

CROSS-LINGUISTIC SEMANTICS

Maria Bittner

Abstract:

Rooth & Partee (1982) and Rooth (1985) have shown that the English-specific rule-by-rule system of PTQ can be factored out into function application plus two transformations for resolving type mismatch (type lifting and variable binding). Building on these insights, this article proposes a universal system for type-driven translation, by adding two more innovations: local type determination for gaps (generalizing Montague 1973) and a set of semantic filters (extending Cooper 1983). This system, dubbed *Cross-Linguistic Semantics (XLS)*, is shown to account for various phenomena — including scope relations in English and Greenlandic Eskimo, internally headed relative clauses in Lakhota, serial verbs in Yoruba and VP ellipsis in English.

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1. INTRODUCTION

In this paper I propose a cross-linguistic system consisting of a small set of semantic rules whose output is assessed by a small set of semantic filters, and use that system to interpret a variety of constructions in typologically diverse languages. The semantic rules apply to Logical Forms (LFs) which are independently motivated by the syntactic GB theory (Chomsky 1981, 1986a,b, 1989, *et al.*). Their output are *Interpreted Logical Forms* (ILFs), which are like the input LFs except that each meaningful constituent is associated with a model-theoretic denotation (cf. the analysis trees of Montague 1973). Any ILF which satisfies the semantic filters is predicted to represent a possible reading.¹ The constructions to be discussed include: simple clauses with dyadic and triadic verbs, verb coordination, VP ellipsis, and relative clauses, in English; ergative, antipassive, comparative, and superlative clauses, as well as possessed nominals, in West Greenlandic Inuit (hereafter *WG Inuit*, Eskimo-Aleut family); internally headed relative clauses in Lakhota (dialect of Dakota, Siouan: South Dakota, Montana, Manitoba); and serial verbs in Yoruba (Kwa, Congo-Kordofanian: Nigeria).

The generative component of the cross-linguistic system I propose consists of six semantic rules. Most of these are generalized versions of language- and construction-specific rules originally due to Montague (1973) and other researchers in Montague Grammar. The original proposals are made less sensitive to cross-linguistic syntactic variation, by eliminating reference to linear order and other structural relations which are not relevant to compositionality, and by replacing reference to syntactic categories with reference to semantic types (as in the type-driven translation system of Klein and Sag 1985). These modifications make it possible to collapse many of the construction-specific rules in Montague's fragment of English to three rules of universal applicability: one for lexically filled terminals (*rule L*), one for nodes with a single meaningful daughter (*rule U*), and one for nodes whose daughters are of suitable types to combine by function application (*rule F*). Two further rules may adjust the type of a node, if

¹ The salience of a reading may depend on the linguistic and extra-linguistic context. A reading counts as possible if native consultants accept it in some context.

function application cannot apply directly, by means of type-lifting (*rule T*; cf. Rooth and Partee 1982, Partee and Rooth 1983) or lambda abstraction (*rule B*). The remaining rule (*rule E*) interprets traces and other empty nodes which are subject to the Empty Category Principle of the syntactic GB theory (Chomsky 1981). In addition to the standard view that a trace is interpreted as a variable, this rule incorporates the new idea that the logical type of the variable is predictable based on the logical type of a local constituent—typically, the sister of the trace. This innovation makes it possible to explain the semantic consequences of various kinds of movement.

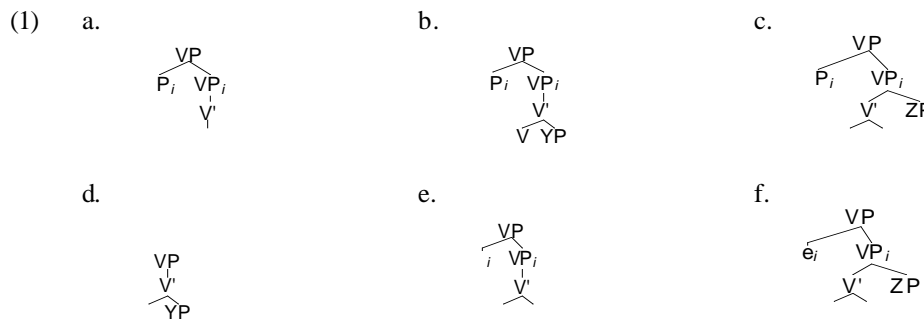
An Interpreted Logical Form (hereafter ILF) generated by the above rules represents a possible reading only if it satisfies three semantic filters. One filter prohibits vacuous constituents from having meaningful parts (*Vacuity Filter*; cf. the principle of full interpretation, Chomsky 1986a). Another filter ensures that every verb has the number of arguments it requires, and that these are of the required logical types (*Type Filter*; cf. θ -criterion, Chomsky 1981). The third filter requires variables introduced by traces to be bound within the ILF, while permitting variables introduced by pronouns to remain free (*Store Filter*; cf. Condition on Proper Binding, May 1977).

Some cross-linguistic evidence for this semantic system is provided by Bittner (1994). It is also shown there that the readings of a wide range of constructions in WG Inuit—a highly polysynthetic language with an ergative case system and typologically unusual scope relations—are predictable on the basis of this semantic system and independently motivated Logical Forms of the syntactic GB theory. By showing that the same holds for other constructions and other languages, I now provide further support for the general hypothesis that natural language semantics can be accounted for by a theory which consists solely of cross-linguistic rules and filters which do not refer to any language- or construction-specific information. It is interesting to note in this context that the semantic theory to be proposed here is organized in a similar way as the syntactic GB framework. The shared aspects of organization include a generative component, consisting of a set of local operations whose output are representations of the relevant sort. Specifically, for any sentence, the syntactic representations are ordered triples of structures which represent the syntactically relevant relations in that sentence at d-structure, s-structure, and Logical Form. The semantic representations are Interpreted Logical Forms, which represent the intuitively available readings. Each representation is assessed as a whole by a filtering component, which is a set of syntactic or semantic filters. The representations which satisfy those filters form the basis of the empirically testable predictions of the theory.

In section 2, I spell out the semantically relevant assumptions of the version of the GB theory I adopt. The cross-linguistic semantics sketched above is formalized in section 3, and its predictions about semantically significant movement are explored in sections 4 and 5.

2. SYNTACTIC ASSUMPTIONS

Concerning the d-structure, I assume that all branching is binary (Kayne 1983, Larson 1988) and that the subject of any verb originates within the VP (see Zagana 1982, Koopman and Sportiche 1985, 1991, Kitagawa 1986, Fukui and Speas 1986, Kuroda 1988, Mohammad 1988, Diesing 1990, Woolford 1991, Bittner 1994, among others, for evidence from English, Yiddish, French, Japanese, Arabic, Jacaltec, Niuean, Chamorro, Breton, and WG Inuit). In general, the verb has at most one *external argument*, i.e. underlying subject. This is generated in a VP-adjoined position and distinguished from other adjuncts by coindexation (as XP_i in (1a–c), cf. Williams 1980, 1981). If the verb has no external argument, then its VP-adjoined subject position is either missing (as in (1d)) or generated empty (as in (1e–f)). The verb may also have at most two *internal arguments*, which are dominated by every segment of the VP (as YP and ZP in (1a–f)).²



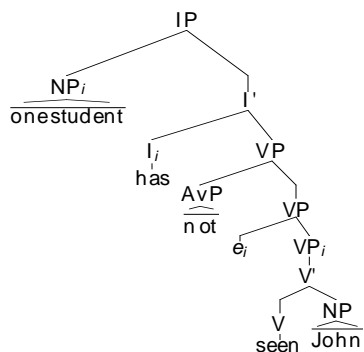
In the spirit of the economy framework of Chomsky (1989), I further assume that the s-structure is either identical to the d-structure, or is derived from it by the minimum of movement required to satisfy the s-structure filters. For example, to satisfy the Case Filter, some NP arguments may have to move, as the nominative subject in the accusative construction (2b) in English, and the nominative object in the ergative construction (3b) in WG Inuit.

² In schematic diagrams, like (1a–f), only the hierarchical relations, not the linear order, are relevant. The order depends on whether the language is head-initial or head-final and other parameter settings.

Other arguments may be licensed at s-structure in situ, as the accusative object in (2b), and the ergative subject in (3b).³

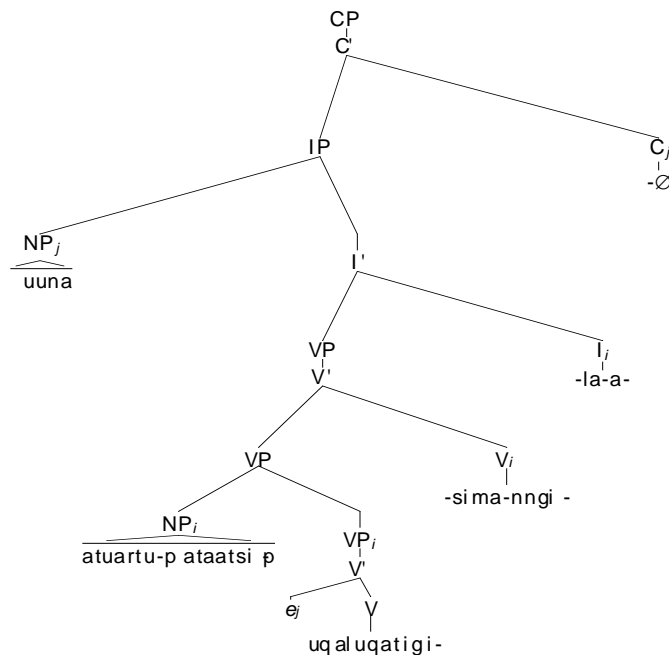
- (2) a. One student has not seen John yet.

b.



- (3) a. Suli atuartu-p ataatsi-p Juuna uqaluqatigi-sima-nngi-la-a-∅
yet student-ERG one-ERG J. talk.to-PRF-neg-IND-3sgERG-3sgNOM
 (i) 'No student has talked to Juuna yet.'
 (ii) 'One student hasn't talked to Juuna yet.'

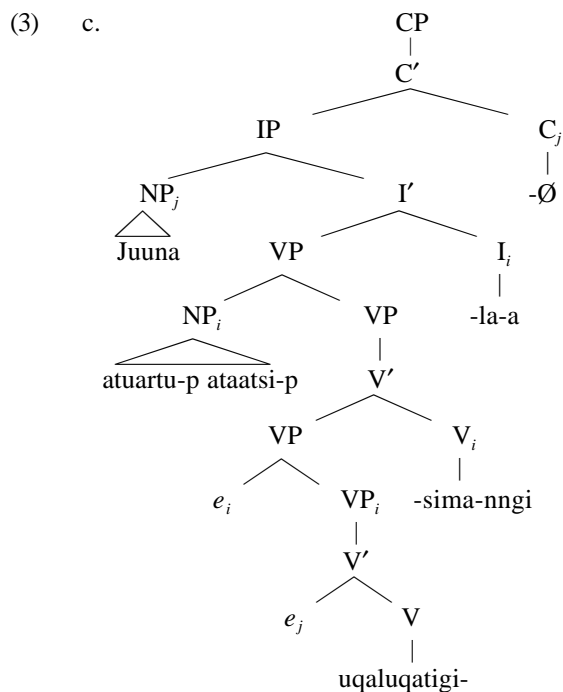
(3) b.



³ For the sake of exposition, the structures in (2b) and (3b) are stripped of semantically irrelevant syntactic details. As a consequence, it is impossible to see why it is the subject which moves in (2b) but the object in (3b). See Bittner (1994) for the full structures and detailed syntactic discussion.

Head-movement (Koopman 1983, Travis 1984, Baker 1988) and other types of movement may also take place at s-structure, if that is necessary to satisfy the filters which apply at that level. For example, according to Bittner (1994), verb raising and noun incorporation, in constructions like (7) and (8) below, apply at s-structure for Case-related reasons. All other movement is postponed till the level when the filters which motivate it must be met. Thus, in (3a), the incorporation of the verbal stem *uqaluqatigi-* into the suffixal verb *-sima-nngi-*, and thence into the inflectional mood and agreement suffixes *-la-a-* and $-\emptyset$, is motivated by morphological rather than syntactic considerations, and therefore presumably takes place at PF. This would explain why it has no consequences for either syntax or truth-conditional semantics. The same appears to hold for certain scrambling operations, such as the optional fronting of the ergative subject over the nominative object in WG Inuit, which is also illustrated in (3a).

The Logical Form (LF) of a sentence is either identical to its s-structure (*default LF*) or else is derived from that structure by optional movement (*alternative LF*). For most of the constructions considered this study, LF movement can be restricted to the standard version of Quantifier Raising (QR)—that is, adjunction of a nominal argument to a dominating IP or VP subject to the usual syntactic constraints on movement (cf. May 1977, 1985, Williams 1977a, Stowell 1981, de Carico 1983, Lasnik and Uriagereka 1988, amongst others). For example, from the s-structure/default LF (3b) of the WG Inuit sentence (3a), QR could derive the alternative LF (3c):



The only constructions to be discussed which call for other kinds of movement at LF are serial verbs in Yoruba (sec. 5.2) and VP ellipsis in English (sec. 5.3), both of which suggest that QR can also apply to VPs.

Given the default the LF (3b) and the alternative LF (3c), of the WG Inuit sentence (3a), the cross-linguistic semantics sketched in the introduction and formalized in section 3 derives two semantically acceptable ILFs. Based on these ILFs, (3a) is predicted to have the following two readings:

- | | | | |
|------|----|--|--------------------------------|
| (3') | b. | $\neg\exists x(\text{student}'(x) \wedge \text{talk.to}'(j)(x))$ | [from the default LF (3b)] |
| | c. | $\exists x(\text{student}'(x) \wedge \neg\text{talk.to}'(j)(x))$ | [from the alternative LF (3c)] |

This prediction was tested by presenting (3a) to five native consultants in the context of the WG Inuit equivalent of the following story: “Two months ago, in order to find out what his students were interested in, Juuna suggested that they come to him individually to tell him about their interests. Yesterday when I talked to him,...”. All of the consultants judged the story compatible with a scenario where none of the students have talked to Juuna (3'b). Two of the consultants also accepted a scenario where all of the students except one have talked to him (3'c). I conclude that (3a) is indeed ambiguous between the predicted readings, and that the reading corresponding to the s-structure/default LF is more salient.

