
  - How tall is Kim?/\*I wonder how tall is Kim.
- c. *Wh*-relative/*Wh*-exclamative/*The*-clause: *never inverted*.
  - \*the one who did he see...
  - \*How tall is Kim!/\*What a nice person is Kim talking to!
  - \*The more do you see (the more (do) you suspect).

And only certain FG clauses allow infinitival realizations, as summarized in (47):

(47) **Must/Can the head daughter be infinitival?**

- a. Topicalization/*Wh*-exclamative/*The*-clause: always finite; never infinitival.
  - \*It's amazing [how many people (for us) to talk to].
  - \*The harder (for them) to come, the harder (for them) to fall.

- b. *Wh*-interrogative/relative: infinitival VP head daughter possible.

I know how much time (\*for them) to take.

The time in which (\*for them) to finish . . .

And, of course, the semantics of FG clauses is not uniform. These are determined as indicated:

(48) **Semantics of the Clause:**

- a. Interrogative: question (propositional function)
- b. Relative: proposition
- c. Exclamative: fact
- d. *The*-Clause: proposition
- e. Topicalization: austinean (proposition or outcome)

This classification follows GS-00, who motivate a Vendlerian semantics analysis (couched in the framework of Situation Semantics) that recognizes facts, propositions, questions, and outcomes as distinct types of semantic object.<sup>24</sup>

As noted earlier, generative discussions have largely ignored the data sets summarized in this section, instead focussing on proposals of ever increasing metatheoretical abstractness and ever diminishing empirical breadth and precision. These proposals are often accompanied by claims about their increased explanatoriness, perhaps most boldly by Chomsky (1993: 435):

A look at the earliest work from the mid-1950s will show that many phenomena that fell within the rich descriptive apparatus then postulated, often with accounts of no little interest and insight, lack any serious analysis within the much narrower theories motivated by the search for explanatory adequacy and remain among the huge mass of constructions for which no principled explanation exists—again, not an unusual concomitant of progress.

It should be noted, however (as Paul Kay reminds me), that while accepting with equanimity a progressive reduction of the range of facts that lie within the domain of a scientific theory may be within the *mainstream* of generative linguistics, it is well outside the mainstream of scientific practice, and should surely to be regarded with extreme skepticism, if more comprehensive alternative theories are available. Moreover, in the sections that follow I will demonstrate that if we step outside the confines of transformational grammar, GB and ‘Minimalism’, then it becomes possible to articulate a more comprehensive theory of grammar that expresses the appropriate generalizations underlying English FG constructions, while at the same time providing a precise account of all the idiosyncrasies found in the data sets outlined in this section.

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<sup>24</sup>GS-00 also treat a class of non-propositional topicalizations that will be ignored here.

### 3.2 The Uniformity of FG Constructions

The common properties of the various FG constructions that we have examined are in part expressed in terms of the common construct type *filler-head-clause* (*fill-hd-cl*). Constructs of this type, which is a subtype of *hd-cxt*, are subject to the following constraint:

$$(49) \quad \textit{fill-hd-cl} \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} \text{SYN} \quad [\text{VAL} \ L_1] \\ \text{GAP} \quad L_2 \end{array} \right] \\ \text{DTRS} \quad \langle [\text{SYN} \ X], H \rangle \\ \text{HD-DTR} \quad H : \left[ \begin{array}{l} \textit{phrase} \\ \text{SYN} \quad \left[ \begin{array}{l} \text{CAT} \quad \textit{verbal} \\ \text{VAL} \quad L_1 \end{array} \right] \\ \text{GAP} \quad \langle [\text{SYN} \ X] \rangle \oplus L_2 \end{array} \right] \end{array} \right]$$

Filler-head constructs thus require exactly two daughters: the first is the filler daughter; the second is the head daughter. (49) links the syntax and semantic information of the filler daughter to those of the first element of the head daughter’s GAP list, which will in turn be identified with the gap position that appears within the head daughter. The syntactic category of the head daughter is moreover specified in terms of the superordinate type *verbal*, which (following Sag 1997 and GS-00) can resolve to either of its two subtypes *verb* and *complementizer*. Thus according to (49) the head daughter of a FG construction (barring some further constraint imposed by a specific construction) may be a verbal projection (S or VP) or a CP.

Following a long tradition in the GPSG/HPSG literature, beginning with Gazdar 1981 and including Pollard and Sag 1994 and Levine and Hukari 2006, the presence of an extraction site (a ‘gap’) is encoded in terms of a feature specification such as  $[\text{GAP} \langle \text{NP} \rangle]$ . By contrast, a gapless expression (more precisely, an expression all of whose gaps are ‘already bound’) is specified as  $[\text{GAP} \langle \rangle]$ . Here I follow GS-00, whose traceless theory allows a lexical head to appear without a complement just in case a sign corresponding to that complement appears as an element of its GAP list. The GAP lists of a word’s syntactic arguments are ‘amalgamated’ to form that word’s GAP list, and a general principle of grammar (such as the generalized version of the HFP in GS-00) requires that a head daughter’s GAP list be the same as its mother’s GAP list. Thus general grammatical principles, all formulated as local constraints that well-formed constructs must satisfy, ensure that GAP specifications are inherited as indicated in a structure like the one shown in Figure 5.

An analysis along these lines has numerous advantages over movement-based analyses that are ubiquitously assumed, but seldom made precise, in the transformational literature. First, by treating FG dependencies purely in terms of constraints on feature specifications, rather than by movement, this analysis provides the basis for a solution to the dilemma (first discussed by Gazdar et al. 1982) that transformational theory fails to provide a uniform account of single-gap movement and across-the-board extraction. These are not avoided by accounts based on ‘three-dimensional’ phrase markers.<sup>25</sup> That is, no unified movement algorithm exists

<sup>25</sup>Such as those developed by Goodall (1987) and Moltmann (1992). For discussion, see Milward 1994, Sag 2000, and the references cited there.

$$\left[ \begin{array}{l} \text{FORM } \langle I, \textit{think}, \textit{Kim}, \textit{likes} \rangle \\ \text{SYN } \mathbf{S} \\ \text{GAP } \langle \text{NP} \rangle \end{array} \right]$$

$$\left[ \begin{array}{l} \text{FORM } \langle I \rangle \\ \text{SYN } \mathbf{NP} \\ \text{GAP } \langle \rangle \end{array} \right] \quad \left[ \begin{array}{l} \text{FORM } \langle \textit{think}, \textit{Kim}, \textit{likes} \rangle \\ \text{SYN } \mathbf{VP} \\ \text{GAP } \langle \text{NP} \rangle \end{array} \right]$$

$$\left[ \begin{array}{l} \text{FORM } \langle \textit{think} \rangle \\ \text{SYN } \mathbf{V} \\ \text{GAP } \langle \text{NP} \rangle \end{array} \right] \quad \left[ \begin{array}{l} \text{FORM } \langle \textit{Kim}, \textit{likes} \rangle \\ \text{SYN } \mathbf{S} \\ \text{GAP } \langle \text{NP} \rangle \end{array} \right]$$

$$\left[ \begin{array}{l} \text{FORM } \langle \textit{Kim} \rangle \\ \text{SYN } \mathbf{NP} \\ \text{GAP } \langle \rangle \end{array} \right] \quad \left[ \begin{array}{l} \text{FORM } \langle \textit{likes} \rangle \\ \text{SYN } \mathbf{S} \\ \text{GAP } \langle \text{NP} \rangle \end{array} \right]$$

Figure 5: An Incomplete Derivation Showing “Inheritance” of GAP-Specifications

that derives both a single filler from movement of one element from its gap position and (in the case of coordinate structures) a single filler from movement of many elements (one from each conjunct). In constraint-based accounts like those available in Categorical Grammar, LFG, HPSG, or SBCG, the across-the-board effect follows from the interaction of the theory of coordination and the theory of FG dependencies. For example, assuming (1) that FG dependencies are encoded via nonempty GAP lists and (2) that coordination involves a schematization over feature structures that include specifications for the feature GAP, it follows that each conjunct in a well-formed coordinate structure has the same value for the feature GAP. When this value is a nonempty list, there will be a corresponding gap in each conjunct, as in familiar examples like (50):

(50) Bagels, I think [[Kim likes \_\_ ] and [Sandy hates \_\_ ]].

A second advantage of this particular constraint-based analysis is that information about the FG dependency is locally encoded along the extraction path, as shown in Figure 5. This provides local syntactic distinctions that could be said to actually predict that in many of the world's languages, the presence of an extraction path has a critical effect on lexical choice and constructional options. These effects, which are now well-documented in the literature, include the following:

- (51) a. Irish complementizer selection (McCloskey 1979, 1990)  
b. French 'stylistic' inversion (Kayne and Pollock 1978).  
c. Spanish 'stylistic' inversion (Torrego 1984)  
d. Kikuyu downstep suppression (Clements 1984, Zaenen 1983)  
e. Chamorro verb agreement (Chung 1982, 1995)  
f. Yiddish inversion (Diesing 1990)  
g. Icelandic expletives (Zaenen 1983)  
h. Adyghe 'wh-agreement' (Polinsky 2007)

As has often been pointed out (Zaenen 1983, Hukari and Levine 1995, Bouma et al. 2001, Levine and Hukari 2006), constraint-based accounts of extraction provide a straight-forward treatment of phenomena sensitive to extraction paths and do so without the introduction of otherwise unmotivated entities like intermediate traces.

A third benefit of the constraint-based analysis of FG constructions is that the relevant constraints need not specify total identity between filler and gap. As emphasized by Bresnan (2000), this provides the basis for an account of category discrepancies of the sort that appear whenever CPs are topicalized, as in (52):

(52) That they will be able to help us, they told us we could rely on \_\_ .

Movement-based accounts, by contrast, leaves us wondering why movement of a CP leaves an NP trace.

Finally, the constraint-based analysis of FG constructions presented here makes no appeal to phonetically unrealized elements in the position of the gap. Though the existence of such elements continues to be taken for granted in introductory textbooks on transformational approaches to grammar, including Minimalism (e.g. Radford 2004: 191-192 and Carnie 2007: 324), the fact remains that there is no independent motivation for the existence of *wh*-traces, not from ‘*wanna*-contraction’ (Postal and Pullum 1982, Sag and Fodor 1994; Pullum 1997), not from auxiliary contraction (Pullum and Zwicky 1997) not from floated quantifiers (Sag and Fodor 1994; Sag 2000), and not from weak crossover phenomena (Dalrymple et al. 2001). In addition, from a traceless account of FG constructions, the exceptions to the ATB exceptions to Ross’s (1967) Coordinate Structure Constraint also follow directly, providing an account of the ungrammatical ATB extraction in examples like (53):

- (53) a.\*Who did you compare \_\_ and \_\_ ?  
b.\*Who did you compare \_\_ and a picture of \_\_ ?

Sag (2000) shows that previous discussions of these data, e.g. that of Goodall (1987)), are inadequate and also that examples like these follow directly from the elimination of *wh*-trace. That is, assuming (1) that *wh*-traces are eliminated in favor of simple ‘non-realization’ of a head’s dependent at the gap site and (2) that only signs can be coordinated, it follows that no coordinations like (53a,b) are possible - what isn’t expressed can’t be coordinated.

## 4 The FG Construction Family

In order to see the role of derivations like the one sketched in Figure 5, we must examine individual FG-constructions more closely.

### 4.1 Topicalization

Perhaps the simplest filler-head construction to understand is the Topicalized Clause construction, which can be formulated as in (54):

(54) **Topicalized Clause:**

$$\text{top-cl} \Rightarrow \left[ \begin{array}{l} \text{MTR} \\ \text{DTRS} \\ \text{HD-DTR } H: \end{array} \left[ \begin{array}{l} \left[ \begin{array}{l} \text{SYN} \left[ \begin{array}{l} \text{CAT} \left[ \text{IC } + \right] \end{array} \right] \\ \text{SEM} \left[ \lambda X.Y \right](Z) \\ \text{GAP} \langle \rangle \end{array} \right] \\ \left\langle \left[ \begin{array}{l} \text{SEM} \ Z \\ \text{WH} \ \{ \} \\ \text{REL} \ \{ \} \end{array} \right], H \right\rangle \\ \left[ \begin{array}{l} \text{SYN} \left[ \begin{array}{l} \text{CAT} \left[ \begin{array}{l} \text{INV} \ - \\ \text{VFORM} \ \textit{fin} \end{array} \right] \\ \text{VAL} \langle \rangle \end{array} \right] \\ \text{SEM} \ Y \\ \text{GAP} \langle [\text{SEM } X] \rangle \end{array} \right] \end{array} \right] \right]$$

The specifications [WH { } ] and [REL { } ], together with a theory of pied piping (e.g. that of GS-00 or Van Eynde (2004)), ensures that the clause-initial filler constituent neither IS nor CONTAINS an interrogative, exclamative, or relative *wh*-word. The specification [IC +] further ensures that all clauses licensed by this construction are independent clauses. This correctly allows topicalization in both ‘root’ environments and in embedded environments where ‘main clause phenomena’ (those specified as [IC +]) are licensed, e.g. those in (55):<sup>26</sup>

- (55) a. They argued convincingly that [[*problems of this sort*], we would never be able to solve \_ ].
- b. Nothing made things clearer than the fact that [[*the people from her district*], no one had issued an invitation to \_ ].

It is important to see that certain information is not mentioned explicitly in (54), but is guaranteed by the constraint already introduced (in (49)) specifying that these are general properties common to all filler-head constructs. These consequences include the fact that there are exactly two daughters, the second of which is the head daughter whose GAP value is related to the filler daughter.

Figure 6 illustrates a construct licensed by the Topicalized Clause construction whose head daughter is the mother of the incomplete derivation tree in Figure 5 above. Note that the variable used to construct the mother’s semantics is identified with that of the element within the head daughter’s GAP list, creating a function-denoting abstract that takes the filler daughter’s semantics as its argument, as indicated in Figure 6. This provides a propositional semantics for the mother. No doubt the construction in (54) should impose some kind of ‘theme-rheme’

<sup>26</sup>See Chomsky 1977 for discussion.

FORM	⟨ <i>bagels, I, think, she, likes</i> ⟩												
SYN	<table style="border-collapse: collapse; margin-left: 20px;"> <tr> <td style="border-right: 1px solid black; padding: 5px;">CAT</td> <td style="padding: 5px;"> <table style="border-collapse: collapse; margin-left: 10px;"> <tr> <td style="padding: 5px;"><i>verb</i></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">VFORM</td> <td style="padding: 5px;"><i>fin</i></td> </tr> <tr> <td style="padding: 5px;">IC</td> <td style="padding: 5px;">+</td> </tr> <tr> <td style="padding: 5px;">INV</td> <td style="padding: 5px;">-</td> </tr> </table> </td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">VAL</td> <td style="padding: 5px;">⟨ ⟩</td> </tr> </table>	CAT	<table style="border-collapse: collapse; margin-left: 10px;"> <tr> <td style="padding: 5px;"><i>verb</i></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">VFORM</td> <td style="padding: 5px;"><i>fin</i></td> </tr> <tr> <td style="padding: 5px;">IC</td> <td style="padding: 5px;">+</td> </tr> <tr> <td style="padding: 5px;">INV</td> <td style="padding: 5px;">-</td> </tr> </table>	<i>verb</i>		VFORM	<i>fin</i>	IC	+	INV	-	VAL	⟨ ⟩
CAT	<table style="border-collapse: collapse; margin-left: 10px;"> <tr> <td style="padding: 5px;"><i>verb</i></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">VFORM</td> <td style="padding: 5px;"><i>fin</i></td> </tr> <tr> <td style="padding: 5px;">IC</td> <td style="padding: 5px;">+</td> </tr> <tr> <td style="padding: 5px;">INV</td> <td style="padding: 5px;">-</td> </tr> </table>	<i>verb</i>		VFORM	<i>fin</i>	IC	+	INV	-				
<i>verb</i>													
VFORM	<i>fin</i>												
IC	+												
INV	-												
VAL	⟨ ⟩												
SEM	$[\lambda X. \mathbf{think}(\mathbf{like}(X)(\mathbf{she}))(\mathbf{I})](\mathbf{bagels})$ $= \mathbf{think}(\mathbf{like}(\mathbf{bagels})(\mathbf{she}))(\mathbf{I})$												
GAP	⟨ ⟩												

FORM	⟨ <i>bagels</i> ⟩
SYN	NP
SEM	<b>bagels</b>
WH	{ }
REL	{ }

FORM	⟨ <i>I, think, she, likes</i> ⟩												
SYN	<table style="border-collapse: collapse; margin-left: 20px;"> <tr> <td style="border-right: 1px solid black; padding: 5px;">CAT</td> <td style="padding: 5px;"> <table style="border-collapse: collapse; margin-left: 10px;"> <tr> <td style="padding: 5px;"><i>verb</i></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">VFORM</td> <td style="padding: 5px;"><i>fin</i></td> </tr> <tr> <td style="padding: 5px;">IC</td> <td style="padding: 5px;">+</td> </tr> <tr> <td style="padding: 5px;">INV</td> <td style="padding: 5px;">-</td> </tr> </table> </td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">VAL</td> <td style="padding: 5px;">⟨ ⟩</td> </tr> </table>	CAT	<table style="border-collapse: collapse; margin-left: 10px;"> <tr> <td style="padding: 5px;"><i>verb</i></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">VFORM</td> <td style="padding: 5px;"><i>fin</i></td> </tr> <tr> <td style="padding: 5px;">IC</td> <td style="padding: 5px;">+</td> </tr> <tr> <td style="padding: 5px;">INV</td> <td style="padding: 5px;">-</td> </tr> </table>	<i>verb</i>		VFORM	<i>fin</i>	IC	+	INV	-	VAL	⟨ ⟩
CAT	<table style="border-collapse: collapse; margin-left: 10px;"> <tr> <td style="padding: 5px;"><i>verb</i></td> <td style="padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;">VFORM</td> <td style="padding: 5px;"><i>fin</i></td> </tr> <tr> <td style="padding: 5px;">IC</td> <td style="padding: 5px;">+</td> </tr> <tr> <td style="padding: 5px;">INV</td> <td style="padding: 5px;">-</td> </tr> </table>	<i>verb</i>		VFORM	<i>fin</i>	IC	+	INV	-				
<i>verb</i>													
VFORM	<i>fin</i>												
IC	+												
INV	-												
VAL	⟨ ⟩												
SEM	<b>think(like X)(she)(I)</b>												
GAP	<table style="border-collapse: collapse; margin-left: 20px;"> <tr> <td style="border-right: 1px solid black; padding: 5px;">SYN</td> <td style="padding: 5px;">NP</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">SEM</td> <td style="padding: 5px;">X</td> </tr> </table>	SYN	NP	SEM	X								
SYN	NP												
SEM	X												

Figure 6: A Construct Licensed by the *Topicalized Clause Construction*

condition (making the filler daughter the theme) on the mother of this kind of construct (presumably, within its CONTEXT value). However, in the absence of a generally accepted theory of ‘information structure’, I will not speculate about the details of this condition.<sup>27</sup>

In the absence of further constraints, the filler daughter in a topicalized construct may be of any syntactic category:

- (56) a. Bagels, I like \_\_ . (NP)
- b. Onto the table, they managed to throw seven books \_\_ . (PP)
- c. Happy, I’m not \_\_ . (AP)

<sup>27</sup>See Prince 1998 for some relevant discussion. Since signs in this theory also specify contextual information, they provide a natural home for the kind of contextual constraints that are associated with particular constructions, according to Prince, Lambrecht (1994) and others.