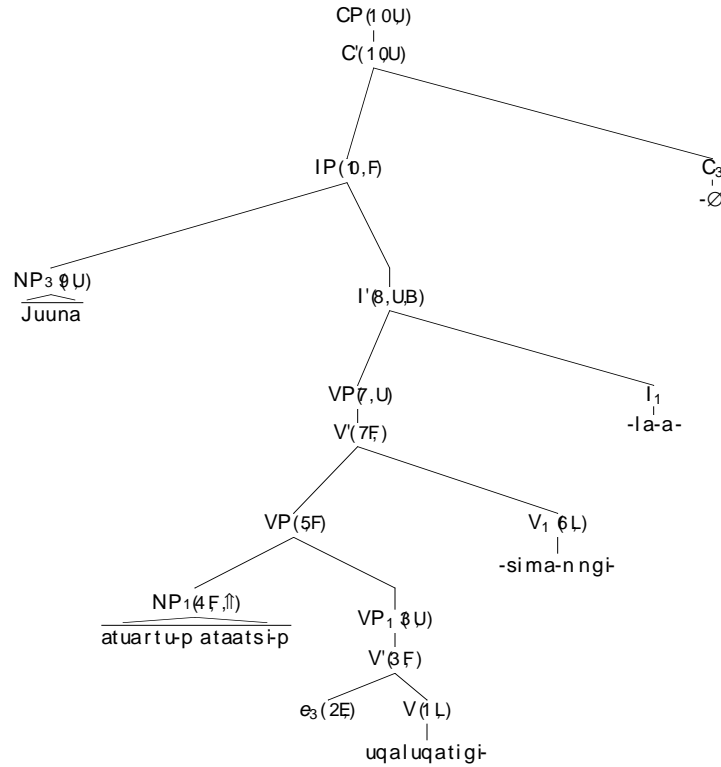
3. FROM LF TO SEMANTICALLY ACCEPTABLE ILF

In the following subsections, I introduce, in order, the *semantic filters* (sec. 3.1), the *core semantic rules*, which associate each node with its basic translation (sec. 3.2), and the *type-adjusting rules*, which derive more abstract translations in cases of type mismatch (sec. 3.3).

3.1. *Semantic filters*

Given an LF like (3b), the semantic rules to be given in sec. 3.2–3 can derive the following ILF:

(3'') b.



Ref.	ϵ	Type of ϵ	σ
1.	talk.to'	$\langle e, \langle e, t \rangle \rangle$	\emptyset
2.	x_3	e	$\{x_3\}$
3.	talk.to'(x ₃)	$\langle e, t \rangle$	$\{x_3\}$
4.	$\lambda P[\exists x(\text{student}'(x) \wedge \sim P(x))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
5.	$\exists x(\text{student}'(x) \wedge \text{talk.to}'(x_3)(x))$	t	$\{x_3\}$
6.	$\lambda p[\sim p]$	$\langle \langle s, t \rangle, t \rangle$	\emptyset
7.	$\neg \exists x(\text{student}'(x) \wedge \text{talk.to}'(x_3)(x))$	t	$\{x_3\}$
8.	$\lambda x_3[\neg \exists x(\text{student}'(x) \wedge \text{talk.to}'(x_3)(x))]$	$\langle e, t \rangle$	\emptyset
9.	j	e	\emptyset
10.	$\neg \exists x(\text{student}'(x) \wedge \text{talk.to}'(j)(x))$	t	\emptyset

The ILF (3''b) is like the input LF except that all meaningful constituents are associated with model-theoretic denotations. The latter are identified by means of a translation language, i.e. a formal language with known semantics, as in Montague (1973). The translation language I use here is ILP, an intensional logic with plurals, which is basically Montague's Intensional Logic (IL) supplemented with some cardinality predicates and operators from Link's (1983) Logic of Plurals and Mass Terms (LPM). A model for ILP is like a model for IL except that the domain has a lattice structure to accommodate the expressions imported from LPM. For any index i , the symbols x_i , O_i , P_i , R_i , S_i , T_i , p_i , r_i , \emptyset_i , and \mathfrak{R}_i , abbreviate the variables $v_{i,e}$, $v_{i,\langle s, \langle e, e \rangle \rangle}$, $v_{i,\langle s, \langle e, t \rangle \rangle}$, $v_{i,\langle s, \langle e, \langle e, t \rangle \rangle \rangle}$, $v_{i,\langle s, \langle e, \langle e, \langle e, t \rangle \rangle \rangle \rangle}$, $v_{i,\langle s, \langle \langle s, \langle e, t \rangle \rangle, \langle e, \langle e, t \rangle \rangle \rangle \rangle}$, $v_{i,\langle s, t \rangle}$, $v_{i,\langle \langle s, t \rangle, t \rangle}$, $v_{i,\langle s, \langle \langle s, \langle e, t \rangle \rangle, t \rangle \rangle}$, and $v_{i,\langle s, \langle \langle s, \langle \langle s, \langle e, t \rangle \rangle, t \rangle \rangle, \langle e, t \rangle \rangle \rangle}$, respectively. The same

symbols without any index abbreviate the 100'th variable of the relevant type; while y , z , Q , and q , abbreviate the variables $v_{101,e}$, $v_{102,e}$, $v_{101,<s,<e,t>>}$, and $v_{101,<s,t>}$. Also, for any expression ε , $T(\varepsilon)$ denotes the semantic type of ε .

For each meaningful ILF constituent, the (final) translation is an ordered pair identified by means of a reference number (Ref). The first coordinate of the translation is an expression of ILP (listed under ε) which identifies a denotation in the model. The second coordinate (listed under σ) is a store—formally, a set of variables of ILP. The store contains any free variables introduced by traces and similar elements which must be bound higher up in the structure (cf. the more powerful, but otherwise similar, mechanism of quantifier storage proposed by Cooper 1975, 1983). Each ILF constituent has one *basic translation*, derived by a core rule, and possibly one *lifted translation*, derived from the basic translation by a type-adjusting rule. If the constituent is complex, then its basic translation must be derived from the final translations of its daughters. The relevant rules are listed, in order, after the reference number. For example, in the ILF (3''b), the annotation (4,F, \uparrow) on the subject NP₁ means that the basic translation of this constituent has been derived, from the translations of its daughters, by function application (core rule F), and its lifted and final translation, (Ref. 4), by subsequent type-lifting using the operator \uparrow (type-adjusting rule T). All the constituents in this ILF are meaningful except for the semantically vacuous mood and agreement morphology under I(nf) and C(omp).

In general, an ILF is (*semantically*) *acceptable*, just in case it satisfies the following semantic filters:

VACUITY FILTER: If a node has a translation, then so does any dominating node.

TYPE FILTER: Some segment of every IP has a translation whose first coordinate is of type t .⁴

STORE FILTER: The root node has a translation whose second coordinate is \emptyset .

For any semantically acceptable ILF, the formula which is the first coordinate in the translation of its root node is predicted to represent a possible reading. For example, the ILF (3''b) is semantically acceptable, because it satisfies all the three filters. The formula (3'b) is therefore correctly predicted to represent a possible reading of the WG Inuit sentence (3a).

⁴ In this filter, *segments* of projections are defined as in Chomsky 1986b.

3.2. Core semantic rules

As illustrated in the ILF (3''b), the interpretation of each meaningful constituent involves one of four rules: L, U, F, or E. These *core rules* of the present system will now be explicated in turn.

Rule L applies to lexically filled terminal nodes. The information about the syntactic category and basic translation which it requires is provided by the Lexicon:

RULE L (lexical):

Let α be a lexical item of category κ and let α' be the basic translation of α .

Then α' is a translation of $[\kappa \alpha]$.

LEXICON for (3a)⁵

<u>Item</u>	<u>Category</u>	<u>Basic translation, $\langle \epsilon, \sigma \rangle$</u>	<u>Type of ϵ</u>
Juuna	N	$\langle j, \emptyset \rangle$	e
atuartu(C)	N	$\langle *student', \emptyset \rangle$	$\langle e, t \rangle$
ataatsi(C)	A	$\langle At, \emptyset \rangle$	$\langle e, t \rangle$
uqaluqatigi-	V	$\langle talk.to', \emptyset \rangle$	$\langle e, \langle e, t \rangle \rangle$
-sima-nngi-	V	$\langle \lambda p[\sim p], \emptyset \rangle$	$\langle \langle s, t \rangle, t \rangle$
-la-a-	I		
- \emptyset	C		

Rule U lets any non-terminal node with a unique meaningful daughter inherit any translation of that daughter. In a given ILF, a node of this kind will therefore inherit the final translation which, in that ILF, has been assigned to its unique meaningful daughter, since the basic translation of a non-terminal node is derived from the final translations of its daughters.

RULE U (unique contribution):

Let α be a daughter of β , α' a translation of α , and let any sister of α have no translation.

Then α' is a translation of β .

For example, in the ILF (3''b), rule U lets VP_1 , which is non-branching, inherit the translation of its unique daughter V' , (Ref. 3). It also lets the branching C' node inherit the translation of its unique meaningful daughter IP, (Ref. 10).

⁵ The pluralization operator, *, and the predicate *At* are defined as in Link (1983). That is, an individual *a* satisfies **student'*, iff it is a student or a sum of students, and it satisfies *At*, iff it is atomic.

Since the agreement morphology under C(omp) has no basic translation, according to the above Lexicon, it plays no role in the semantics.

For any other non-terminal node, the basic translation must be derived from the translations of its daughters by rule F. The *basic operation* f , referred to by this rule, is defined below:

RULE F (function application):

Let α and β , with translations α' and β' , be daughters of γ and let $\langle \alpha', \beta' \rangle \in \text{Dom}(f)$.

Then $f(\alpha', \beta')$ is a translation of γ .

DEFINITION 1 (basic operation). By f is understood a function such that (i) $\text{Dom}(f)$ is the set

$$\{ \langle \langle \varepsilon, \sigma \rangle, \langle \varepsilon', \sigma' \rangle \rangle \in (ME \times \wp(VAR))^2 : \{ \varepsilon(\varepsilon'), \varepsilon'(\varepsilon), \varepsilon(\hat{\varepsilon}'), \varepsilon'(\hat{\varepsilon}), [\check{\varepsilon}](\varepsilon'), [\check{\varepsilon}'](\varepsilon), [\check{\varepsilon}](\hat{\varepsilon}'), [\check{\varepsilon}'](\hat{\varepsilon}) \} \cap ME \neq \emptyset \}$$

where ME is the set of meaningful expressions of ILP, and VAR is the set of variables, and

(ii) whenever $\langle \langle \varepsilon, \sigma \rangle, \langle \varepsilon', \sigma' \rangle \rangle \in \text{Dom}(f)$, $f(\langle \varepsilon, \sigma \rangle, \langle \varepsilon', \sigma' \rangle)$ is $\langle \varepsilon'', \sigma \cup \sigma' \rangle$, where ε'' is the unique element of ME which is in the set $\{ \varepsilon(\varepsilon'), \varepsilon'(\varepsilon), \varepsilon(\hat{\varepsilon}'), \varepsilon'(\hat{\varepsilon}), [\check{\varepsilon}](\varepsilon'), [\check{\varepsilon}'](\varepsilon), [\check{\varepsilon}](\hat{\varepsilon}'), [\check{\varepsilon}'](\hat{\varepsilon}) \}$.

For example, in the ILF (3''b), the translation of V' (Ref. 3) is derived by rule F from the translations of the two daughters of this node: the verb *uqaluqatigi-* (Ref. 1) and the empty object e_3 (Ref. 2). In the translation of the verb, $\langle \text{talk.to}', \emptyset \rangle$, the first coordinate is of a functor type, while in the translation of the object, $\langle x_3, \{x_3\} \rangle$, the first coordinate is of a type which is suited to serve as an argument of that functor. Rule F can therefore combine the first coordinates of these translations by (standard) function application and the second elements, i.e., the stores, by set union. The result is the translation $\langle \text{talk.to}'(x_3), \{x_3\} \rangle$ which is listed for V' under (Ref. 3).

Since the basic operation f can accommodate certain type-differences involving intensionality, rule F can also combine the extensional translation of VP_1 , $\langle \text{talk.to}'(x_3), \{x_3\} \rangle$, with the intensional translation of the subject NP_1 , $\langle \lambda P[\exists x(\text{student}'(x) \wedge \check{P}(x))], \emptyset \rangle$. The result is $\langle \lambda P[\exists x(\text{student}'(x) \wedge \check{P}(x))](\hat{\text{talk.to}}'(x_3)), \{x_3\} \rangle$, which has the same denotation, relative to any model and assignment, as the simpler translation listed in (Ref. 5) for the VP which immediately dominates NP_1 and VP_1 . For the sake of perspicuity, I generally give the translations in their simplest possible form. That is, the semantics of the translation language is used to simplify the expressions derived by the rules, to the extent that this is permitted by the fact that the empirical predictions of the present system do not depend on the form of the translations, but only on what they denote (cf. Montague 1973).