- d. Carefully, she rotated the timing device \_\_ . (AdvP)
- e. Go to the store, he wouldn't \_\_ . (VP)

In all likelihood there are syntactic restrictions on topicalized fillers, and some of the examples in (56) may well instantiate constructions (related to, but) distinct from Topicalization. The present approach can scale up (using construct types to express cross-constructural generalizations) to the diverse range of non-*wh* fronting constructions that is required for a more comprehensive analysis of English.

Note further that (54) requires that the head daughter be finite, correctly ruling out examples like (57):

(57)\*Bagels, (for) Kim to like.

But like the SPC discussed earlier, the head daughter in a topicalized construct may be subjunctive: (58):

- (58) a. We suggest that [[proposals of this kind], *she be kept informed of* \_\_ .]
- b. [Proposals of this kind], *nobody be taken in by* \_\_ !

This is an interesting difference between topicalized clauses and the other kinds of filler-head constructions that we will consider. For more on the semantic treatment of subjunctives as outcomes (the same semantic type as imperatives), see GS-00, Ch. 2.

Note that the head daughter of a topicalized clause must be [VAL < >]. This means that VPs cannot head a topicalized clause, ruling out 'spurious' ambiguity for a sentence like (59), which is analyzed only as an untopicalized declarative clause:

(59) [Proposals of this kind] bother me.

In addition, the [GAP < >] requirement on (the mother of) a topicalized clause makes it an extraction island:

(60)\*[How many of the visitors]<sub>i</sub> did he say that [[bagels]<sub>j</sub>, he would give \_\_<sub>j</sub> to \_\_<sub>i</sub>]?

And finally, because the filler daughter is also specified as [GAP < >], no further FG dependency can penetrate the filler daughter, correctly ruling out examples like (61):

(61)\*[How many of the visitors]<sub>i</sub> did he say that [[pictures of \_\_<sub>i</sub>]<sub>j</sub>, he would give \_\_<sub>j</sub> to the newspaper]?

Absolute extraction islands can thus be treated in terms of a simple constraint requiring that a certain construction (or one of its daughters) be [GAP < >]. By contrast, 'weak' islands<sup>28</sup>

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<sup>28</sup>Kluender (1992, 1998) presents experimental evidence that weak island phenomena can in fact be explained by independently motivated considerations of processing complexity. For further evidence of this kind, see Arnon et al. to appear, Sag et al. to appear, Hofmeister et al. 2007, and Hofmeister to appear, 2007. This seems to be a highly promising line of inquiry for actually EXPLAINING certain island phenomena, rather than treating them as an arbitrary property of grammar.

(those out of which some, but not all extractions are grammatically excluded) can be accommodated by placing restrictions on the GAP value of certain construction types. The restriction [GAP *list*(NP)], for example, ensures that a given phrase's GAP value is either the empty list, or else a list all of whose members are of category NP. If a constraint of this form is imposed on a given phrase, then the only kind of FG-dependency that can permeate it involves an NP gap. This kind of analysis can provide a natural account of the fact that island constraints are more construction-specific than standardly assumed, as argued, for example, by Postal (1998, 2001).

## 4.2 *Wh*-Exclamatives

As noted earlier, GS-00 treat exclamatives as facts (as distinct from propositions). This, they argue, provides an account of the possibility of exclamative complements of factive verbs and the impossibility of using exclamatives assertorically. In addition, the fact-based analysis of exclamatives provides an analysis of a number of new semantic observations involving substitutivity in dialogues with copular sentences, for example the validity of arguments like (62) and (63):

- (62) a. Merle is struck by how incredibly well Bo did in the elections.  
 b. Hence, Merle is struck by the fact that Bo did very well in the elections.
- (63) a. Bo told us a fact, which was that Micky did very badly on the exam.  
 b. Hence, Bo told us just how badly Micky did on the exam.

Adapting the GS-00 proposal to the SBCG framework and the semantic assumptions being made here, we may formulate the *Wh*-Exclamative Construction as follows:<sup>29</sup>

(64) ***Wh*-Exclamative Clause:**

$$wh-excl-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \text{SEM} \quad fact(E^uV[\lambda X.Y(Z)]) \right] \\ \text{DTRS} \quad \left\langle \left[ \begin{array}{l} \text{SEM} \quad Z \\ \text{WH} \quad \{V\} \\ \text{REL} \quad \{\} \end{array} \right], \left[ \begin{array}{l} \text{SYN} \quad \left[ \begin{array}{l} \text{CAT} \quad \left[ \begin{array}{l} \text{INV} \quad - \\ \text{VFORM} \quad fin \end{array} \right] \\ \text{VAL} \quad \langle \rangle \end{array} \right] \\ \text{SEM} \quad Y \\ \text{GAP} \quad \langle [SEM X] \rangle \end{array} \right] \right\rangle \end{array} \right]$$

This construction interacts with the constraints introduced earlier to license constructs like the one shown in Figure 7.

<sup>29</sup>I have not attempted here to unify the GS-00 analysis with the treatment of exclamatives presented by Michaelis and Lambrecht (1996), who also make crucial use of facts, albeit in a different way.

$\left[ \begin{array}{l} \text{FORM } \langle \textit{what}, \textit{a}, \textit{play} \rangle \\ \text{SYN } \text{NP} \\ \text{SEM } \lambda P \exists x [\mathbf{play}(x) \wedge x = v \wedge P(x)] \\ \text{WH } \{ v \} \\ \text{REL } \{ \} \end{array} \right]$	$\left[ \begin{array}{l} \text{FORM } \langle \textit{I}, \textit{saw} \rangle \\ \text{SYN } \left[ \begin{array}{l} \text{CAT } \left[ \begin{array}{l} \textit{verb} \\ \text{VFORM } \textit{fin} \\ \text{IC } + \\ \text{INV } - \end{array} \right] \\ \text{VAL } \langle \rangle \end{array} \right] \\ \text{SEM } \mathbf{see}(\varnothing)(\mathbf{I}) \\ \text{GAP } \left\langle \left[ \begin{array}{l} \text{SYN } \text{NP} \\ \text{SEM } \varnothing \end{array} \right] \right\rangle \end{array} \right]$
$\left[ \begin{array}{l} \text{FORM } \langle \textit{what}, \textit{a}, \textit{play}, \textit{I}, \textit{saw} \rangle \\ \text{SYN } \left[ \begin{array}{l} \text{CAT } \left[ \begin{array}{l} \textit{verb} \\ \text{VFORM } \textit{fin} \\ \text{IC } + \\ \text{INV } - \end{array} \right] \\ \text{VAL } \langle \rangle \end{array} \right] \\ \text{SEM } \mathit{fact}(E^u v [\lambda \varphi. \mathbf{see}(\varphi)(\mathbf{I}) \\ (\lambda P \exists x [\mathbf{play}(x) \wedge x = v \wedge P(x)])]) \\ = \mathit{fact}(E^u v [\mathbf{play}(v) \wedge \mathbf{see}(v)(\mathbf{I})]) \\ \text{GAP } \langle \rangle \end{array} \right]$	

Figure 7: A Construct Licensed by the *Wh-Exclamative Clause* Construction

The semantics illustrated here (adapting that of GS-00) assumes that a *wh*-exclamative clause denotes a fact that involves an existential quantification. The symbol  $E^u$  here is an existential quantifier over entities that are ‘unusual’ in the relevant context (one directly related to the speaker’s mental space). Exclamative *wh*-expressions like *what (a)* require that the value of the WH feature be a singleton set containing a distinguished variable (V) in (64). This WH specification is then inherited in accordance with general constraints similar to the constraints governing GAP-specifications.<sup>30</sup> As a result, the filler daughter in (64) includes a non-empty specification for WH precisely because it contains an exclamative *wh*-expression, which is the only way such a specification could arise. As the *wh*-exclamative clause is constructed, the semantics is required to introduce  $E^u$ , binding the variable in the filler daughter’s WH set. The reduced semantics for the clause illustrated in Figure 7 can be loosely paraphrased as ‘It’s a fact that there’s an unusual play that I saw’.

The constraints in (64) allow for exclamatives to appear as independent and non-independent clauses (the IC value is unconstrained), but the head daughter must always be both uninverted and finite. The following observations are thus correctly predicted:

- (65) a. It’s amazing [what a nice person Sandy is \_\_ ].  
 b. \*It’s amazing [what a nice person is Sandy \_\_ ].  
 c. What a nice person Sandy is \_\_ !  
 d. \*What a nice person is Sandy \_\_ !  
 e. \*It’s amazing [what a nice person (for) Sandy to be \_\_ ].  
 f. \*What a nice person (for) Sandy to be \_\_ !

In addition, the [VAL < >] condition on the head daughter in (64) correctly predicts that subject exclamative clauses, like subject topicalizations, are impossible:

- (66) a. \*It’s amazing [what a nice person just walked in].  
 b. \*What a nice person is talking to Sandy.

Because a fact is constructed from a proposition (see GS-00, Ch. 3), the only phrases that can serve as the head daughter of a *wh*-exclamative clause are those whose SEM value is of this type. This provides a principled semantic explanation for the deviance of examples like the following, where the head daughter’s semantics is not a proposition:

- (67) a. \*What a nice person [be sure to visit \_\_ ]!  
 b. \*It’s amazing what a nice person [they be considering \_\_ ].  
 c. \*What a nice person [will you visit \_\_ ]!/?

---

<sup>30</sup>In particular, these specifications are also threaded through the heads of complex *wh*-phrases, predicting the possibility of a language where the head of such a phrase agrees with the *wh*-element contained within that phrase. Polinsky (2007) discusses what appears to be a case of exactly this.

d.\*What a nice person [am I fond of \_\_ ]!