Finally, rule E applies to terminal nodes which are empty in the sense of the Empty Category Principle (Chomsky 1981). This includes traces of movement, exemplified by e_3 in the ILF (3''b), but not nodes silent lexical items, such as C(omp) in the same ILF. In this study, I use the symbol e_i , where i is an index, for nodes which are empty in the relevant sense. Concerning the semantics of such nodes, I adopt the standard view that they are interpreted as variables, with the index of the empty node determining the index of the variable (cf. indexed pronouns in Montague 1973). The new idea is that the semantic type of the variable is predictable based on the type of some local constituent—typically, the sister of the empty node. To make this idea precise, we first note that, by and large, X° -heads are interpreted as predicates; complements, specifiers, and subjects (i.e. distinguished adjuncts), as arguments; and (ordinary) adjuncts, as predicate modifiers. While these correlations are not perfect, the expectations they give rise to appear to inform the interpretation of empty nodes. Specifically, given the classification of syntactic positions defined below, I propose the following semantic rule for empty nodes:

DEFINITION 2 (ARG- and MOD-positions). Consider the phrase structure rule schema (i)–(iv):⁶

- | | | | | |
|-------|------------|---------------|----------------------|--|
| (i) | X' | \rightarrow | $X, (YP)$ | (X° head, YP complement) |
| (ii) | XP | \rightarrow | $X', (YP)$ | (X' head, YP specifier) |
| (iii) | $XP_{(j)}$ | \rightarrow | XP_i, YP_i | (XP_i head, YP_i subject) |
| (iv) | $XP_{(j)}$ | \rightarrow | $XP_{(j)}, YP_{(j)}$ | ($XP_{(j)}$ head, $YP_{(j)}$ adjunct) |

An *ARG-position* is a complement, specifier, or subject, and a *MOD-position*, an adjunct, of a head.

RULE E (empty nodes):

Let e_i be an empty node with the index i , α , a node with a translation $\langle \varepsilon, \sigma \rangle$, and τ , a type.

Moreover, let (i), (ii), or (iii), hold:

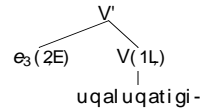
- (i) e_i is in an ARG-position and sister to α and, for some type ρ , $T(\varepsilon) = \langle \tau, \rho \rangle$; or
- (ii) e_i is in a MOD-position and sister to α , and $\tau = \langle s, T(\varepsilon) \rangle$; or
- (iii) e_i is the X° -head of a complement of α , α has the index i , and $\tau = \langle s, T(\varepsilon) \rangle$.

Then $\langle v_{i,\tau}, \{v_{i,\tau}\} \rangle$ is a translation of e_i .

⁶ In (i)–(iv), as usual, the commas indicate that the categories are unordered with respect to each other, and the parentheses indicate optional material (i.e. optional nodes in (i)–(ii), optional indices in (iii)–(iv)).

For example, the ILF (3''b), whose relevant portion is repeated in (4), contains a trace in an ARG-position (complement of V):

(4)



<u>Ref.</u>	<u>ε</u>	<u>Type of ε</u>	<u>σ</u>
1.	talk.to'	<e,<e,t>>	\emptyset
2.	x_3	e	{ x_3 }

Since the sister of the trace is interpreted as a functor, the trace itself is interpreted as a variable of the right type to serve as an argument of that functor (x_3 , i.e., the third variable of type e). And since that variable is stored, it will have to be bound by a higher node to satisfy the Store Filter.

Empty nodes in specifier and subject positions also fall under clause (i) of rule E, and are therefore interpreted in an analogous manner. This predicts, in conformity to the standard view, that intermediate traces of cyclic *wh*-movement are semantically vacuous. For example, in (5a), the topicalized object moves through the specifier of C(omp), as indicated in (5b), giving rise to two traces. The trace in the underlying object position is interpreted just like the trace in (4), and for the same reasons. In contrast, the intermediate trace in (Spec,CP) is not assigned any translation at all by rule E, because its sister, C' , is not interpreted as a functor, but as an open sentence (type t or < s,t >).

- (5) a. One student, Mary says that John has already seen.
 b. *One student* _{i} , Mary says [_{CP} e_i [_{C'} that John has already [_{V'} seen e_i]]].

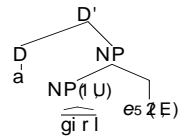
The sentences in (6) exemplify movement from MOD-positions. This includes extraposition of a PP, as in (a), or of a relative clause, as in (b).

- (6) a. John has been ordering many books e_i recently *about dinosaurs* _{i} .
 b. A girl e_i appeared *that John knows* _{i} .

Assuming the DP analysis of nominal phrases (Brame 1981, 1982, Fukui 1986, Hellan 1986, Abney 1987, Ritter 1987, etc.), the trace of such movement can be analyzed as an adjunct of the NP complement of D, as in (6'). On

this analysis, clause (ii) of rule E is applicable and, since the sister of the trace is interpreted as a predicate of the extensional type $\langle e,t \rangle$, the trace itself is interpreted as a variable of the corresponding intensional type, $\langle s, \langle e,t \rangle \rangle$. Semantically, then, the trace of an extraposed PP or relative clause functions as a place-holder for that constituent.

(6')

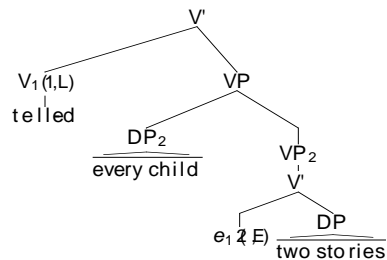


<u>Ref.</u>	<u>ε</u>	<u>Type of ε</u>	<u>σ</u>
1.	girl'	$\langle e,t \rangle$	\emptyset
2.	P ₅	$\langle s, \langle e,t \rangle \rangle$	{P ₅ }

Finally, movement of an X^o-head is exemplified by verb raising in the ditransitive English construction (7), and by noun incorporation in the possessed WG Inuit nominal (8). The former illustrates X^o-movement of the substitution type, the latter, of the adjunction type. Both must take place at s-structure for Case-related reasons (cf. Larson 1988, Bittner 1994).

(7) John told every child two stories.

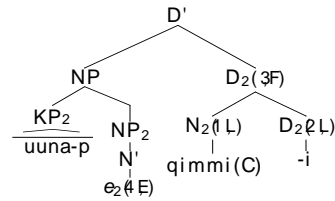
(7')



<u>Ref.</u>	<u>ε</u>	<u>Type of ε</u>	<u>σ</u>
1.	tell'	$\langle e, \langle e, \langle e,t \rangle \rangle \rangle$	\emptyset
2.	S ₁	$\langle s, \langle e, \langle e, \langle e,t \rangle \rangle \rangle \rangle$	{S ₁ }

(8) Juuna-p qimmi-i
J-ERG dog-3sgERG.pl
 'Juuna's dogs'

(8')



<u>Ref.</u>	<u>ϵ</u>	<u>Type of ϵ</u>	<u>σ</u>
1.	*dog'	<e,t>	\emptyset
2.	$\lambda Q\lambda x[\sigma y[\text{of}'(Q)(x)(y) \wedge \neg \text{At}(y)]]$	<<s,<e,t>>,<e,e>>	\emptyset
3.	$\lambda x[\sigma y[\text{of}'(^*\text{dog}') (x)(y) \wedge \neg \text{At}(y)]]$	<e,e>	\emptyset
4.	O_2	<s,<e,e>>	$\{O_2\}$

In general, by clause (iii) of rule E, the trace of a raised lexical head (substitution movement) is interpreted as a variable of the corresponding intensional type, as in (7'). That is, it functions as a place-holder for the moved element (cf. (6')). In contrast, the trace of an incorporated head (adjunction movement) is a place-holder for the complex head formed by that incorporation. In WG Inuit, this makes it possible for “possessive” noun meanings, which take possessor arguments, to be systematically derived by incorporating simple nouns into possessive determiners, as in (8', Ref. 3).⁷ This movement forms a complex N-D head and leaves a trace which semantically functions as a place-holder for that head (Ref. 4).⁸

The evidence for rule E comes primarily from the semantic consequences of various kinds of movement, which are discussed in sections 4 and 5. But first we need to introduce the rules which bind the free variables introduced by traces, and derive intersective modifiers from the basic property-type meanings of traces left by extraposed PPs and relative clauses.

3.3. Type-adjusting rules

In the present system, translation is not a function, as in Montague (1973), but rather a relation. Specifically, in addition to its basic translation, derived by one of the core rules L, E, U, or F, a constituent of an ILF may also have one *lifted translation*. The latter is obtained from its basic translation by one of two *type-adjusting* rules: B or T.

⁷ Link's (1983) operator σ is a generalized version of the descriptive operator t . If A is a predicate of type <e,t>, then $\sigma y[A(y)]$ denotes the supremum of $\|A\|$ (here, the maximal sum of dogs of the individual $g(x)$).

⁸ Clause (iii) of rule E is the only non-compositional rule in the present translation system. It is not clear that it should be compositional, since it applies to *terminal* nodes. It is therefore interesting to note that clauses (i) and (ii) of this rule are compositional in the sense that the translation of any node they apply to is determined by the translation of its sister, while clause (iii) relaxes the relevant notion of locality only to the extent of allowing an X^0 -head to “look” as far as the sister of its maximal projection.

Rule B derives the lifted translation by abstracting over a stored variable whose index is “compositionally visible” from the constituent to which the rule applies:

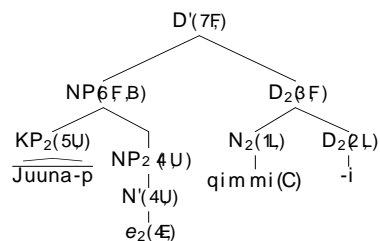
RULE B (variable binding):

Let α have a translation $\langle \varepsilon, \sigma \rangle$, let i be the index of either α or a sister of α , and let $u_i \in \sigma$.

Then $\langle \lambda u_i[\varepsilon], \sigma - \{u_i\} \rangle$ is a translation of α .

Typical applications of this rule mediate the anaphoric relation between a moved constituent and its trace. This is illustrated in the ILF (3''b) (sec. 3.1), as well as the following completed ILF of the possessed nominal construction (8) in WG Inuit:

(8'')



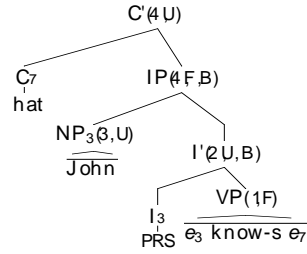
<u>Ref.</u>	<u>ε</u>	<u>Type of ε</u>	<u>σ</u>
1.	*dog'	$\langle e, t \rangle$	\emptyset
2.	$\lambda Q \lambda x [\sigma y [\text{of}'(Q)(x)(y) \wedge \neg \text{At}(y)]]$	$\langle \langle s, \langle e, t \rangle \rangle, \langle e, e \rangle \rangle$	\emptyset
3.	$\lambda x [\sigma y [\text{of}'(^* \text{dog}') (x)(y) \wedge \neg \text{At}(y)]]$	$\langle e, e \rangle$	\emptyset
4.	O_2	$\langle s, \langle e, e \rangle \rangle$	$\{O_2\}$
5.	j	e	\emptyset
6.	$\lambda O_2 [\sim O_2(j)]$	$\langle \langle s, \langle e, e \rangle \rangle, e \rangle$	\emptyset
7.	$\sigma y [\text{of}'(^* \text{dog}') (j)(y) \wedge \neg \text{At}(y)]$	e	\emptyset

Rule B may also allow an otherwise vacuous indexed node to license the binding of a variable which has been introduced by a coindexed node in its scope. For example, in the ILF (9), which represents the relative clause *that John knows*, the complementizer C_7 has no translation itself. But, by virtue of its index, it licenses the binding of the variable introduced by the empty object e_7 .⁹ So the syntactic binding relation between the complementizer and the empty position in a relative clause is semantically significant, although it does not involve anaphora.¹⁰

⁹ Semantically, it does not matter whether the object position is underlyingly empty or is vacated at s-structure by the movement of some non-overt and semantically vacuous constituent. The choice between these two analyses could presumably be made on the basis of syntactic evidence.

¹⁰ A node α (syntactically) binds a node β , iff α is coindexed with β and c-commands β . The IP in (9) satisfies the Type Filter, because the first coordinate of its basic translation, $\langle \text{know}'(x_7)(j), \{x_7\} \rangle$, is of type t .

(9)



<u>Ref.</u>	<u>ε</u>	<u>Type of ε</u>	<u>σ</u>
1.	know'(x ₇)(x ₃)	t	{x ₇ , x ₃ }
2.	$\lambda x_3[\text{know}'(x_7)(x_3)]$	<e,t>	{x ₇ }
3.	j	e	\emptyset
4.	$\lambda x_7[\text{know}'(x_7)(j)]$	<e,t>	\emptyset

In all of the examples given so far, stored variables were introduced by rule E as part of the translation of some empty node. Another source of such variables is rule L applied to dependent lexical items. A case in point are selected prepositions, such as the preposition *to* which in (10) is selected by the verb:

(10) John *told* two stories *to* every child.

To interpret this example, as well as the corresponding ditransitive construction (7) and other constructions in this study, we need one more type-adjusting rule, and two families of type-lifting operators, defined as follows:

RULE T (type-lifting):

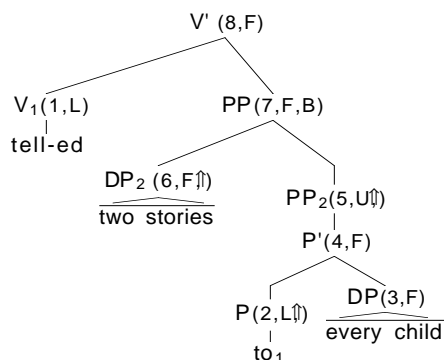
Let α and β , with translations α' and β' , be sisters, $\langle \alpha', \beta' \rangle \notin \text{Dom}(f)$, and let ω be a type-lifting operator such that $\langle \alpha', \langle \omega, \emptyset \rangle \rangle \in \text{Dom}(f)$. Then $f(\alpha', \langle \omega, \emptyset \rangle)$ is a translation of α .