And the [GAP < >] condition correctly predicts that *wh*-exclamatives, like topicalized clauses, are islands for purposes of FG constructions:

(68)\*This is [the person]<sub>i</sub> that it's amazing [[what a nice present]<sub>j</sub> they gave \_\_<sub>j</sub> to \_\_<sub>i</sub>.]

Finally, it appears that *wh*-exclamatives require that the filler daughter be an NP, AP, or AdvP:

(69) a. What an interesting person Kim wrote about \_\_ !

b. How happy Kim is \_\_ !

c. How quickly they forget \_\_ !

d.\*About what an interesting person Kim wrote \_\_ !

e.\*Go to what a fine store he would \_\_ !

### 4.3 *Wh*-Interrogatives

GS-00 (Ch. 6) propose an analysis that draws a fundamental distinction between subject and nonsubject *wh*-interrogatives. Instances of the former type occur in both matrix and embedded environments, as shown in (70):

(70) a. What fell?

b. I wonder [what fell].

The Subject *Wh*-Interrogative Construction thus involves very local extraction - the *wh*-expression is both the filler and the highest subject in the sense made precise in GS-00. Here we will confine our attention to nonsubject interrogatives, as these provide the most interesting comparison with other FG constructions. Interrogative clauses like those in (70) are licensed by a distinct construction which is related to the one discussed in this section.

The potential semantic difficulties of quantifying into questions are avoided in GS-00 by treating questions as propositional abstracts (functions from sets to propositions). *Wh*-questions are individuated in terms of a non-empty set of 'parameters' and an open proposition. Accordingly, the SEM value of both (70a) and the embedded clause in (70b) is written as in (71), where the abstracted parameter set is singleton:

(71)  $\lambda\{x\}[\mathbf{fall}(x)]$

The Nonsubject *Wh*-Interrogative Construction places a number of conditions on the constructs that it licenses:

(72) **Nonsubject *Wh*-Interrogative Clause:**

$$ns-wh-int-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad [SEM \ \lambda\{V, \dots\}[\lambda X.Y(Z)]] \\ \text{DTRS} \quad \left\langle \left[ \begin{array}{l} SEM \ Z \\ WH \ \{V\} \end{array} \right], \left[ \begin{array}{l} \text{SYN} \quad \left[ \begin{array}{l} \text{CAT} \quad \left[ \begin{array}{l} \text{INV} \ W \\ \text{IC} \ W \end{array} \right] \end{array} \right] \\ SEM \ Y \\ \text{GAP} \ \langle [SEM \ X] \rangle \end{array} \right] \right\rangle \end{array} \right]$$

(72) interacts with our earlier constraints governing headed constructs and filler-head constructs in a now familiar way, licensing constructs like the one in Figure 8.

In fact the constraint interaction is quite subtle here, as constraints on the construct type *interrogative-clause* (*int-cl*) play an important role:

$$(73) \quad int-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} SEM \quad \left[ \begin{array}{l} question \\ PARAMS \ \Sigma_1 \end{array} \right] \\ STORE \ \Sigma_2 \end{array} \right] \\ \text{HD-DTR} \quad [STORE \ \Sigma_1 \cup \Sigma_2] \end{array} \right]$$

According to (72), the variable  $V$  in the filler daughter's WH value must be included in the set of variables that is abstracted over to form the question that serves as the clause's SEM value. And because of (73), this variable is also part of the head daughter's STORE value, but not the mother's. That is (thinking 'bottom-up'),  $V$  and possibly some other parameters are 'retrieved' from the head daughter's STORE value and the remaining parameters are 'passed up' to constitute the mother's STORE value. This is a general property of interrogative clauses both here and in GS-00.<sup>31</sup> This analysis permits other variables to be retrieved as well, thus allowing for multiple readings of multiple *wh*-interrogative sentences like (74a), first discussed by Baker (1970):

- (74) Who remembers where we bought what?
- a. Who remembers the answer to the question 'Where did we buy what?'  
 $\lambda\{v\}[v \text{ remembers } \lambda\{x, y\}[\text{we bought } x \text{ at } y]]$
  - b. For which pairs  $x, y$ , does  $x$  remember where we bought  $y$ ?  
 $\lambda\{v, x\}[v \text{ remembers } \lambda\{y\}[\text{we bought } x \text{ at } y]]$

Let us now consider the interaction of the various constraints included within the Nonsubject *Wh*-Interrogative Construction in (72). First, the head daughter's SEM value must be a

<sup>31</sup>Note that the Polar Interrogative Construction in (13) above also obeys (73), even though the abstracted set is empty. Polard-interrogative constructs are also classified as interrogative clauses. See Appendix 1.

FORM	⟨ <i>which, play, do, you, like</i> ⟩					
SYN	CAT	<table style="border: none;"> <tr><td style="padding-right: 10px;"><i>verb</i></td></tr> <tr><td style="padding-right: 10px;">VFORM <i>fin</i></td></tr> <tr><td style="padding-right: 10px;">IC        +</td></tr> <tr><td style="padding-right: 10px;">INV      -</td></tr> </table>	<i>verb</i>	VFORM <i>fin</i>	IC        +	INV      -
<i>verb</i>						
VFORM <i>fin</i>						
IC        +						
INV      -						
	VAL	⟨ ⟩				
SEM	$\lambda\{v\}[\lambda\varphi[\mathbf{like}(\varphi)(\mathbf{you})](\lambda P.\mathbf{the } x[\mathbf{play}(x) \wedge x = v \wedge P(x)])]$ $= \lambda\{v\}[\mathbf{the } x[\mathbf{play}(x) \wedge x = v \wedge \mathbf{like}(x)(\mathbf{you})]]$					
GAP	⟨ ⟩					

FORM	⟨ <i>which, play</i> ⟩	
SYN	NP	
SEM	$\lambda P.\mathbf{the } x[\mathbf{play}(x) \wedge x = v \wedge P(x)]$	
WH	{ <i>v</i> }	
REL	{ }	

FORM	⟨ <i>do, you, like</i> ⟩					
SYN	CAT	<table style="border: none;"> <tr><td style="padding-right: 10px;"><i>verb</i></td></tr> <tr><td style="padding-right: 10px;">VFORM <i>fin</i></td></tr> <tr><td style="padding-right: 10px;">IC        +</td></tr> <tr><td style="padding-right: 10px;">INV      +</td></tr> </table>	<i>verb</i>	VFORM <i>fin</i>	IC        +	INV      +
<i>verb</i>						
VFORM <i>fin</i>						
IC        +						
INV      +						
	VAL	⟨ ⟩				
SEM	$\mathbf{like}(\varphi)(\mathbf{you})$					
GAP	$\left\langle \left[ \begin{array}{l} \text{SYN NP} \\ \text{SEM } \varphi \end{array} \right] \right\rangle$					

Figure 8: A Construct Licensed by the Nonsubject *Wh-Interrogative Clause Construction*

proposition, as nothing else is compatible with being the basis (PROP argument) of a *question*, the general type of meaning that all interrogative clauses must have. This provides a semantic account of the impossibility of *wh*-interrogatives formed from imperatives, exclamatives, other interrogatives, and subjunctives:

- (75) a. \*Who [(everybody/you) visit \_ ]!/?  
b. \*I wonder who [what a nice book you gave \_ to \_ ].  
c. \*I wonder when [what to read \_ \_ ]?  
d. \*I wonder [what you be upset about \_ ].

Second, in constructs licensed by (72), the mother and the head daughter must include matching specifications for the features IC and INV. This ensures that inversion happens only in independent clauses:

- (76) a. Who will you visit \_ ?  
b. \*Who you will visit \_ ?  
c. They don't know who you will visit \_ .  
d. \*They don't know who will you visit \_ .

In English, this effect is restricted to *wh*-interrogatives; in other Germanic languages it applies more generally, so as to affect a broader class of clauses. What is analyzed in transformational frameworks in terms of head movement and a considerable number of attendant theory-internal assumptions is here the consequence of a simple identity constraint.

Third, the mother of a construct licensed by (72) need not be [VAL < >]; nor need it be finite (though a more general constraint requires all clauses to be finite or infinitival). However, when the VAL list is nonempty, it must contain a covert element (what Fillmore (1986a) calls *free null instantiation (fni)*). Covert signs can only appear on a valence list, never as a daughter of any construction. A *fni* element receives a free indefinite or contextually anchored interpretation, and hence can be used to analyze so-called '*arb*' interpretations of unexpressed elements. Since these elements are accusative in English, this construction never sanctions interrogatives like (70) above, where the finite VP requires a nominative subject. However, an infinitival head daughter like the one in (77) is licensed:

- (77) I wonder who [to visit \_ ].

And since infinitive *to* is a nonfinite verbal element specified as [INV -] and [IC -], such clauses must be embedded.<sup>32</sup>

Fourth, the range of filler constituents in *wh*-interrogatives parallels that of topicalization. NP, PP, AP, and AdvP fillers are possible, subject to constraints governing pied-piping:

---

<sup>32</sup>Note that since there are no phrases like [Kim to go] (because of the finiteness constraint included in the SPC; see (20) above), there are no interrogative clauses like (i):

(i) \*I wonder [who [Sandy to visit \_ ]].

- (78) a. Who did you see \_\_ ?  
 b. To whom did you send the letter \_\_ ?  
 c. How happy are they \_\_ ?  
 d. How quickly do you think you can do that \_\_ ?

Non-NP QP fillers are also allowed (if this is the correct analysis of examples like (79a)); VP fillers are never possible:<sup>33</sup>

- (79) a. How much does it cost \_\_ ?  
 b. \*Go to which store would they not \_\_ ?

Finally, observe that the grammar sketched here does not treat *wh*-interrogative clauses as extraction islands. That is, the constraints formulated in (72) allow for extractions like the following:

- (80) a. They are [the kind of relative]<sub>i</sub> that I never know [[what sort of present]<sub>j</sub> to give \_\_<sub>j</sub> to \_\_<sub>i</sub>].  
 b. ?They are [the kind of relative]<sub>i</sub> that I never know [[what sort of present]<sub>j</sub> I should give \_\_<sub>j</sub> to \_\_<sub>i</sub>].  
 c. \*?These are [the relatives]<sub>i</sub> that I don't know [[what presents]<sub>j</sub> they gave \_\_<sub>j</sub> to \_\_<sub>i</sub>].