DEFINITION 3 (type-lifting operators)

$\hat{\Pi}$:	Type, τ , of the input	Operator, $\hat{\Pi}_\tau$	Type of the output
	e	$\lambda x \lambda Q [\sim Q(x)]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$
	$\langle s, \langle e, t \rangle \rangle$	$\lambda P \lambda Q [\exists x (\sim P(x) \wedge \sim Q(x))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$
	$\langle s, \langle e, \langle e, t \rangle \rangle \rangle$	$\lambda R \lambda \wp \lambda x [\sim \wp (\sim \lambda y [\sim R(y)(x)])]$	$\langle \langle s, \langle \langle s, \langle e, t \rangle \rangle, t \rangle \rangle, \langle e, t \rangle \rangle$
	$\langle s, \langle e, \langle e, \langle e, t \rangle \rangle \rangle \rangle$	$\lambda S \lambda \wp \lambda y \lambda x [\sim \wp (\sim \lambda z [\sim S(z)(y)(x)])]$	$\langle \langle s, \langle \langle s, \langle e, t \rangle \rangle, t \rangle \rangle, \langle e, \langle e, t \rangle \rangle \rangle$
μ :	Type, τ , of the input	Operator, μ_τ	Type of the output
	$\langle \langle s, t \rangle, t \rangle$	$\lambda r \lambda \wp \lambda Q [r (\sim \wp (Q))]$	$\langle \langle s, \langle \langle s, \langle e, t \rangle \rangle, t \rangle \rangle, \langle \langle s, \langle e, t \rangle \rangle, t \rangle \rangle$
	$\langle s, \langle e, t \rangle \rangle$	$\lambda P \lambda Q \lambda x [\sim Q(x) \wedge \sim P(x)]$	$\langle \langle s, \langle e, t \rangle \rangle, \langle e, t \rangle \rangle$
	$\langle s, \langle e, \langle e, t \rangle \rangle \rangle$	$\lambda R \lambda Q \lambda y \lambda x [\sim Q(y) \wedge \sim R(y)(x)]$	$\langle \langle s, \langle e, t \rangle \rangle, \langle e, \langle e, t \rangle \rangle \rangle$
	$\langle s, \langle e, \langle e, \langle e, t \rangle \rangle \rangle \rangle$	$\lambda S \lambda Q \lambda z \lambda y \lambda x [\sim Q(z) \wedge \sim S(z)(y)(x)]$	$\langle \langle s, \langle e, t \rangle \rangle, \langle e, \langle e, \langle e, t \rangle \rangle \rangle \rangle$

Going back to (10) now, suppose that the preposition *to*, when selected by a triadic verb, has an index, *i*, and is basically interpreted as $\langle \lambda y \lambda z \lambda x [\sim S_i(z)(y)(x)], \{S_i\} \rangle$. The verb and the selected preposition can then act in concert to determine the thematic roles of the internal arguments, as in (10'):

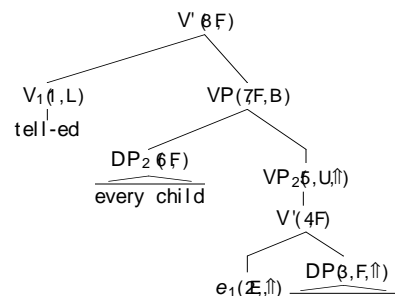
(10')



<u>Ref.</u>	<u>ϵ</u>	<u>Type of ϵ</u>	<u>σ</u>
1.	tell'	$\langle e, \langle e, \langle e, t \rangle \rangle \rangle$	\emptyset
2.	$\lambda \wp \lambda z \lambda x [\sim \wp (\sim \lambda y [\sim S_1(z)(y)(x)])]$	$\langle T(\wp), \langle e, \langle e, t \rangle \rangle \rangle$	$\{S_1\}$
3.	$\lambda P [\forall y (\text{child}'(y) \rightarrow \sim P(y))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
4.	$\lambda z \lambda x [\forall y (\text{child}'(y) \rightarrow \sim S_1(z)(y)(x))]$	$\langle e, \langle e, t \rangle \rangle$	$\{S_1\}$
5.	$\lambda \wp \lambda x [\sim \wp (\sim \lambda z [\forall y (\text{child}'(y) \rightarrow \sim S_1(z)(y)(x))])]$	$\langle T(\wp), \langle e, t \rangle \rangle$	$\{S_1\}$
6.	$\lambda P [\exists z (\text{two}'(z) \wedge * \text{story}'(z) \wedge \sim P(z))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
7.	$\lambda S_1 [\lambda x [\exists z (\text{two}'(z) \wedge * \text{story}'(z) \wedge \forall y (\text{child}'(y) \rightarrow \sim S_1(z)(y)(x))]]]$	$\langle T(S), \langle e, t \rangle \rangle$	\emptyset
8.	$\lambda x [\exists z (\text{two}'(z) \wedge * \text{story}'(z) \wedge \forall y (\text{child}'(y) \rightarrow \text{tell}'(z)(y)(x)))]$	$\langle e, t \rangle$	\emptyset

In contrast, in the ditransitive construction (7), the thematic roles are determined by the verb alone:

(10'')

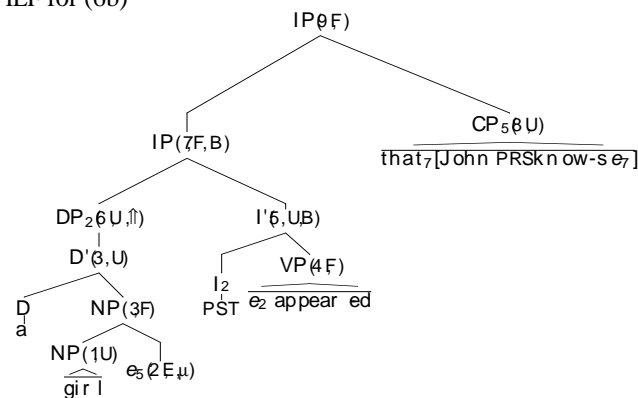


<u>Ref.</u>	<u>ϵ</u>	<u>Type of ϵ</u>	<u>σ</u>
1.	tell'	$\langle e, \langle e, \langle e, t \rangle \rangle \rangle$	\emptyset
2.	$\lambda \wp \lambda y \lambda x [\sim \wp (\sim \lambda z [\sim S_1(z)(y)(x)])]$	$\langle T(\wp), \langle e, \langle e, t \rangle \rangle \rangle$	$\{S_1\}$
3.	$\lambda P [\exists z (\text{two}'(z) \wedge * \text{story}'(z) \wedge \sim P(z))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
4.	$\lambda y \lambda x [\exists z (\text{two}'(z) \wedge * \text{story}'(z) \wedge \sim S_1(z)(y)(x))]$	$\langle e, \langle e, t \rangle \rangle$	$\{S_1\}$
5.	$\lambda \wp \lambda x [\sim \wp (\sim \lambda y [\exists z (\text{two}'(z) \wedge * \text{story}'(z) \wedge \sim S_1(z)(y)(x))])]$	$\langle T(\wp), \langle e, t \rangle \rangle$	$\{S_1\}$
6.	$\lambda P [\forall y (\text{child}'(y) \rightarrow \sim P(y))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
7.	$\lambda S_1 [\lambda x [\forall y (\text{child}'(y) \rightarrow \exists z (\text{two}'(z) \wedge * \text{story}'(z) \wedge \sim S_1(z)(y)(x))]]]$	$\langle T(S), \langle e, t \rangle \rangle$	\emptyset
8.	$\lambda x [\forall y (\text{child}'(y) \rightarrow \exists z (\text{two}'(z) \wedge * \text{story}'(z) \wedge \text{tell}'(z)(y)(x)))]$	$\langle e, t \rangle$	\emptyset

Here, rules E, B, and F, render the raising of the verb semantically vacuous, since the trace is syntactically bound by the raised verb, and is of the same semantic type up to differences in intensionality which are tolerated by rule F.

As for the nominal arguments, I follow Montague (1973) in analyzing DPs headed by strong quantificational determiners (*every*, *most*, etc.) as generalized quantifiers. In contrast, definite DPs, names, and pronouns, are analyzed as individual terms (cf. Frege 1892, Kalish, Montague, and Mar 1980, Link 1983). Indefinite articles have no translation at all, while other weak determiners are basically interpreted as cardinality predicates (eg., *two*, as the predicate *two*', which is true of an individual *a*, iff *a* has exactly two atomic parts; cf. Milsark 1974, 1977, Hoeksema 1983). The existential force which weak determiners appear to have in certain syntactic environments is attributed to type-lifting with the $\hat{\uparrow}$ -operator $\lambda P\lambda Q[\exists x(\sim P(x) \wedge \sim Q(x))]$, which predictably applies in those environments. Specifically, in (10'), (10''), (3''b), as well as (11') below, this operator must apply to phrases modified by weak determiners at the point when these phrases combine with their sisters (eg., in (11'), to DP₂, yielding (Ref. 6)). Otherwise, the resulting ILF would violate at least one of the semantic filters: Type, Store, or Vacuity.¹¹

(11') ILF for (6b)



Ref.	ε	Type of ε	σ
1.	girl'	<e,t>	\emptyset
2.	$\lambda Q\lambda x[\sim Q(x) \wedge \sim P_5(x)]$	<<s,<e,t>>,<e,t>>	{P ₅ }
3.	$\lambda x[\text{girl}'(x) \wedge \sim P_5(x)]$	<e,t>	{P ₅ }
4.	appear'(x ₂)	t	{x ₂ }
5.	$\lambda x_2[\text{appear}'(x_2)]$	<e,t>	\emptyset
6.	$\lambda Q[\exists x(\text{girl}'(x) \wedge \sim P_5(x) \wedge \sim Q(x))]$	<<s,<e,t>>,<t>	{P ₅ }
7.	$\lambda P_5[\exists x(\text{girl}'(x) \wedge \sim P_5(x) \wedge \text{appear}'(x))]$	<<s,<e,t>>,<t>	\emptyset
8.	$\lambda x_7[\text{know}'(x_7)(j)]$	<e,t>	\emptyset
9.	$\exists x(\text{girl}'(x) \wedge \text{know}'(x)(j) \wedge \text{appear}'(x))$	t	\emptyset

¹¹ Note that the analysis in (11') predicts relative clause extraposition to be semantically vacuous—just like X^o-raising (substitution movement), illustrated in (10''), and for the same reasons.

The hypothesis that indefinites have no quantificational force of their own, and that whatever force they may appear to have is predictable based on their syntactic environment, is due to Lewis (1975), Kamp (1981), and Heim (1982). It is empirically supported, for example, by the quantificational variability of indefinites. In the above analysis of indefinites and other nominals with weak determiners, I adopt this basic view, but modify the details. The main difference is that I attribute the existentially quantified readings of such nominals to an independently motivated operation of type-lifting, rather than to an operation like Heim's existential closure, which has not yet been shown to have any independent support.

Type-lifting was originally proposed by Rooth and Partee (1982) and Partee and Rooth (1983) to account for the interaction of verb coordination with intensionality. In the system of Montague (1973), all members of a given syntactic category are assigned translations of the highest type which is needed by any member of that category. For dyadic verbs, this is the type required by intensional verbs, exemplified by *want* and *need*. Partee and Rooth note that, when this type assignment is combined with standard cross-categorical semantics for coordination (von Stechow 1974, Gazdar 1980), constituents of the form $[V_1 \text{ and } V_2]$ are translated as

$$(12) \quad \lambda\phi\lambda x[V_1'(\phi)(x) \wedge V_2'(\phi)(x)]$$

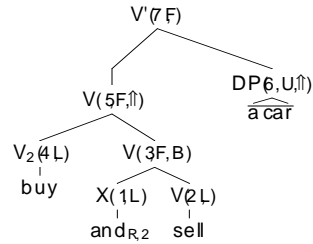
When both verbs are extensional, (12) results in counterintuitive readings. A case in point is (13a), which intuitively requires that there be some car that John bought and sold, but is wrongly predicted to be true also if John bought one car and sold another. On the other hand, if one or both verbs are intensional, as in (13b) or (13c), then the predictions based on (12) accord with the intuitive judgements.

- (13) a. John bought and sold a car.
 b. John needed and bought a car.
 c. John wants and needs two secretaries.

To account for the full paradigm, Partee and Rooth modify Montague's system in a way which I adopt. Every lexical item is assigned a basic translation of the simplest possible type. Thus, only intensional verbs have basic translations of the type proposed by Montague, $\langle T(\phi), \langle e, t \rangle \rangle$. The basic translations of extensional verbs like *buy* and *sell* are of type $\langle e, \langle e, t \rangle \rangle$. Predictable translations of the intensional type can, however, be derived by means of

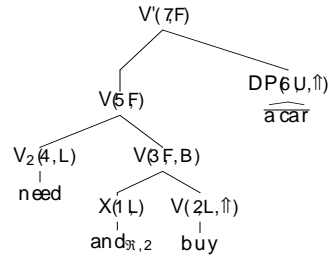
type-lifting in cases of type-mismatch. This idea is built into rule T, which can derive a lifted translation if the conditions for applying the core rule F fail to be met—*eg.* in (13'b), but not in (13'a).

(13') a.



Ref.	ε	Type of ε	σ
1.	$\lambda R \lambda y \lambda x [\sim R_2(y)(x) \wedge \sim R(y)(x)]$	$\langle T(R), \langle e, \langle e, t \rangle \rangle \rangle$	$\{R_2\}$
2.	sell'	$\langle e, \langle e, t \rangle \rangle$	\emptyset
3.	$\lambda R_2 \lambda y \lambda x [\sim R_2(y)(x) \wedge \text{sell}'(y)(x)]$	$\langle T(R), \langle e, \langle e, t \rangle \rangle \rangle$	\emptyset
4.	buy'	$\langle e, \langle e, t \rangle \rangle$	\emptyset
5.	$\lambda \emptyset \lambda x [\sim \emptyset (\wedge \lambda y [\text{buy}'(y)(x) \wedge \text{sell}'(y)(x)])]$	$\langle T(\emptyset), \langle e, t \rangle \rangle$	\emptyset
6.	$\lambda Q [\exists y (\text{car}'(y) \wedge \sim Q(y))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
7.	$\lambda x [\exists y (\text{car}'(y) \wedge \text{buy}'(y)(x) \wedge \text{sell}'(y)(x))]$	$\langle e, t \rangle$	\emptyset

b.