Note that here, as elsewhere, the finite verb with specific time reference brings degraded acceptability in (80c), with a less eventive finite clause like (80b) being intermediate. Facts like these can be better explained in terms of processing complexity, rather than via grammatical constraints, along the lines suggested by Gibson (1998, 2000), Kluender (1998), Hofmeister et al. (2007), Sag et al. (to appear), Arnon et al. (to appear) and others. But even if this intrinsically more interesting approach to explaining island effects should prove to be untenable, such a result could easily be accommodated by further restricting the construction in (72).

#### 4.4 *Wh*-Relatives

Relative *wh*-words, which (as noted earlier) are only partly homophonous with interrogative and exclamative *wh*-words, are distinguished (following Pollard and Sag 1994) in terms of non-empty specifications for the feature REL. The Finite *Wh*-Relative Construction guarantees that the filler daughter in a finite *wh*-relative clause (and hence a relative word somewhere within the filler) bears a [REL {*x*}] specification, where the variable *x* is abstracted over to form the semantics of the relative clause. Assuming *fin-wh-rel-cl* is a further subtype of *fill-hd-cl*, this construction can be formulated as shown in (81):

<sup>33</sup>Examples like (79b) are independently accounted for by the pied piping theory of GS-00 and hence may not bear on the question of which constraints the Nonsubject *Wh*-Interrogative Construction should impose on its filler daughter.

(81) **Finite *Wh*-Relative Clause:**

$$\text{fin-wh-rel-cl} \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \text{SEL} \left[ \text{SYN} \text{ CNP} \right] \right] \right] \right] \\ \text{SEM} \quad \lambda P \lambda x [\lambda \varphi X(Y) \wedge P(x)] \end{array} \right] \\ \text{DTRS} \left\langle \begin{array}{l} \text{SYN} \left[ \begin{array}{l} \text{CAT} \textit{ nom} \\ \text{VAL} \langle \rangle \end{array} \right] \\ \text{WH} \quad \{ \} \\ \text{REL} \quad \{x\} \\ \text{SEM} \quad Y \end{array} \right\rangle, \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \begin{array}{l} \text{INV} \quad - \\ \text{IC} \quad - \\ \text{VFORM} \textit{ fin} \end{array} \right] \right] \\ \text{SEM} \quad X \\ \text{GAP} \quad \langle [\text{SEM} \varphi] \rangle \end{array} \right] \right\rangle \end{array} \right]$$

Here the filler daughter's syntactic category is specified as *nom* (*nominal*), which is an intermediate category type that must resolve to either *noun* or *preposition*. Thus only NP or PP fillers are allowed in constructs licensed by this construction, as noted in (43) above.

The semantics specified in (81) ensures that the head daughter (the clause that follows the filler daughter) has a propositional semantics. This again provides a natural semantic account of why many kinds of phrase cannot head a relative clause, including all the following, where the head daughter's 'clause-type/meaning-type' is as indicated:

- (82) a. \*[the people]<sub>i</sub> [who [what a story they told \_\_ to \_\_<sub>i</sub> ] ]... (\*interrogative/question)
- b. \*[the people]<sub>i</sub> [who [what else they read \_\_ to \_\_<sub>i</sub> ] ]... (\*interrogative/question)
- c. \*[the people]<sub>i</sub> [who [what book to read \_\_ to \_\_<sub>i</sub> ] ]... (\*interrogative/question)
- d. \*the books [which [be sure to read \_\_ by tomorrow] ]... (\*imperative/outcome)
- e. \*the books [which [he have \_\_ read by tomorrow] ]... (\*subjunctive/outcome)

The Finite *Wh*-Relative Clause Construction gives rise to constructs like the one shown in Figure 9. In addition, since no VAL value is specified for the head daughter in (81), nothing rules out *wh*-relatives like (83), where the italicized head daughter is a finite VP:

- (83) the woman [[whose friend] *likes Kim*]. . .

Relative clauses combine with a nominal expression, a CNP, to form a larger CNP in accordance with a kind of head-functor construction that adds the semantics of the relative clause to the restriction set of the CNP's parameter. This gives rise to head-relative constructs like the one sketched in Figure 10, where the head daughter's SEL value is identified with the nominal head daughter, as indicated by shading. This construction can apply recursively, giving rise to 'stacked' relative clauses of the sort shown in (84):

- (84) a. [[My uncle who lives in Oregon] whose friend Kim likes] . . .

$$\left[ \begin{array}{l} \text{FORM } \langle \textit{whose, friend, Kim, likes} \rangle \\ \text{SYN } \left[ \begin{array}{l} \text{CAT } \left[ \begin{array}{l} \textit{verb} \\ \text{VFORM } \textit{fin} \\ \text{INV } - \\ \text{SEL } \text{CNP} \end{array} \right] \\ \text{VAL } \langle \rangle \end{array} \right] \\ \text{SEM } \lambda P \lambda x [\lambda \varphi [\mathbf{like}(\varphi)(\mathbf{Kim})](x\text{'s-friend}) \wedge P(x)] \\ = \lambda P \lambda x [\mathbf{like}(x\text{'s-friend})(\mathbf{Kim}) \wedge P(x)] \end{array} \right]$$

$$\left[ \begin{array}{l} \text{FORM } \langle \textit{whose, friend} \rangle \\ \text{SYN } \text{NP} \\ \text{SEM } x\text{'s-friend} \\ \text{WH } \{ \} \\ \text{REL } \{x\} \end{array} \right] \left[ \begin{array}{l} \text{FORM } \langle \textit{Kim, likes} \rangle \\ \text{SYN } \left[ \begin{array}{l} \text{CAT } \left[ \begin{array}{l} \textit{verb} \\ \text{VFORM } \textit{fin} \\ \text{INV } - \\ \text{SEL } \text{CNP} \end{array} \right] \\ \text{VAL } \langle \rangle \end{array} \right] \\ \text{SEM } \mathbf{like}(\varphi)(\mathbf{Kim}) \\ \text{GAP } \langle [\text{SEM } \varphi] \rangle \end{array} \right]$$

Figure 9: A Construct Licensed by the Finite *Wh*-Relative Clause Construction

$$\left[ \begin{array}{l} \text{FORM } \langle \textit{joker, whose, friend, Kim, likes} \rangle \\ \text{SYN } \text{CNP} \\ \text{SEM } \lambda P \lambda x [\mathbf{like}(x\text{'s-friend})(\mathbf{Kim}) \wedge P(x)](\mathbf{joker}) \\ = \lambda x [\mathbf{like}(x\text{'s-friend})(\mathbf{Kim}) \wedge \mathbf{joker}(x)] \end{array} \right]$$

$$\left[ \begin{array}{l} \text{FORM } \langle \textit{joker} \rangle \\ \text{SYN } \text{CNP} \\ \text{SEM } \mathbf{joker} \end{array} \right] \left[ \begin{array}{l} \text{FORM } \langle \textit{whose, friend, Kim, likes} \rangle \\ \text{SYN } \left[ \begin{array}{l} \text{CAT } \left[ \begin{array}{l} \text{VFORM } \textit{fin} \\ \text{SEL } \text{CNP} \end{array} \right] \end{array} \right] \\ \text{SEM } \lambda P \lambda x [\mathbf{like}(x\text{'s-friend})(\mathbf{Kim}) \wedge P(x)] \end{array} \right]$$

Figure 10: A Nominal-Modifier Construct

b. [[Any person whose friends Kim likes] that you failed to invite to the party] . . .

As noted in section 3.1, finite and infinitival *wh*-relatives have distinct properties. Finite *wh*-relatives allow a filler daughter that is either an NP or a PP, as we have seen. By contrast, an infinitival *wh*-relative requires that the filler daughter be a PP:

- (85) a. people [with whom [to confer \_ ] ]... (PP)  
 b. \*people [who(m) [to confer with \_ ] ]... (NP)  
 c. \*the degree [how happy [to remain \_ ] ]... (AP)  
 d. \*the degree [how happily [to agree \_ ] ]... (AdvP)  
 e. \*the people [talk to whom [to dare to \_ ] ]... (VP)

These contrasts suggest a separate construction for infinitival *wh*-relatives, which can be formulated as in (86):<sup>34</sup>

(86) **Infinitival *Wh*-Relative Clause:**

$$inf\text{-}wh\text{-}rel\text{-}cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \text{SEL} \left[ \text{SYN} \text{ CNP} \right] \right] \right] \\ \text{SEM} \lambda P \lambda x [M[[\lambda \phi X](Y) \wedge P(x)]] \end{array} \right] \\ \text{DTRS} \left\langle \begin{array}{l} \text{SYN} \left[ \begin{array}{l} \text{CAT } prep \\ \text{VAL} \langle \rangle \end{array} \right] \\ \text{SEM} Y \\ \text{WH} \{ \} \\ \text{REL} \{ x \} \end{array} \right\rangle , \left[ \begin{array}{l} \text{SYN} \left[ \begin{array}{l} \text{CAT} [VFORM \text{ inf}] \\ \text{VAL} \langle \text{fni} \rangle \end{array} \right] \\ \text{SEM} X \\ \text{GAP} \langle [SEM \phi] \rangle \end{array} \right] \right\rangle \end{array} \right]$$

Here, *M* stands for whatever modality is appropriate for this construction. Note that some such modality must be part of an adequate grammatical description, because *to*-phrases in other contexts lack this modal aspect of their interpretation.<sup>35</sup>

Finally, (86) requires that the head daughter be specified as [VAL *fni* ], where *fni* abbreviates ‘free null instantiation’, a kind of null argument instantiation distinct from ‘definite null instantiation’ and ‘indefinite null instantiation’ (See Fillmore 1986a). The constructs licensed by (86) will thus all be subjectless infinitival VPs (not Ss or CPs) with either an indefinite or definite reference. This correctly predicts contrasts like the following:

<sup>34</sup>For a proposal factoring out generalizations common to the two types of *wh*-relative discussed here, see Sag 1997.

<sup>35</sup>Compare (i) and (ii):

- (i) The person to do this job... [≈ the person who should do this job...]  
 (ii) We believed him to be incompetent. [≈ we believed that he was incompetent].

- (87) a. The person [[in whom] to place your trust] is our president.
- b. Rather, there, it seems a more reasonable hypothesis that Freud chose another, more obvious Jewish personage [[with whom to identify himself], ... [Blatt, D.S. (1988). *The Development of the Hero: Sigmund Freud and the Reformation of the Jewish Tradition*. Available online at <http://www.pep-web.org>]
- c.\*The person [[in whom] for you to place your trust] is our president.

## 4.5 The-Clauses

The Comparative Correlative construction (also known as the ‘More-the-Merrier’ construction, and the Comparative Conditional construction) has been discussed by various scholars over the last few decades.<sup>36</sup> Here, I follow Borsley (2004) and Abeillé and Borsley (in press) in viewing sentences like (88a) in terms of a paratactic construction related to those illustrated in (88b–c):

- (88) a. The more you read, the more you understand.
- b. If you read, (then) you’ll understand.
- c. As you read, (so) you’ll understand.

These are related to an historically well attested Indo-European pattern, traditionally referred to as the Relative-Correlative Construction. Borsley makes the reasonable assumption that there is a syntactic feature that identifies the component clauses that participate in such parataxes. I will follow him in this, positing a feature CORRELATIVE (CREL) whose values are *the*, *if*, *as*, *then*, *so*, ... and *none*. This enables the analysis of comparative conditional sentences to be based on a construction like (89).<sup>37</sup>

(89) **Comparative Correlative Clause:**

$$comp-corr-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} \text{CREL} \quad none \\ \text{SEM} \quad R(\alpha, \beta) \end{array} \right] \\ \text{DTRS} \quad \left\langle \left[ \begin{array}{l} \text{CREL} \quad the \\ \text{SEM} \quad \alpha \end{array} \right], \text{H:} \left[ \begin{array}{l} \text{CREL} \quad the \\ \text{SEM} \quad \beta \end{array} \right] \right\rangle \\ \text{HD-DTR} \quad H \end{array} \right]$$

<sup>36</sup>See Ross 1967, Fillmore 1986b, Fillmore et al. 1988, McCawley 1988b, Kay and Fillmore 1999, Culicover and Jackendoff 1999, 2005 (Ch. 13), Borsley 2004, den Dikken 2005, Abeillé and Borsley in press.

<sup>37</sup>In a more comprehensive treatment, the more general Relative-Correlative Construction would specify whatever general constraints applied to the entire family of constructs, of which comparative conditional sentences form just one subtype. For discussion of variant realizations of comparative conditionals, see Fillmore 1985 and Borsley 2004.

Although any of the recent proposals for analyzing the semantics of correlatives (e.g. that of Beck 1997) are broadly compatible with the analysis presented here, I base my treatment on that of Brasoveanu (2008), who argues that the semantic essence of this construction is a relation of correspondence  $R$  that is predicated of the differentials specified within the two *the*-clauses. On this view, what (90) means is sketched in (91):

(90) The greater a natural number is, the greater its square is.

(91) There is a natural correspondence between  $\alpha$  and  $\beta$ , where  $\alpha$  is the difference (differential) between (any) two natural numbers and  $\beta$  is the difference between the squares of those two numbers.

The first approximation of the meaning of  $R$  suggested by Brasoveanu is that it simply guarantees the truth of (92):

(92) Given two natural numbers  $x$  and  $y$ , if  $x - y$  is positive, then so is  $x^2 - y^2$

As Brasoveanu points out, the relation in question varies from language to language. In Romanian, for example, the relevant relation is simple identity. As a result, the Romanian analog of (90) is false.<sup>38</sup>

A detailed analysis of comparative correlatives is beyond the scope of this paper, but the direction such an analysis would take is reasonably clear. The comparative specifier *the* semantically introduces a differential within each clause, that is, *the* functions as a differential specifier like *much* or *three feet* in *three feet/much taller than Sandy is*. Just as the grammar of degree words must ensure that *three feet* picks out the differential between the height that Kim has and the height that Sandy has in (93), that same grammar, together with constraints specified within the lexical entry for the differential specifier *the*, must ensure that the differential of the two heights in (94) corresponds to the variable  $\Delta$ :

(93) Kim is three feet taller than Sandy is. [the positive difference between Kim's height and Sandy's height is three feet]

(94) The taller Sandy is... [the positive difference between Sandy's height at  $t_1$  and Sandy's earlier height at  $t_2$  is  $\Delta$ ]

I will assume that the singleton set containing  $\Delta$  is the REL value of specifier *the* and that this is inherited as the REL value of phrases containing *the*, in accordance with the general theory of pied piping discussed earlier. Thus, phrases like the following will all be specified as [REL { $\Delta$ }]:

(95) *the more, the taller, the taller a man, the more customers, the more customers' accounts,...*

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<sup>38</sup>For further discussion of these and related issues, in particular the dynamic aspects of the interpretation of these sentences, which I am ignoring here, see Brasoveanu 2008.

These assumptions allow an account of *the*-clauses that is parallel to the other kinds of filler-head constructs discussed above. I posit the construction in (96) to license constructs of type *the-clause* (*the-cl*) as a distinct subtype of *fill-hd-cl*:

(96) **The-Clause:**

$$\textit{the-cl} \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} \quad [\text{CREL } \textit{the} ] \\ \text{SEM} \quad (\iota\Delta : [\lambda V.X](Y)) \end{array} \right] \\ \text{DTRS} \left\langle \begin{array}{l} \text{SYN} \quad \left[ \begin{array}{l} \text{CAT } \textit{adjectival} \\ \text{VAL } \langle \ \rangle \end{array} \right] \\ \text{SEM} \quad Y \\ \text{WH} \quad \{ \} \\ \text{REL} \quad \{ \Delta \} \end{array} \right\rangle, \left[ \begin{array}{l} \text{CAT} \quad [\text{VFORM } \textit{fin} ] \\ \text{SEM} \quad X \\ \text{GAP} \quad \langle [\text{SEM } V ] \rangle \end{array} \right] \right\rangle
 \end{array} \right]$$

Here *adjectival* is an intermediate-level category type that must resolve to *noun*, *adjective* or *adverb*, requiring the filler daughter within a *the*-clause to be an NP, AP or AdvP. Since the filler daughter is specified as [REL { $\Delta$ }], it must contain an occurrence of the differential specifier *the*, as just noted. It also follows that the differential variable associated with the differential specifier *the* is the one used to construct the  $\iota$ -term which (simplifying somewhat) is the interpretation of the *the*-clause. A well-formed construct of type *the-cl* is illustrated in Figure 11. And since each *the*-clause has an  $\iota$ -term as its SEM value, these serve as the arguments of the relation *R* in a relative-correlative construct like the one sketched in Figure 12.

## 5 Conclusion

In this paper, I have examined the often subtle grammatical and semantic factors that distinguish the various kinds of filler-gap clauses in English. In addition, I have provided a surface-oriented analyses of these clauses in a framework where constructions are taken as basic. All of the English extraction constructions examined here are related. The classes of construct they license form subtypes of the *filler-head-construct* type. Hence constraints stated in terms of this construct type reflect general properties of all the filler-gap sentences examined here. Moreover, the constraint-based analysis of extraction I have presented is independently motivated by the existence of numerous languages where words and constructions are sensitive to the presence or absence of a filler-gap dependency at intermediate levels along the extraction path,<sup>39</sup> and provides a uniform analysis of general properties of extraction dependencies within a given language, as well as the cross-linguistic generalizations.

As shown here in detail, particular extraction constructions exhibit idiosyncrasies that any observationally adequate grammar must account for. These include variation in:

<sup>39</sup>For further discussion of these issues, see Hukari and Levine 1995, Bouma et al. 2001, and Levine and Hukari 2006.



FORM	$\langle$ <i>the, more, books, you, read, the, more, you, understand</i> $\rangle$	
SYN	CAT	$\begin{bmatrix} \textit{verb} \\ \textit{VFORM fin} \\ \textit{INV -} \end{bmatrix}$
	VAL	$\langle \rangle$
	CORREL	<i>none</i>
	SEM	$R(\iota\Delta_1$ [ <b>you read <math>\delta_1</math> many books at <math>t_1</math></b> & <b>you read <math>\delta_2</math> many books at an earlier <math>t_2</math></b> & $\delta_1 > \delta_2$ & $\delta_1 - \delta_2 = \Delta_1$ ], $\iota\Delta_2$ [ <b>you understand <math>\delta_3</math> much at <math>t_1</math></b> & <b>you understand <math>\delta_4</math> much at an earlier <math>t_2</math></b> & $\delta_3 > \delta_4$ & $\delta_3 - \delta_4 = \Delta_2$ ])

FORM	$\langle$ <i>the, more, books, you, read</i> $\rangle$	
SYN	CAT	$\begin{bmatrix} \textit{verb} \\ \textit{VFORM fin} \\ \textit{INV -} \end{bmatrix}$
	VAL	$\langle \rangle$
	CORREL	<i>the</i>

FORM	$\langle$ <i>the, more, you, understand</i> $\rangle$	
SYN	CAT	$\begin{bmatrix} \textit{verb} \\ \textit{VFORM fin} \\ \textit{INV -} \end{bmatrix}$
	VAL	$\langle \rangle$
	CORREL	<i>the</i>

Figure 12: A *Comparative-Correlative* Clause

- whether the head daughter can or must be inverted,
- what constraints are imposed on the grammatical category of the filler daughter,
- the presence of a particular kind of *wh*-word (interrogative, exclamative, or relative) within the filler vs. the absence of any *wh*-word,
- whether the head daughter can be subjectless or not,
- whether the clause can or must be a main (independent) clause,
- whether the head daughter must be finite, must be infinitival, or may be either, and
- the possibility of a non-propositional head daughter

The construction-based analysis that I have presented deals with both the regularities of extraction and a reasonable range of the construction-specific variation. The remaining FG gap constructions of English (*though/as* ‘Preposing’, VP-Fronting, free relatives, clefts bear a strong family resemblance to those treated here and are amenable to similar analysis.