Ref.	ε	Type of ε	σ
1.	$\lambda \mathfrak{R} \lambda \emptyset \lambda x [\sim \mathfrak{R}_2(\emptyset)(x) \wedge \sim \mathfrak{R}(\emptyset)(x)]$	$\langle T(\mathfrak{R}), \langle T(\emptyset), \langle e, t \rangle \rangle \rangle$	$\{\mathfrak{R}_2\}$
2.	$\lambda \emptyset \lambda x [\sim \emptyset (\wedge \lambda y [\text{buy}'(y)(x)])]$	$\langle T(\emptyset), \langle e, t \rangle \rangle$	\emptyset
3.	$\lambda \mathfrak{R}_2 \lambda \emptyset \lambda x [\sim \mathfrak{R}_2(\emptyset)(x) \wedge \sim \emptyset (\wedge \lambda y [\text{buy}'(y)(x)])]$	$\langle T(\mathfrak{R}), \langle T(\emptyset), \langle e, t \rangle \rangle \rangle$	\emptyset
4.	need'	$\langle T(\emptyset), \langle e, t \rangle \rangle$	\emptyset
5.	$\lambda \emptyset \lambda x [\text{need}'(\emptyset)(x) \wedge \sim \emptyset (\wedge \lambda y [\text{buy}'(y)(x)])]$	$\langle T(\emptyset), \langle e, t \rangle \rangle$	\emptyset
6.	$\lambda Q [\exists y (\text{car}'(y) \wedge \sim Q(y))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
7.	$\lambda x [\text{need}'(\wedge \lambda Q [\exists y (\text{car}'(y) \wedge \sim Q(y))])(x) \wedge \exists y (\text{car}'(y) \wedge \text{buy}'(y)(x))]$	$\langle e, t \rangle$	\emptyset

According to this analysis, English has not one conjunction *and*, but a whole family, one for each conjoinable type.

The different members of the family happen to sound the same in English, but not in many other languages. For example, in Yoruba, *sì* 'and_t' is used to coordinate sentences, but *ati* 'and_∅', to coordinate nominal phrases. The type of the coordinating conjunction is determined by the more abstract conjunct, and in turn determines whether or

not type-lifting will apply to the other conjunct. This accounts for the paradigm illustrated in (13a–c), as well as the fact that cross-categorical coordination is language-specific.¹²

In later work, Partee (1986a,b) relaxes the requirement that type-lifting apply only in cases of type-mismatch, and assumes that it is always optionally available. While this enables her to give a type-lifting account of certain ambiguities, the original account of the paradigm exemplified in (13a–c) is lost. So is the explanation which I derive from this requirement in sec. 4.1 for one of the conditions for semantically significant movement. Another modification in Partee's later work which I do not adopt here is that there is not only type-*lifting* but also type-*lowering*. At this point, the evidence for type-lowering does not seem to me compelling. As a null hypothesis, I have therefore opted for a leaner semantic system which does not include type-lowering as an option. From the theoretical point of view, this seems to be more in keeping with the hypothesis that the basic translation of any item is of the *lowest* possible type. Also, the asymmetry in the semantics between type-*lifting*, which is possible, and type-*lowering*, which is not, parallels a well-known asymmetry in the syntax. Within the framework of the GB theory, *upward* movement is well-established, whereas *downward* movement is not (see May 1977, Chomsky 1981, Barrs 1986, and Bittner 1994, amongst others, for relevant discussion).

This completes my presentation of the cross-linguistic semantic system which I claim to be applicable, not only to English and WG Inuit, but to natural languages in general.

4. CONDITIONS FOR SEMANTICALLY SIGNIFICANT MOVEMENT

Within the present theory, syntactic movement is generally predicted to be semantically vacuous if the following two conditions are met: the moved constituent syntactically binds its trace, and is of the same semantic type up to any differences in intensionality which can be accommodated by rule F (cf. (10') and (11'') in sec. 3). The rare exceptions to this generalization, which will be exemplified in sec. 5.2–3, involve movement which increases the scope of the moved constituent to include, not only its trace, but also some other source of the same variable. In more typical instances of semantically significant movement, we find either that the moved constituent and its trace are of

¹² The binary-branching adjunction structure of X^o-coordination, which I assume in (13'a,b), is non-standard but compatible with a version of the X-bar theory which differs from the standard version (Chomsky 1986b) only in that it permits XP- and X^o-adjunction at d-structure. Extending the X-bar theory in this way seems to be necessary for independent reasons, and is theoretically attractive because it would make the Structure-Preserving Hypothesis applicable to all movement (cf. Emonds 1976).

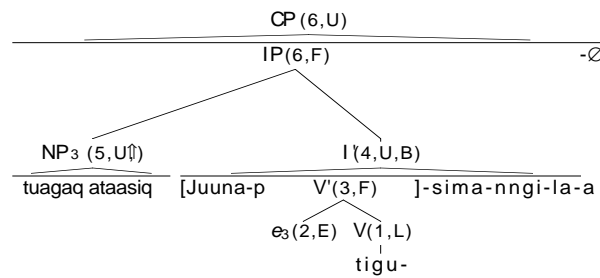
non-trivially different types (sec. 4.1), or that the moved constituent is a proper part of the expression which syntactically binds its trace (sec. 4.2).

4.1. Movement of quantified nominal arguments

Between them, rules E, B, and F, predict that raising a quantified nominal from an extensional argument position will increase its scope. This accounts for the scope of the raised quantified subjects in English (2) and WG Inuit (3c), as well as the scope of the raised object in WG Inuit (14).

- (14) Suli atuagaq ataasiq Juuna-p tigu-sima-nngi-la-a- \emptyset
yet book one J-ERG receive-PRF-not-IND-3sgERG-3sgNOM
 $\exists y(\text{book}'(y) \wedge \neg \text{receive}'(y)(j))$

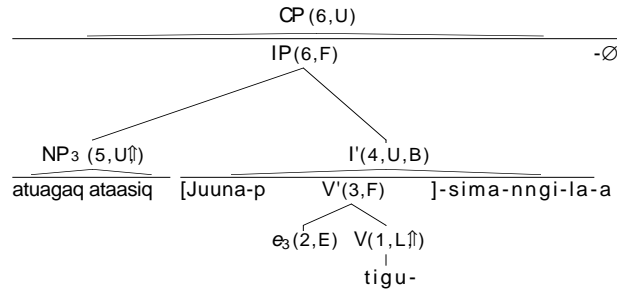
(14')



Ref.	ϵ	Type of ϵ	σ
1.	receive'	$\langle e, \langle e, t \rangle \rangle$	\emptyset
2.	x_3	e	$\{x_3\}$
3.	receive'(x ₃)	$\langle e, t \rangle$	$\{x_3\}$
4.	$\lambda x_3[\neg \text{receive}'(x_3)(j)]$	$\langle e, t \rangle$	\emptyset
5.	$\lambda P[\exists y(\text{book}'(y) \wedge \neg P(y))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
6.	$\exists y(\text{book}'(y) \wedge \neg \text{receive}'(y)(j))$	t	\emptyset

Sentences like (14) provide further evidence that type-lifting must be licensed by type-mismatch of the kind required by rule T. For if type-lifting were freely available, then it could optionally derive an intensional translation for an extensional verb like *tigu-* 'receive' in (14'), Ref. 1). The sentence (14) should then be interpretable as if the object NP₃ had not moved (Ref. 6).

(14'') *



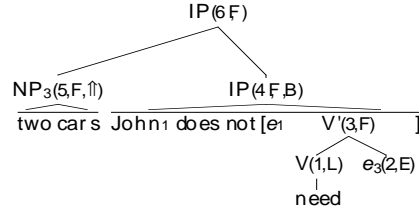
Ref.	ε	Type of ε	σ
1.	$\lambda \wp \lambda x [\neg \wp (\wedge \lambda y [\text{receive}'(y)(x)])]$	$\langle T(\wp), \langle e, t \rangle \rangle$	\emptyset
2.	\wp_3	$T(\wp)$	$\{\wp_3\}$
3.	$\lambda x [\neg \wp_3 (\wedge \lambda y [\text{receive}'(y)(x)])]$	$\langle e, t \rangle$	$\{\wp_3\}$
4.	$\lambda \wp_3 [\neg \wp_3 (\wedge \lambda y [\text{receive}'(y)(j)])]$	$\langle T(\wp), t \rangle$	\emptyset
5.	$\lambda P [\exists y (\text{book}'(y) \wedge \sim P(y))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
6.	$\neg \exists y (\text{book}'(y) \wedge \text{receive}'(y)(j))$	t	\emptyset

This reading, however, was rejected by all of the (seven) consultants who were asked.¹³

In contrast, movement from a basically intensional object position is indeed vacuous:

(15) Two cars, John (really) does not need.

(15')



Ref.	ε	Type of ε	σ
1.	need'	$\langle T(\wp), \langle e, t \rangle \rangle$	\emptyset
2.	\wp_3	$T(\wp)$	$\{\wp_3\}$
3.	need'(\wp_3)	$\langle e, t \rangle$	$\{\wp_3\}$
4.	$\lambda \wp_3 [\neg \text{need}'(\wp_3)(j)]$	$\langle T(\wp), t \rangle$	\emptyset
5.	$\lambda P [\exists y (\text{two}'(y) \wedge \text{*car}'(y) \wedge \sim P(y))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
6.	$\neg \text{need}'(\wedge \lambda P [\exists y (\text{two}'(y) \wedge \text{*car}'(y) \wedge \sim P(y))])(j)$	t	\emptyset

4.2. Head-movement

Concerning head-movement which takes place at s-structure (typically, for Case-related reasons), the present semantic system distinguishes between the substitution type, i.e. head raising, and the adjunction type, i.e. incorporation.

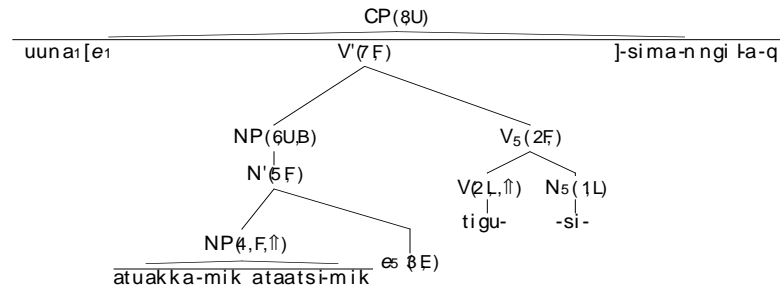
¹³ Analogous results were obtained, from four consultants, for a universally quantified object, *atuakkat tamaasa* 'all books'. This, too, was systematically interpreted as taking wide scope relative to negation.

The former is predicted to be semantically vacuous, because the trace is interpreted as a temporary place-holder for the raised head (as in the ditransitive construction (10'')). The latter, on the other hand, can be semantically significant, because the trace of an incorporated head functions as a place-holder for the complex head formed by the incorporation. If the host head has a translation of its own, the derived structure can therefore have a different interpretation than if the incorporation had not taken place. The motivation for this semantic analysis has already been illustrated, in (8''), by the incorporation of a simple noun into a possessive determiner in WG Inuit. I now provide further support, using evidence from two other noun incorporation constructions in this language.

One of these is the antipassive incorporation, illustrated in (16) and analyzed in (16'):

- (16) Juuna atuakka-mik ataatsi-mik tigu-si-sima-nngi-la-q
J. book-INS one-INS receive-AP-PRF-not-IND-3sgNOM
 $\neg\exists y(\text{book}'(y) \wedge \text{receive}'(y)(j))$

(16')



Ref.	ε	Type of ε	σ
1.	$\lambda\mathfrak{R}[\sim\mathfrak{R}]$	$\langle T(\mathfrak{R}), \langle T(\emptyset), \langle e, t \rangle \rangle \rangle$	\emptyset
2.	$\lambda\emptyset\lambda x[\sim\emptyset(\sim\lambda y[\text{receive}'(y)(x)])]$	$\langle T(\emptyset), \langle e, t \rangle \rangle$	\emptyset
3.	\mathfrak{R}_5	$\langle s, \langle T(\emptyset), \langle e, t \rangle \rangle \rangle$	$\{\mathfrak{R}_5\}$
4.	$\lambda P[\exists y(\text{book}'(y) \wedge \sim P(y))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
5.	$\sim\mathfrak{R}_5(\sim\lambda P[\exists y(\text{book}'(y) \wedge \sim P(y))])$	$\langle e, t \rangle$	$\{\mathfrak{R}_5\}$
6.	$\lambda\mathfrak{R}_5[\sim\mathfrak{R}_5(\sim\lambda P[\exists y(\text{book}'(y) \wedge \sim P(y))])]$	$\langle T(\mathfrak{R}), \langle e, t \rangle \rangle$	\emptyset
7.	$\lambda x[\exists y(\text{book}'(y) \wedge \text{receive}'(y)(x))]$	$\langle e, t \rangle$	\emptyset
8.	$\neg\exists y(\text{book}'(y) \wedge \text{receive}'(y)(j))$	t	\emptyset

Based on syntactic evidence from Case, agreement, affix order, etc., Bittner (in press) argues that an antipassive suffix in WG Inuit (-si in (16)) is a suffixal noun which underlyingly heads an NP complement of the verb and takes the instrumental “object” as its own complement (cf. Baker 1988). To license that object at s-structure, the antipassive noun incorporates into the verb, resulting in a default ILF like (16').¹⁴ Semantically, this incorporation leads to a

¹⁴ For expository reasons, the syntactic analysis sketched here and illustrated in (16') is simplified in ways which do not

“scope freezing” effect which restricts the antipassive object to take scope corresponding to its underlying position, whether or not it moves at LF.¹⁵ The semantic analysis in (16’) explains this effect, because the (basic) translation of the incorporated antipassive noun (Ref. 1) induces type-lifting of the extensional host verb to the type of an intensional verb (Ref. 2). The scope of the antipassive object is thereby frozen, just like the scope of the object of a basically intensional verb, exemplified by *need* in (15’).