Moreover, this explicit and fully formalized account is surface-oriented, model-theoretic,<sup>40</sup> and strongly lexicalist. It thus embodies the design properties argued by Jackendoff (1997, 2002), Culicover and Jackendoff (2005), and Sag and Wasow (in press) to be most compatible with what modern psycholinguistics tells us that competence grammars should look like. Despite a half century of intense investigation by thousands of researchers, it still remains unknown whether analyses of comparable coverage, precision, and psycholinguistic plausibility can be developed within any framework that employs grammatical transformations, let alone one that seeks to employ a restricted subset of the transformational operations that have been discussed in the literature, e.g. the ‘minimalist program’ articulated by Chomsky (1995) or any of the variants of minimalism delineated in mainstream generative textbooks. Far from being the epiphenomena disparaged by Chomsky in words that have been repeated countless times by generations of transformational grammarians, grammatical constructions are much more likely to be the cornerstone of explanatory adequacy in the realms of natural language syntax, semantics, and the interface between the two.<sup>41</sup>

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<sup>40</sup>I mean this in the sense of Pullum and Scholz 2001: a grammar is model-theoretic if it is formulated as a set of constraints that grammatical objects must simultaneously satisfy. That is, it involves no operations that destructively modify grammatical objects and the determination of well-formedness involves no appeal to comparison of one grammatical object with other competitors.

<sup>41</sup>In addition, the Construction Grammar framework illustrated here has the potential to explain further properties of constructions. As argued by Prince (1996), constructions may involve arbitrary form-function associations: a single function can be associated with many forms and a single syntactic form may be associated with multiple constructions. The former case arises when two distinct constructions require identical SEM value or identical contextual information; the latter when two sister types inherit identical formal constraints, but require distinct meanings (e.g. two of the aux-initial constructions discussed in section 2 above). Similarly, a construction theorist could posit a universal inventory of constructions, making it possible to identify constructions across languages, as suggested by Prince.

# Appendix 1

## Grammar Signature

### Type Partitions:

Partition of *linguistic-object*: *list*( $\sigma$ ), *set*( $\sigma$ ) *sign*, *construct*, *phon-obj*, *syn-obj*, *sem-obj*, *ctxt-obj*, *cat*, *boolean*, . . .

Partition of *list*( $\sigma$ ): *nonempty-list*( $\sigma$ ), *empty-list* ( $\langle \ \rangle$ ).

Partition of *set*( $\sigma$ ): *nonempty-set*( $\sigma$ ), *empty-set* ( $\{ \}$ ).

Partition of *sign*: *lex-sign*, *expr*

Partition of *expr*: *word*, *phrase*

Partition of *lex-sign*: *word*, *lexeme*

Partition of *cat*: *nominal*, *verbal*, . . .

Partition of *nominal*: *preposition*, *noun*

Partition of *adjectival*: *noun*, *adj*, *adv*

Partition of *verbal*: *complementizer*, *verb*

Partition of *construct*: *phr-ctxt*, *lex-ctxt*

Partition of *phr-ctxt*: *hd-ctxt* and *nhd-ctxt*

Partition of *phr-ctxt*: *clause* and *non-clause*

Partition of *hd-ctxt*: *ai-ctxt*, *hd-comp-ctxt*, *sp-cl*, *fill-hd-cl*, *comp-corr-cl*. . .

Partition of *nhd-ctxt*: *coord-ctxt*, . . .

Partition of *clause*: *decl-cl*, *int-cl*, *imp-cl*, *excl-cl*, *rel-cl*, *comp-corr-cl*, . . .

Partition of *decl-cl*: *sp-cl*, . . .

Partition of *int-cl*: *pol-int-cl*, *subj-wh-int-cl*, *ns-wh-int-cl*, . . .

Partition of *excl-cl*: *inv-excl-cl*, *wh-excl-cl*, . . .

Partition of *rel-cl*: *fin-wh-rel-cl*, *inf-wh-rel-cl*, . . .

Partition of *fill-hd-cl*: *top-cl*, *ns-wh-int-cl*, *wh-excl-cl*, *fin-wh-rel-cl*, *inf-wh-rel-cl*, *the-cl*, . . .

Partition of *boolean*: *plus* (+), *minus* (-)

### Feature Declarations:

$$\text{sign: } \left[ \begin{array}{ll} \text{PHON} & \textit{phon-obj} \\ \text{SYN} & \textit{syn-obj} \\ \text{SEM} & \textit{sem-obj} \\ \text{CNTXT} & \textit{ctxt-obj} \\ \text{CNTXT} & \textit{set(sem-obj)} \end{array} \right]$$
$$\text{lex-sign: } \left[ \text{ARG-ST} \quad \textit{list(expr)} \right]$$
$$\text{construct: } \left[ \begin{array}{ll} \text{MTR} & \textit{sign} \\ \text{DTRS} & \textit{list(sign)} \end{array} \right]$$
$$\text{syn-obj: } \left[ \begin{array}{ll} \text{CAT} & \textit{cat} \\ \text{VAL} & \textit{list(expr)} \end{array} \right]$$
$$\text{cat: } \left[ \text{SEL} \quad \textit{expr} \right]$$
$$\text{verbal: } \left[ \begin{array}{ll} \text{VFORM} & \textit{fin, inf, ...} \\ \text{IC} & \textit{boolean} \end{array} \right]$$
$$\text{verb: } \left[ \begin{array}{ll} \text{AUX} & \textit{boolean} \\ \text{INV} & \textit{boolean} \end{array} \right]$$
$$\text{noun: } \left[ \text{CASE} \quad \textit{nom/acc} \right]$$

### Some Grammatical Constructions of English:

#### Head Feature Principle:

$$\text{hd-ctx} \Rightarrow \left[ \begin{array}{ll} \text{MTR} & \left[ \text{SYN} \quad \left[ \text{CAT} \quad X \right] \right] \\ \text{HD-DTR} & \left[ \text{SYN} \quad \left[ \text{CAT} \quad X \right] \right] \end{array} \right]$$

**Subject-Predicate Clause:**

$$sp-cl \Rightarrow \left[ \begin{array}{l} hd-cxt \\ MTR \quad \left[ \begin{array}{l} SYN \quad \left[ \begin{array}{l} CAT \quad \left[ \begin{array}{l} VFORM \quad fn \\ INV \quad - \end{array} \right] \\ VAL \quad \langle \rangle \end{array} \right] \\ SEM \quad \mathbf{FR}(X_1, X_2) \end{array} \right] \\ DTRS \quad \left\langle Y: [SEM X_1] , H: \left[ \begin{array}{l} SYN [VAL \langle Y \rangle ] \\ SEM X_2 \end{array} \right] \right\rangle \\ HD-DTR \quad H \end{array} \right]$$

**Head-Complement:**

$$hd-comp-cxt \Rightarrow \left[ \begin{array}{l} MTR \quad \left[ \begin{array}{l} SYN \quad [VAL \langle Z \rangle ] \\ SEM \quad \mathbf{FR}_{\langle NP,p \rangle}(X_0, \dots, X_n) \end{array} \right] \\ DTRS \quad \left\langle H, Y_1:[SEM X_1], \dots, Y_n:[SEM X_n] \right\rangle \\ HD-DTR \quad H: \left[ \begin{array}{l} word \\ SYN \quad [VAL \langle Z, Y_1, \dots, Y_n \rangle ] \\ SEM \quad X_0 \end{array} \right] \end{array} \right]$$

**Filler-Head Clause:**

$$fill-hd-cl \Rightarrow \left[ \begin{array}{l} MTR \quad \left[ \begin{array}{l} SYN \quad [VAL L_1] \\ GAP \quad L_2 \end{array} \right] \\ DTRS \quad \left\langle [SYN X], H \right\rangle \\ HD-DTR \quad H: \left[ \begin{array}{l} phrase \\ SYN \quad \left[ \begin{array}{l} CAT \quad verbal \\ VAL \quad L_1 \end{array} \right] \\ GAP \quad \langle [SYN X] \rangle \oplus L_2 \end{array} \right] \end{array} \right]$$

**Aux-Initial-Clause:**

$$ai-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \text{SYN} \quad \left[ \text{VAL} \quad \langle \rangle \right] \right] \\ \text{DTRS} \quad \langle X_0, X_1, \dots, X_n \rangle \\ \text{HD-DTR} \quad X_0 : \left[ \begin{array}{l} \text{word} \\ \text{SYN} \quad \left[ \text{CAT} \quad \left[ \text{INV} \quad + \right] \right] \\ \text{VAL} \quad \langle X_1, \dots, X_n \rangle \end{array} \right] \end{array} \right]$$

**Interrogative Clause:**

$$int-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} \text{SEM} \quad \left[ \begin{array}{l} \text{question} \\ \text{PARAMS} \quad \Sigma_1 \end{array} \right] \\ \text{STORE} \quad \Sigma_2 \end{array} \right] \\ \text{HD-DTR} \quad \left[ \text{STORE} \quad \Sigma_1 \cup \Sigma_2 \right] \end{array} \right]$$

**Comparative Correlative Clause:**

$$comp-corr-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} \text{CREL} \quad \text{none} \\ \text{SEM} \quad R(\alpha, \beta) \end{array} \right] \\ \text{DTRS} \quad \left\langle \left[ \begin{array}{l} \text{CREL} \quad \text{the} \\ \text{SEM} \quad \alpha \end{array} \right], \text{H:} \left[ \begin{array}{l} \text{CREL} \quad \text{the} \\ \text{SEM} \quad \beta \end{array} \right] \right\rangle \\ \text{HD-DTR} \quad H \end{array} \right]$$

**Polar Interrogative Clause:**

$$pol-int-cxt \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} \text{SYN} \quad \left[ \text{CAT} \quad \left[ \text{IC} \quad + \right] \right] \\ \text{SEM} \quad \lambda \{ \} [\mathbf{FR}_p(X_1, \dots, X_n)] \end{array} \right] \\ \text{DTRS} \quad \left\langle \left[ \text{SEM} \quad X_1 \right], \dots, \left[ \text{SEM} \quad X_n \right] \right\rangle \end{array} \right]$$

**Inverted Exclamative Clause:**

$$inv-excl-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} \text{SYN} \quad \left[ \text{CAT} \quad \left[ \text{IC} \quad + \right] \right] \\ \text{SEM} \quad \text{fact}(\mathbf{FR}_p(X_1, \dots, X_n)) \end{array} \right] \\ \text{DTRS} \quad \left\langle \left[ \text{SEM} \quad X_1 \right], \dots, \left[ \text{SEM} \quad X_n \right] \right\rangle \end{array} \right]$$

**Inverted Conditional Clause:**

$$inv\text{-}cond\text{-}cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \begin{array}{l} \text{IC} \quad - \\ \text{SELECT} \quad \mathbf{S} \end{array} \right] \right] \\ \text{SEM} \quad \lambda q. [\mathbf{FR}_p(X_1, \dots, X_n) \Rightarrow_{\kappa} q] \end{array} \right] \\ \text{DTRS} \quad \langle [\text{SEM } X_1], \dots, [\text{SEM } X_n] \rangle \end{array} \right]$$

**Inverted Propositional Clause:**

$$inv\text{-}prop\text{-}cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \text{IC} \quad + \right] \right] \\ \text{GAP} \quad \text{nelist} \\ \text{SEM} \quad \mathbf{FR}_p(X_1, \dots, X_n) \end{array} \right] \\ \text{DTRS} \quad \langle [\text{SEM } X_1], \dots, [\text{SEM } X_n] \rangle \end{array} \right]$$

**Topicalized Clause:**

$$top\text{-}cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \text{IC} \quad + \right] \right] \\ \text{SEM} \quad [\lambda X.Y](Z) \\ \text{GAP} \quad \langle \rangle \end{array} \right] \\ \text{DTRS} \quad \left\langle \left[ \begin{array}{l} \text{SEM} \quad Z \\ \text{WH} \quad \{ \} \\ \text{REL} \quad \{ \} \end{array} \right], H \right\rangle \\ \text{HD-DTR} \quad H: \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \begin{array}{l} \text{INV} \quad - \\ \text{VFORM} \quad \text{fin} \end{array} \right] \right] \\ \text{VAL} \quad \langle \rangle \\ \text{SEM} \quad Y \\ \text{GAP} \quad \langle [\text{SEM } X] \rangle \end{array} \right] \end{array} \right]$$

**Wh-Exclamative Clause:**

$$wh-excl-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad [SEM \quad fact(E^uV[\lambda X.Y(Z)])] \\ \text{DTRS} \quad \left\langle \begin{array}{l} [SEM \quad Z] \\ [WH \quad \{V\}] \\ [REL \quad \{\}] \end{array} \right\rangle, \left[ \begin{array}{l} \text{SYN} \quad \left[ \begin{array}{l} \text{CAT} \quad \left[ \begin{array}{l} \text{INV} \quad - \\ \text{VFORM} \quad fin \end{array} \right] \\ \text{VAL} \quad \langle \rangle \end{array} \right] \\ \text{SEM} \quad Y \\ \text{GAP} \quad \langle [SEM \ X] \rangle \end{array} \right] \right\rangle \end{array} \right]$$

**Nonsubject Wh-Interrogative Clause:**

$$ns-wh-int-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad [SEM \ \lambda\{V, \dots\}[\lambda X.Y(Z)]] \\ \text{DTRS} \quad \left\langle \begin{array}{l} [SEM \ Z] \\ [WH \ \{V\}] \end{array} \right\rangle, \left[ \begin{array}{l} \text{SYN} \quad \left[ \begin{array}{l} \text{CAT} \quad \left[ \begin{array}{l} \text{INV} \quad W \\ \text{IC} \quad W \end{array} \right] \\ \text{SEM} \quad Y \\ \text{GAP} \quad \langle [SEM \ X] \rangle \end{array} \right] \right] \end{array} \right] \right\rangle \end{array} \right]$$

**Finite Wh-Relative Clause:**

$$fin-wh-rel-cl \Rightarrow \left[ \begin{array}{l} \text{MTR} \quad \left[ \begin{array}{l} \text{SYN} \quad \left[ \begin{array}{l} \text{CAT} \quad \left[ \begin{array}{l} \text{SEL} \quad [SYN \ \text{CNP}] \end{array} \right] \\ \text{SEM} \quad \lambda P \lambda x [\lambda \varphi X(Y) \wedge P(x)] \end{array} \right] \end{array} \right] \\ \text{DTRS} \quad \left\langle \begin{array}{l} \left[ \begin{array}{l} \text{SYN} \quad \left[ \begin{array}{l} \text{CAT} \quad nom \\ \text{VAL} \quad \langle \rangle \end{array} \right] \\ \text{WH} \quad \{\} \\ \text{REL} \quad \{x\} \\ \text{SEM} \quad Y \end{array} \right] \\ \left[ \begin{array}{l} \text{SYN} \quad \left[ \begin{array}{l} \text{CAT} \quad \left[ \begin{array}{l} \text{INV} \quad - \\ \text{IC} \quad - \\ \text{VFORM} \quad fin \end{array} \right] \\ \text{SEM} \quad X \\ \text{GAP} \quad \langle [SEM \ \varnothing] \rangle \end{array} \right] \end{array} \right] \end{array} \right\rangle \end{array} \right]$$

### Infinitival *Wh*-Relative Clause:

$$\text{inf-wh-rel-cl} \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} \left[ \text{CAT} \left[ \text{SEL} \left[ \text{SYN} \text{ CNP} \right] \right] \right] \\ \text{SEM} \lambda P \lambda x [M[[\lambda \phi X](Y) \wedge P(x)]] \end{array} \right] \\ \text{DTRS} \left\langle \begin{array}{l} \text{SYN} \left[ \begin{array}{l} \text{CAT} \textit{prep} \\ \text{VAL} \langle \rangle \end{array} \right] \\ \text{SEM} Y \\ \text{WH} \{ \} \\ \text{REL} \{x\} \end{array} \right\rangle, \left[ \begin{array}{l} \text{SYN} \left[ \begin{array}{l} \text{CAT} [\text{VFORM} \textit{inf}] \\ \text{VAL} \langle \textit{fni} \rangle \end{array} \right] \\ \text{SEM} X \\ \text{GAP} \langle [\text{SEM} \phi] \rangle \end{array} \right] \end{array} \right]$$

### The-Clause:

$$\text{the-cl-cxt} \Rightarrow \left[ \begin{array}{l} \text{MTR} \left[ \begin{array}{l} \text{SYN} [\text{CREL} \textit{the}] \\ \text{SEM} (\iota \Delta : [\lambda V.X](Y)) \end{array} \right] \\ \text{DTRS} \left\langle \begin{array}{l} \text{SYN} \left[ \begin{array}{l} \text{CAT} \textit{adjectival} \\ \text{VAL} \langle \rangle \end{array} \right] \\ \text{SEM} Y \\ \text{WH} \{ \} \\ \text{REL} \{ \Delta \} \end{array} \right\rangle, \left[ \begin{array}{l} \text{CAT} [\text{VFORM} \textit{fin}] \\ \text{SEM} X \\ \text{GAP} \langle [\text{SEM} V] \rangle \end{array} \right] \end{array} \right]$$

## 6 Appendix 2: Abbreviations

### Features:

ARG-ST (ARGUMENT-STRUCTURE), CAT (CATEGORY), CNTXT (CONTEXT), CREL (CORRELATIVE), DTRS (DAUGHTERS), HD-DTR (HEAD-DAUGHTER), IC (INDEPENDENT-CLAUSE), INV (INVERTED), MTR (MTR), PHON (PHONOLOGY), REL (RELATIVE), SEL (SELECT), SEM (SEMANTICS), SYN (SYNTAX), VAL (VALENCE)

### Types:

*adj* (adjective), *adv* (adverb), *ai-cl* (aux-initial-clause), *decl-cl* (declarative-clause), *excl-cl* (exclamative-clause), *expr* (expression), *fill-hd-cl* (filler-head-clause), *fin* (finite), *fin-wh-rel-cl* (finite-wh-relative-clause), *hd-comp-cxt* (head-complement-construct), *hd-cxt* (headed-construct), *hd-func-cxt* (head-functor-construct), *imp-cl* (imperative-clause), *inf* (infinitive), *inf-wh-rel-cl* (infinitival-wh-relative-clause), *int-cl* (interrogative-cl), *inv-excl-cl* (inv-excl-cl),

*lex-cxt* (lexical-construct), *nhd-cxt* (nonheaded-construct), *ns-wh-int-cl* (nonsubject-wh-interrogative-clause), *phr-cxt* (phrasal-construct), *pol-int-cl* (polar-interrogative-clause), *rel-cl* (relative-clause), *sp-cl* (subject-predicate-clause), *subj-wh-int-cl* (subject-wh-interrogative-clause), *wh-excl-cl* (wh-exclamative-clause)

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