The third example of a semantically significant incorporation is provided by the superlative construction in WG Inuit, illustrated in (17c). In (a) and (b), I include the related simple clause (which here is antipassive), and a related comparative construction.¹⁶

- (17) a. Juuna ataata-mi-nik ataqqi-nnip-pu-q
J. [e_i father-3sgPROX_i.sg-INS] respect-AP-IND-3sgNOM
 ‘Juuna_i respects his_i father.’
- b. Juuna Kaali-mit ataata-mi-nik ataqqi-nnin-nir-u-vu-q
J. K-ABL [e_i father-3sgPROX_i.sg-INS] respect-AP-CMP-be-IND-3sgNOM
 ‘Juuna_i respects his_i father more than Kaali.’
- c. Juuna miiqqa-nit tama-nit ataata-mi-nik
J. [children-ABL all-ABL] [e_i father-3sgPROX_i.sg-INS]
 ataqqi-nnin-nir-pa-u-vu-q
 respect-AP-CMP-DIS-be-IND-3sgNOM
 ‘Juuna_i respects his_i father most of all the children.’

In general, comparatives are formed in WG Inuit by suffixing the verb with the nominal suffix *-nir* and the verbal copula *-u*. This licenses an additional ablative argument, which expresses the standard of comparison. Any arguments of the original verb remain unaffected, as does the verbal inflection. The superlative is formed by augmenting the comparative *-nir* with the nominal distributive suffix *-pa(q)*. The ablative standard of comparison must then be plural.

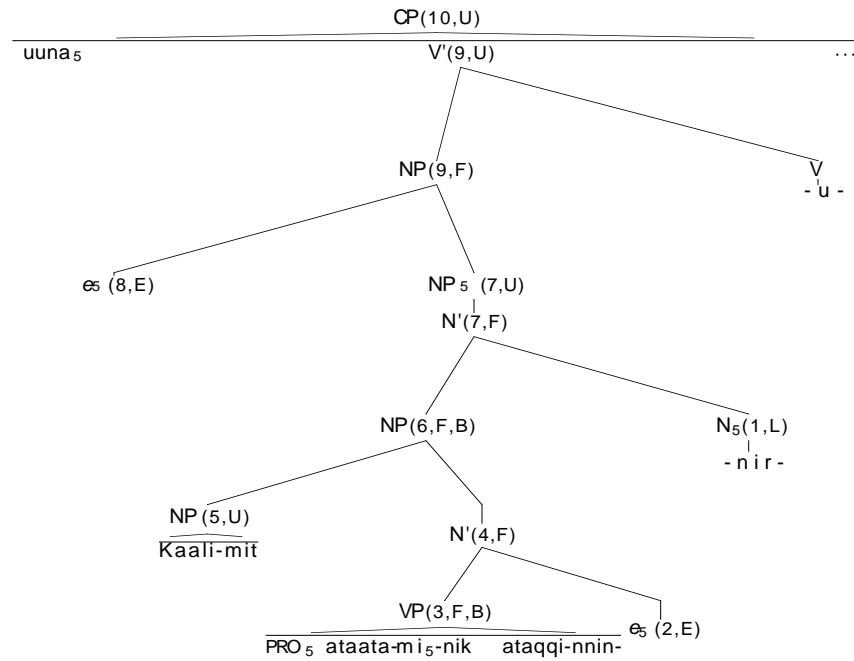
affect the semantic point under the discussion.

¹⁵ Thus, in (16), which was tested with seven consultants, the instrumental object must take scope under the negation.

¹⁶ In (17a–c), the proximate form *-mi* of the possessor agreement indicates that the (non-overt) possessor is syntactically bound by the subject—here, the trace of the nominative argument *Juuna*.

Based on this and other syntactic evidence, Bittner (1994) argues that the comparative suffix *-nir* is a suffixal noun which projects a Larsonian NP shell structure of the same form as the VP shell structure projected by one class of triadic verbs in WG Inuit (cf. the ditransitive English construction (10'')). Noun movement at s-structure then leads to ILFs like (17'b):

(17') b.



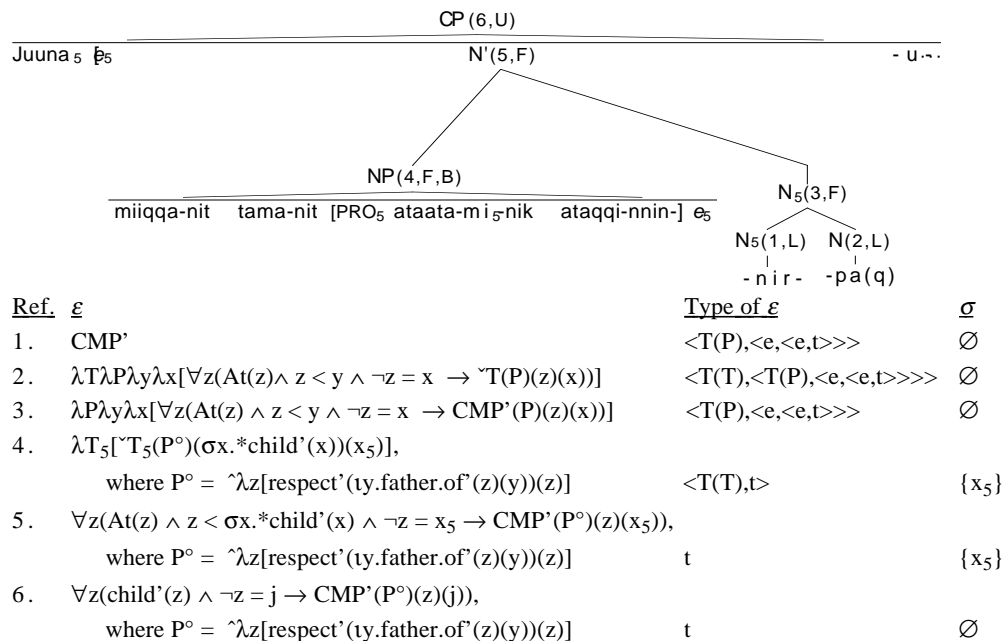
Ref.	ϵ	Type of ϵ	σ
1.	CMP'	$\langle T(P), \langle e, \langle e, t \rangle \rangle \rangle$	\emptyset
2.	T_5	$\langle s, \langle T(P), \langle e, \langle e, t \rangle \rangle \rangle \rangle$	$\{T_5\}$
3.	$\lambda x_5[\text{respect}'(\text{ty.father.of}'(x_5)(y))(x_5)]$	$\langle e, t \rangle$	\emptyset
4.	$\sim T_5(\hat{\lambda} x_5[\text{respect}'(\text{ty.father.of}'(x_5)(y))(x_5)])$	$\langle e, \langle e, t \rangle \rangle$	$\{T_5\}$
5.	k	e	\emptyset
6.	$\lambda T_5[\sim T_5(\hat{\lambda} x_5[\text{respect}'(\text{ty.father.of}'(x_5)(y))(x_5)])(k)]$	$\langle T(T), \langle e, t \rangle \rangle$	\emptyset
7.	$\text{CMP}'(\hat{\lambda} x_5[\text{respect}'(\text{ty.father.of}'(x_5)(y))(x_5)])(k)$	$\langle e, t \rangle$	\emptyset
8.	x_5	e	$\{x_5\}$
9.	$\text{CMP}'(\hat{\lambda} z[\text{respect}'(\text{ty.father.of}'(z)(y))(z)])(k)(x_5)$	t	$\{x_5\}$
10.	$\text{CMP}'(\hat{\lambda} z[\text{respect}'(\text{ty.father.of}'(z)(y))(z)])(k)(j)$	t	\emptyset

Specifically, the suffixal comparative noun *-nir* is raised from its underlying position, as the head of the lower NP, to the higher N-position, where it heads the NP-shell. While syntactically required to license the ablative argument σ , this head movement is semantically vacuous, since it is of the substitution variety (cf. the semantically vacuous movement of *tell-ed* in the English ditransitive (10'')). Assuming that the comparative *-nir* is basically interpreted as a

three-place relation, CMP' , which holds between a property π , an individual b , and an individual a , just in case a has π to a greater degree than b does, we therefore derive the same reading, (Ref. 11), as if *-nir* had not moved.¹⁷

The superlative construction differs from the comparative in that the higher N-position is filled at d-structure by the suffixal distributive noun *-pa(q)*. To license the ablative standard of comparison, the suffixal comparative noun *-nir* must now incorporate into the distributive noun *-pa(q)*, forming a complex nominal head *nir-pa(q)*:

(17') c.



As a consequence, the trace in the underlying position of the comparative noun *-nir* is now interpreted as a placeholder for the complex superlative relation (Ref. 3), formed by combining the comparative relation (Ref. 1) with the distributive operator contributed by *-pa(q)* (Ref. 2).

5. OBLIGATORY MOVEMENT AT LF

All of the derivations discussed so far represent the typical situation, where each level of syntactic representation makes a characteristic contribution to the semantics. Specifically, the d-structure of a sentence, which can be recov-

¹⁷ The bound variable reading derived in (17'b) is the salient reading of the WG Inuit sentence (17b), which is three-ways ambiguous just like its English translation. That is, (17b) can also mean that Juuna has the property of respecting Juuna's father to a greater degree than Kaali does, or that Juuna's father has the property of being respected by Juuna to a greater degree than Kaali does. See Bittner (1994) for a detailed discussion and analysis.

ered from the traces of movement, determines the predicate-argument relations and the predicate-modifier relations on any reading of that sentence. The s-structure, as the default LF, determines the “default reading”, which is usually salient in absence of contextual bias. Any other LF, derived by QR, represents an alternative reading, which may differ from the default reading in regard to the scope or variable-binding relations involving the moved constituent.

But since the semantic rules apply at LF, the present theory also permits the s-structure/default LF to be uninterpretable. That is, the translation rules may be unable to derive any semantically acceptable ILF which would satisfy all of the semantic filters. This is possible provided that QR can derive an alternative LF which the semantic system can interpret. Under these circumstances, QR is predicted to be obligatory. In the following subsections, I discuss three constructions which illustrate these general points—to wit, internally headed relative clauses in Lakhota (sec. 5.1), serial verbs in Yoruba (sec. 5.2), and VP ellipsis in English (sec. 5.3).

5.1. Internally headed relative clauses in Lakhota

In many languages, complex nominal phrases which in English are headed by an NP with an adjoined relative clause correspond to nominalized sentences in which the corresponding NP or DP occupies a sentence internal position. The sentences in (18) illustrate such *internally headed relative clauses* in Lakhota (Siouan, Williamson 1987), Tibetan (Sino-Tibetan, Keenan 1985), Dogon (Mali, Culy 1990), and Miskitu (Misumalpan, Atlantic Coast, Hale p.c.):

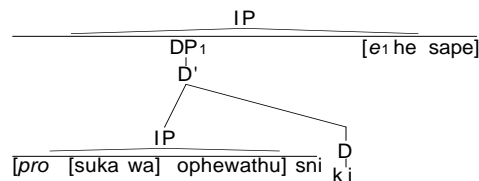
- (18) a. Mary owiza wa kage ki he ophewathu (Lakhota)
 [M. [quilt a] make] the DEM I.buy
 ‘I bought the quilt that Mary made.’
- b. Peemε thep khii-pa the nee yin (Tibetan)
 [P.-ERG [book] carry-PRT] the my be
 ‘The book that Peem carried is mine.’
- c. kadow nyan gε tε-go nε yu gaw to (Dogon)
 [just fire [granary] burn.PST.3sg]-the in millet much was
 ‘In the granary that the fire just burnt, there was a lot of millet.’
- d. Jan witin mairin ra kaik-an nani ba sut ra paiw-an (Miskitu)
 J. [he [woman ACC] see-PST] pl the all ACC invite-PST
 ‘Jan invited all the women that he saw.’

In the gloss of each example, the internally headed relative clause, as well as its internal head, are bracketed. Other genetically unrelated languages which have internally headed relative clauses include Navajo (Athapascan, Platero 1974, Hale and Platero 1974), Diegueño (Yuman, Gorbet 1974), Hopi (Uto-Aztecan, Jeanne 1978), and Quechua (Andean, Cole 1987).¹⁸ In the following discussion, I focus on Lakhota because of the exceptionally detailed syntactic and semantic description provided by Williamson (1987). All of the following Lakhota examples, as well as their syntactic analysis, come from that insightful work.¹⁹ Judging by the above-mentioned studies, the semantic analysis which I propose would generalize to internally headed relative clauses in other languages as well.

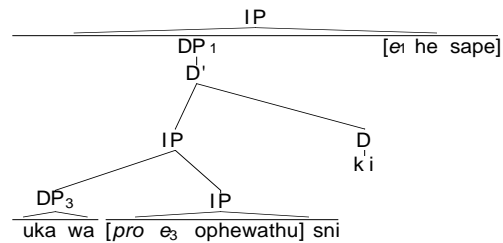
Williamson (1984, 1987) argues on syntactic grounds that an internally headed relative clause in Lakhota is a sentential complement of a determiner. At LF, the internal head undergoes QR to a sentence-adjoined position. Modulo the assumptions of the present study, the d-structure/s-structure representation for (19) is therefore (19'a), where *pro* stands for the non-overt first person subject. The LF derived by QR is (19'b).²⁰

- (19) suka wa ophewathu sni ki he sape
 [[dog a] 3sg.buy.1sg not] the DEM black
 'The dog I didn't buy is black.'

(19') a.



b.



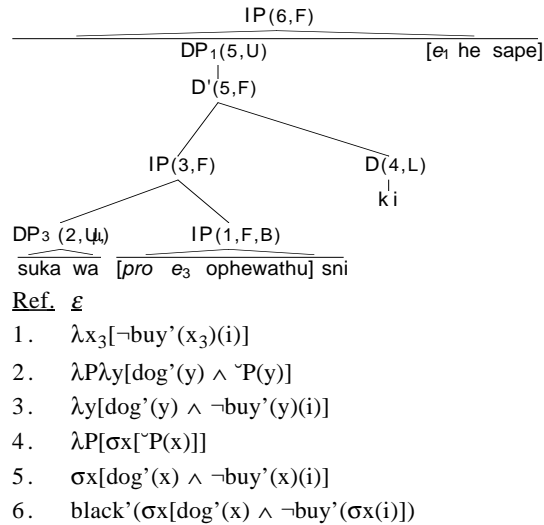
¹⁸ The Mande language Bambara, which was the first language reported to have internally headed relative clauses (Bird 1968), probably has a correlative construction instead (Keenan 1985, Culy 1990). While an internally headed relative clause occupies a regular nominal position in the matrix clause, as in (18a-d), correlative clauses are adjoined to the matrix and related to the relevant nominal positions by resumptive elements, as in Warlpiri (Pama-Nyungan, Hale 1976), Wappo (Yuki, Amerindian, Keenan 1985), Hindi (Indo-European, Srivastav 1991a,b), and Bambara.

¹⁹ Some of Williamson's interlinear glosses are spelled out in more detail, based on her discussion in the text.

²⁰ Based on the fact that the matrix verb agrees with the internal head, Williamson further hypothesizes that the internal head is coindexed with the containing subject. Since this hypothesis plays no role in the semantics I propose, and the syntactic argument seems to me problematic, I ignore it here.

Combining this with the present semantic framework, we predict QR to be obligatory because no semantically acceptable ILF can be derived from (19'a). As long as the internal head remains in situ, it is not possible to satisfy both the Type Filter (which requires the embedded IP to have a translation of type t) and the Vacuity Filter (which requires that IP to combine with D, whose basic translation is $\langle \lambda P[\sigma x[\neg P(x)]], \emptyset \rangle$). The crucial role of QR is to derive a structure, viz. LF (19'b), which can be interpreted just like an externally headed relative clause (cf. (9)):

(19') b'.



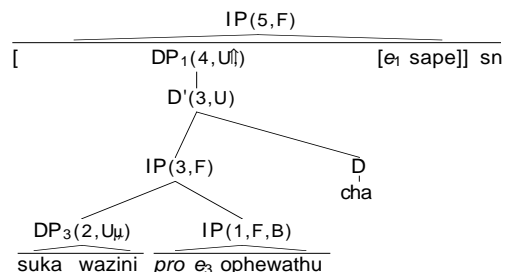
In the ILF (19'b'), the embedded IP projection satisfies the Type Filter, because its lower segment has a basic translation, $\langle \neg \text{buy}'(x_3)(i), \{x_3\} \rangle$, whose first coordinate is of the required type, t .

By hypothesis, indefinite determiners, such as *a* in English (11') or *wa* in Lakhota (19'b'), have no translation (sec. 3.3). If this hypothesis is extended to *wazini* 'any (negative polarity item)' and *cha* 'some (unstressed)', then the analysis of (19) will carry over to (20) and (21), which are analyzed in (20') and (21'), respectively:

(20) *suka wazini ophewathu cha sape sni*
 [[*dog any*] 3sg.buy.1sg] *sm black not*
 'No dog that I bought is black.'

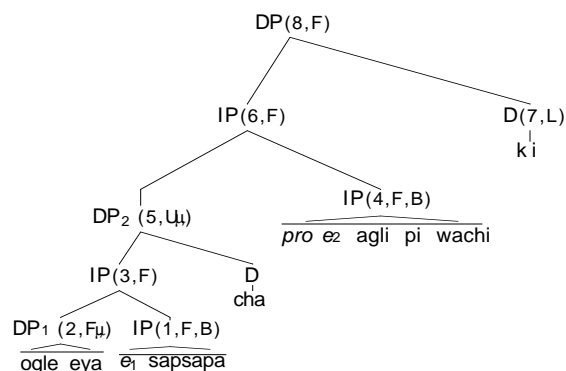
(21) *Ogle eya sapsapa cha agli pi wachi ki lena e*
 [[[*shirt some*] dirty] *sm take.home pl want.1sg*] *the these be*
 'These are the shirts that are dirty that I want them to take home.'

(20')



Ref.	ε	Type of ε	σ
1.	$\lambda x_3[\text{buy}'(x_3)(i)]$	$\langle e, t \rangle$	\emptyset
2.	$\lambda P \lambda y[\text{dog}'(y) \wedge \sim P(y)]$	$\langle \langle s, \langle e, t \rangle \rangle, \langle e, t \rangle \rangle$	\emptyset
3.	$\lambda y[\text{dog}'(y) \wedge \text{buy}'(y)(i)]$	$\langle e, t \rangle$	\emptyset
4.	$\lambda P[\exists x(\text{dog}'(x) \wedge \text{buy}'(x)(i) \wedge \sim P(x))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
5.	$\neg \exists x(\text{dog}'(x) \wedge \text{buy}'(x)(i) \wedge \text{black}'(x))$	t	\emptyset

(21')



Ref.	ε	Type of ε	σ
1.	$\lambda x_1[\text{dirty}'(x_1)]$	$\langle e, t \rangle$	\emptyset
2.	$\lambda P \lambda y[*\text{shirt}'(y) \wedge \sim P(y)]$	$\langle \langle s, \langle e, t \rangle \rangle, \langle e, t \rangle \rangle$	\emptyset
3.	$\lambda y[*\text{shirt}'(y) \wedge \text{dirty}'(y)]$	$\langle e, t \rangle$	\emptyset
4.	$\lambda x_2[\text{want.to.take.home}'(x_2)(i)]$	$\langle e, t \rangle$	\emptyset
5.	$\lambda P \lambda y[*\text{shirt}'(y) \wedge \text{dirty}'(y) \wedge \sim P(y)]$	$\langle \langle s, \langle e, t \rangle \rangle, \langle e, t \rangle \rangle$	\emptyset
6.	$\lambda y[*\text{shirt}'(y) \wedge \text{dirty}'(y) \wedge \text{want.to.take.home}'(y)(i)]$	$\langle e, t \rangle$	\emptyset
7.	$\lambda Q[\sigma y[\sim Q(y)]]$	$\langle \langle s, \langle e, t \rangle \rangle, e \rangle$	\emptyset
8.	$\sigma y[*\text{shirt}'(y) \wedge \text{dirty}'(y) \wedge \text{want.to.take.home}'(y)(i)]$	e	\emptyset

Indeed, the proposed semantics correctly interprets all of Williamson's examples of internally headed relative clauses in Lakhota, as well as the examples from other languages which have been cited in the literature (including (18b) in Tibetan, (18c) in Dogon, and (18d) in Miskitu). Furthermore, it explains the definiteness restriction which Williamson notes for Lakhota, and which appears to be universal (Culy 1990, Srivastav 1991a, Hale p.c.): the head of an internally headed relative clause must be either bare, as in (18b,c,d), or headed by a weak determiner, as in the Lakhota examples (18a), (19), (20), (21), and (22a–d) below. This restriction follows under the present analysis, be-

cause an internally headed relative clause is interpretable only if its internal head has a translation of the predicative type $\langle e,t \rangle$ (which can be lifted by means of a μ -operator to the required modifier type $\langle \langle s, \langle e,t \rangle \rangle, \langle e,t \rangle \rangle$). Nominal phrases which are bare or headed by weak determiners are the class which meets this semantic requirement (cf. Milsark 1974)—in contrast to names (23a), pronouns (23b), and nominal phrases with strong determiners (23c–e):

- (22) a. Mary taku kage ki ophewathu
[Mary [something] 3sg.make.3sg] the 3sg.buy.1sg
 ‘I bought what Mary made.’
- b. Wichasa ota t’a pi ki hena Lakhota pi
[[men many] die pl] the those Lakhota pl
 ‘The many men who died were Lakhota.’
- c. Ed sukawakha conala othetika pi cha wichayuha
E. [[horses few] expensive pl] sm 3pl.own.3sg
 ‘Ed has few (a few?, MB) horses that are expensive.’
- d. Wakhayeza nup iyota wachi wophika pi ki atkuku ki slolwaye
[[children two] best dance be.skillful pl] the father the 3sg.know.1sg
 ‘I know the father of the two children who know how to dance best.’
- (23) a. *Edwin kuze ki/cha he lel thi
[[Edwin] sick] the/sm that here live
 (‘Edwin, who is sick, lives here.’)
- b. *(Miye) makuze ki/cha wichawota ki ekta mni kte
[[I] 1sg.sick] the/sm feast the to 1sg.go FUT
 (‘I, who am sick, will go to the feast.’)
- c. *Mary owiza ki kage ki/cha he ophewathu
[Mary [quilt the] 3sg.make.3sg] the/sm that 3sg.buy.1sg
 (‘I bought the quilt that Mary made.’)
- d. *Ed sukawakha ota-hca othetika pi ki/cha wichayuha
Ed [[horses most] expensive pl] the/sm 3pl.own.3sg
 (‘Ed has most horses that are highly priced.’)
- e. *Wichasa iyuha t’a pi ki/cha Lakhota pi
[[men all] die pl] the/sm Lakhota pl
 (‘All the men who died were Lakhota.’)

5.2. *Serial verbs in Yoruba*

Though descriptively similar constructions are referred to as “serial verbs” in many languages, it is not clear that they form a syntactically or semantically uniform class. Indeed, Bamgbose (1974, 1982) shows that there are at least two types of serial verb constructions in Yoruba, the *linking* type and the *modifying* type, with rather different syntactic and semantic properties (compare, eg., Campbell 1989, Joseph and Zwicky 1990, and Baker 1989). In what follows, I focus on the linking construction in Yoruba illustrated in (24).²¹

- (24) a. Olú n-gbeàga wá. (Bamgbose 1982)
Olu [[PRG-take chair] come]
 ‘Olu is bringing a chair.’
- b. Ajé rí aso jí gbé wò (Awóyalé 1988)
Aje [[[saw dress] steal] take] wear]
 ‘Aje saw a dress, stole it, and put it on.’
- c. Olú fi ìsó gún omo náà (Bamgbose 1974)
Olu [[held nail] pierce child the]
 ‘Olu pierced the child with a nail.’
 (Lit. ‘...held a nail and the nail pierced the child.’)
- d. Olú lo aso náà gbó (Bamgbose 1974)
Olu [[used dress the] worn.out]
 ‘Olu used the dress and it became worn out.’

In general, this construction consists of an ordinary VP followed by one or more *serial* VPs. The subject of any serial verb is non-overt and is construed with some argument of the initial verb, the subject (24a–b) or the object (24c–d).²² If a serial verb is transitive, then its object may also be elided, as in (24b), and is then likewise construed with some argument of the initial verb, usually, the object. Only the initial verb carries the tense and aspect inflection (null in the past tense, but overtly marked eg. in the progressive (24a)), and behaves like a main verb with respect to focusing, as the following examples (from Bamgbose 1974) illustrate:

²¹ The Yoruba sentence (24b) does not imply that Aje saw only one dress. He could see several dresses and, out of those, steal and put on just one (Akinlabi p.c.). A more accurate translation might be *There is a dress that Aje saw, stole, and put on*. Similarly, in (27a) below, with a plural object, Bamgbose’s translation correctly implies that Olu could eat just some of the groundnuts he bought (Akinlabi p.c.).

²² In (24a), the verb *wá* ‘come’ requires an animate subject, so it can only be construed with *Olú*.

- (25) a. Olú wá
Olu came
 ‘Olu came.’
- b. wíwá ni Olú wá
coming FOC Olu came
 ‘Olu DID come.’
- (26) a. gbígbé ni Olú gbé àga wá
taking FOC Olu [[took chair] come]
 ‘Olu DID bring a chair.’
- b. *wíwá ni Olú gbé àga wá
coming FOC Olu [[took chair] come]
 (‘Olu DID bring a chair.’)

The morphosyntactic facts concerning the verbal inflection, interaction with the focusing construction, and the apparently unlimited number of VPs which can occur in a series, all support the surface structure proposed by Bamgbose (1974), where the serial VPs are adjoined to the initial (head) VP. To account for the various construal possibilities, Bamgbose derives this structure from an underlying coordination of two full sentences.²³

Adapting this analysis to the present framework, I assume that serial verbs (of the linking type) in Yoruba have the same VP-adjoined structure at the underlying and the s-structure levels. The different construal possibilities arise for two reasons. One, a serial VP can be adjoined to different segments of the head VP; and two, when a serial VP is transitive, it can be generated with an empty internal argument position. Thus, for example, a serial VP which is adjoined below the underlying position of the matrix subject can be predicated of that subject, as in (27a), whose d- and s-structure is shown in (27'a). The underlyingly empty object of the serial verb *je* ‘eat’ is interpretable only if it is coindexed with some argument of the head verb *ra* ‘bought’. Here, the pragmatically plausible construal is with the object argument, *èpà* ‘groundnuts’. In contrast, the serial VP₂ in (27b) will be predicated of the object of the head

²³ Bamgbose also claims that the bi-sentential structure is required to account for the ambiguity of negation, but it is not clear that there is any ambiguity, since the putative alternative readings all entail the reading where the negation takes scope over the entire series. Since the latter reading is expected on the basis of the proposed surface structure, no other structure is required to account for these facts.

verb, because it is coindexed with that object and is adjoined above the underlying position of the matrix subject.

The d- and s-structure of this sentence is shown in (27'b).

(27) a. Olú ra èpà je (Bamgbose 1982)

Olu [[*bought groundnuts*] *eat*]

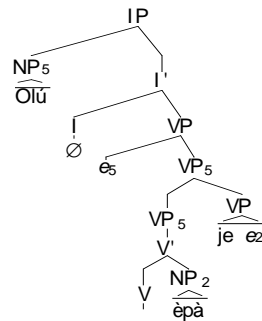
'Bola bought and ate some groundnuts.'

b. Fémi tì Akin subú (Lord 1974)

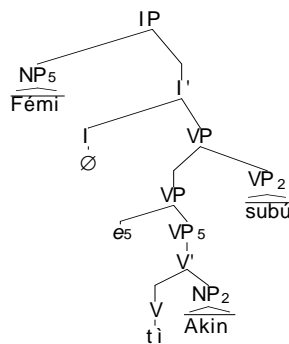
F. [[*pushed Akin*] *fall*]

'Femi pushed Akin down.'

(27') a.



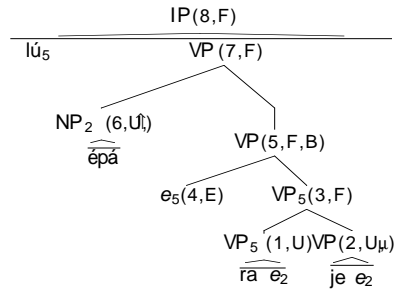
b.



As they stand, neither of the s-structures in (27') is interpretable. Thus, any ILF derived from (27'a) will violate the Store Filter, because the underlyingly empty object of the serial VP introduces a free variable which, in this structure, cannot be bound. And starting from (27'b), it is impossible to satisfy the Vacuity Filter, since the semantic rules cannot derive any translation for the VP-segment which immediately dominates the serial VP₂. Both problems can be solved by means of QR, which can adjoin the matrix object to the VP-complement of I(nfl). This movement, which is effectively obligatory, derives LFs which can be interpreted as follows:²⁴

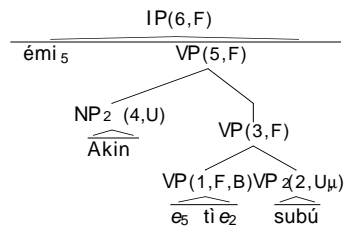
²⁴ The analysis of (27'b) can probably be extended to its English translation, *Femi* [[*pushed Akin*] *down*], and other resultative constructions, eg. *John* [[*wiped every table*] *clean*].

(27'') a.



<u>Ref.</u>	<u>ε</u>	<u>Type of εσ</u>	
1.	buy'(x ₂)	<e,t>	{x ₂ }
2.	λQλx[~Q(x) ∧ eat'(x ₂)(x)]	<<s,<e,t>>,<e,t>>	{x ₂ }
3.	λx[buy'(x ₂)(x) ∧ eat'(x ₂)(x)]	<e,t>	{x ₂ }
4.	x ₅	e	{x ₅ }
5.	λx ₂ [buy'(x ₂)(x ₅) ∧ eat'(x ₂)(x ₅)]	<e,t>	{x ₅ }
6.	λP[∃y(*groundnut'(y) ∧ ~P(y))]	<<s,<e,t>>,<e,t>>	∅
7.	∃y(*groundnut'(y) ∧ buy'(y)(x ₅) ∧ eat'(y)(x ₅))	t	{x ₅ }
8.	∃y(*groundnut'(y) ∧ buy'(y)(o) ∧ eat'(y)(o))	t	∅

b.



<u>Ref.</u>	<u>ε</u>	<u>Type of εσ</u>	
1.	λx ₂ [push'(x ₂)(x ₅)]	t	{x ₅ }
2.	λQλx[~Q(x) ∧ fall'(x)]	<<s,<e,t>>,<e,t>>	∅
3.	λx[push'(x)(x ₅) ∧ fall'(x)]	<e,t>	{x ₅ }
4.	a	e	∅
5.	push'(a)(x ₅) ∧ fall'(a)	t	{x ₅ }
6.	push'(a)(f) ∧ fall'(a)	t	∅

If QR is also permitted to move VPs, then this analysis can be generalized to account for the three-way ambiguity of constructions such as the following (from Bamgbose (1974), judgements confirmed by Akinlabi (p.c)):

(28) Olú bú omo náà já.de

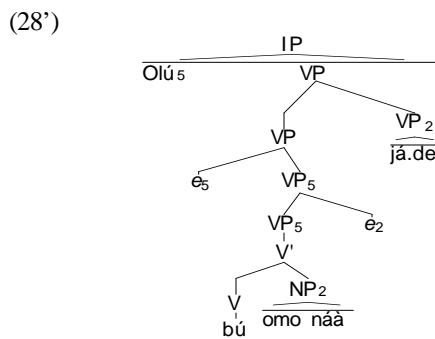
O. [[scolded child the] go.out]

(i) 'Olu scolded the child and went out.'

(ii) 'Olu scolded the child and the child went out.'

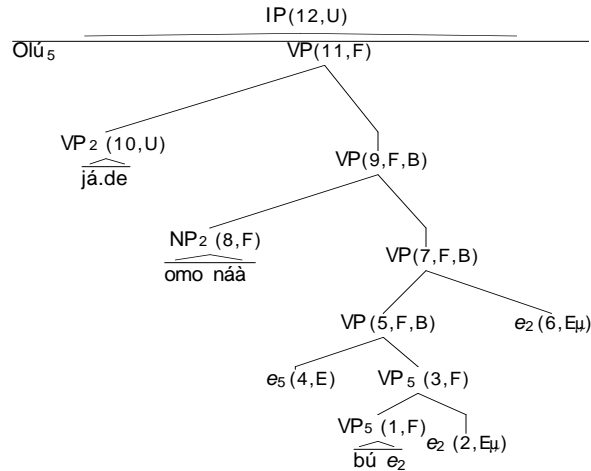
(iii) 'Olu_i scolded the child and both he_i and the child went out.'

The “subject-oriented” reading (i) and the “object-oriented” reading (ii) arise just like the corresponding construal possibilities for the sentences in (27). If the latter are not perceived as ambiguous, it is because one of the possible readings is pragmatically implausible. To account for the “conjoined” reading (iii), I hypothesize that, when a serial VP_i is coindexed with the matrix object and adjoined above the underlying position of the matrix subject (as in (27’b)), it may bind an empty node in the lower position where serial VPs can also be adjoined, as in (28’) (cf. (27’a)). I leave it open whether this node is generated empty or is created by moving the serial VP_i from the lower to the higher adjunct position, at s-structure:



Unlike the s-structures of the sentences in (27), the s-structure (28’) is interpretable as it stands. As a default LF of (28), it provides another source for the subject-oriented reading (i). But (28’) can also be optionally transformed into an alternative LF which yields the desired conjoined reading (iii). Specifically, by applying QR both to the object NP₂ and to the serial VP₂, we can derive an LF whose subtrees can be interpreted just like the corresponding constituents in (27’’a) and (27’’b). The resulting acceptable ILF is shown in (28’’) below. The main difference, relative to (27’’a,b), is that the MOD-positions which in those ILFs were occupied by full serial VPs are now realized as empty nodes which are syntactically bound by the raised serial VP₂ (*já.de*). By rule E, these VP-adjoined empty nodes are interpreted as place-holders for the raised VP₂ (cf. (11’)), which therefore, by rules B and F, is predicated both of the subject (by virtue of the lower adjunct *e*₂, cf. (27’’a)) and of the object (by virtue of the higher adjunct *e*₂, cf. (27’’b)):

(28'')



<u>Ref.</u>	<u>ϵ</u>	<u>Type of ϵ</u>	<u>σ</u>
1.	scold'(x ₂)	<e,t>	{x ₂ }
2.	$\lambda Q\lambda x[\sim Q(x) \wedge \sim P_2(x)]$	<<s,<e,t>>,<e,t>>	{P ₂ }
3.	$\lambda x[\text{scold}'(x_2)(x) \wedge \sim P_2(x)]$	<e,t>	{x ₂ , P ₂ }
4.	x ₅	e	{x ₅ }
5.	$\lambda x_2[\text{scold}'(x_2)(x_5) \wedge \sim P_2(x_5)]$	<e,t>	{x ₅ , P ₂ }
6.	$\lambda Q\lambda x[\sim Q(x) \wedge \sim P_2(x)]$	<<s,<e,t>>,<e,t>>	{P ₂ }
7.	$\lambda x[\text{scold}'(x)(x_5) \wedge \sim P_2(x_5) \wedge \sim P_2(x)]$	<e,t>	{x ₅ , P ₂ }
8.	ty.child'(y)	e	\emptyset
9.	$\lambda P_2[\text{scold}'(\text{ty.child}'(y))(x_5) \wedge \sim P_2(x_5) \wedge \sim P_2(\text{ty.child}'(y))]$	<<s,<e,t>>,t>	{x ₅ }
10.	go.out'	<e,t>	\emptyset
11.	$\text{scold}'(\text{ty.child}'(y))(x_5) \wedge \text{go.out}'(x_5) \wedge \text{go.out}'(\text{ty.child}'(y))$	t	{x ₅ }
12.	$\text{scold}'(\text{ty.child}'(y))(o) \wedge \text{go.out}'(o) \wedge \text{go.out}'(\text{ty.child}'(y))$	t	\emptyset

The logical translation derived in (Ref. 12) is consistent with the English translation given (by native speakers of Yoruba) in (28.iii), and correctly predicts that (28) cannot be disambiguated in favour of its conjoined reading by means of *pò* or *papò* 'together', as in *(29c):

- (29) a. Olú àti Kofi já.de pò/papò. (Akinlabi, p.c.)
Olu and Kofi went.out together
 'Olu and Kofi went out together.'
- b. *Olú já.de pò/papò. (Akinlabi, p.c.)
Olu went.out together
 ('Olu went out together.')
- c. *Olú bú omo náâ já.de pò/papò. (Akinlabi, p.c.)
Olu [[scolded child the] go.out together]
 ('O. scolded the child, and O. went out together, and the child went out together.')

The construction *(29c) is unacceptable for the same reason that *(29b) is: the collective predicate *já.de pò/papò* ‘go out together’ must have a sum-denoting subject, as in (29a).

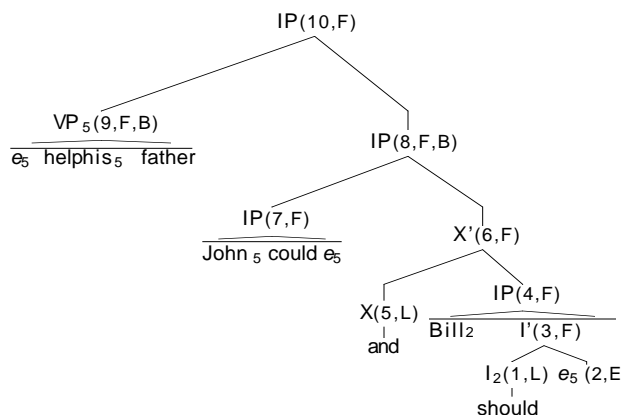
5.3. Verb phrase ellipsis in English

Extending the possibility of QR to VPs will also enable us to interpret VP ellipsis, including the typologically less common antecedent-contained variety.²⁵

For example, from the s-structure of a VP ellipsis construction of the kind represented by (30), QR can derive an interpretable LF by adjoining the “antecedent” VP to the matrix IP:²⁶

(30) John could *help his father*_i and Bill should *e_i*.

(30')



Ref.	ϵ	Type of ϵ	σ
1.	$\lambda P \lambda x [\text{should}'(\sim P(x))]$	$\langle \langle s, \langle e, t \rangle \rangle, \langle e, t \rangle \rangle$	\emptyset
2.	P_5	$\langle s, \langle e, t \rangle \rangle$	$\{P_5\}$
3.	$\lambda x [\text{should}'(\sim P_5(x))]$	$\langle e, t \rangle$	$\{P_5\}$
4.	$\text{should}'(\sim P_5(b))$	t	$\{P_5\}$
5.	$\lambda p \lambda q [\sim q \wedge \sim p]$	$\langle \langle s, t \rangle, \langle \langle s, t \rangle, t \rangle \rangle$	\emptyset
6.	$\lambda q [\sim q \wedge \text{should}'(\sim P_5(b))]$	$\langle \langle s, t \rangle, t \rangle$	$\{P_5\}$
7.	$\text{could}'(\sim P_5(j))$	t	$\{P_5\}$
8.	$\lambda P_5 [\text{could}'(\sim P_5(j)) \wedge \text{should}'(\sim P_5(b))]$	$\langle \langle s, \langle e, t \rangle \rangle, t \rangle$	\emptyset
9.	$\lambda x_5 [\text{help}'(\text{ty}[\text{father.of}'(x_5)(y)])(x_5)]$	$\langle e, t \rangle$	\emptyset
10.	$\text{could}'(\text{help}'(\text{ty}[\text{father.of}'(j)(y)])(j)) \wedge \text{should}'(\text{help}'(\text{ty}[\text{father.of}'(b)(y)])(b))$	t	\emptyset

²⁵ See Sag (1976), Williams (1977a), Partee and Bach (1981), May (1985), Kitagawa (1991), and Dalrymple *et al.* (1991), amongst others, for relevant empirical discussion and alternative analyses.

²⁶ At LF, this derivation would violate the Proper Binding Condition of May (1977), but the resulting ILF (30') satisfies the Store Filter. Since the Store Filter also accounts for the evidence cited by May, it can be viewed as a more general filter which replaces the Proper Binding Condition in the present system.

Also, the structure of XP-coordination assumed in (30') is non-standard, but would explain, eg., why coordinating conjunctions behave like heads for the purposes of the head-initial/head-final parameter.

Since the trace of the extracted antecedent VP, as well as the underlyingly empty complement of the second I(nfl), are both in ARG-positions, they are interpreted on a par with nominal arguments, by rule E. Assuming that both I(nfl)s can be interpreted as property operators, we then get (Ref. 1) through (Ref. 8). Furthermore, since the raised VP contains the trace of the subject and is coindexed with that trace, rule B can derive a predicate in which the variable contributed by the trace is bound by the same λ -operator as the variable contributed by the syntactically bound pronoun *his*₅ (Ref. 9; cf. the Derived VP Rule of Partee 1973). From this predicate, rule F then obtains the corresponding (intensional) property which serves as the argument of both I(nfl)s. The resulting final translation, (Ref. 10), represents the bound variable reading of (30). The other readings of this sentence can be derived analogously.

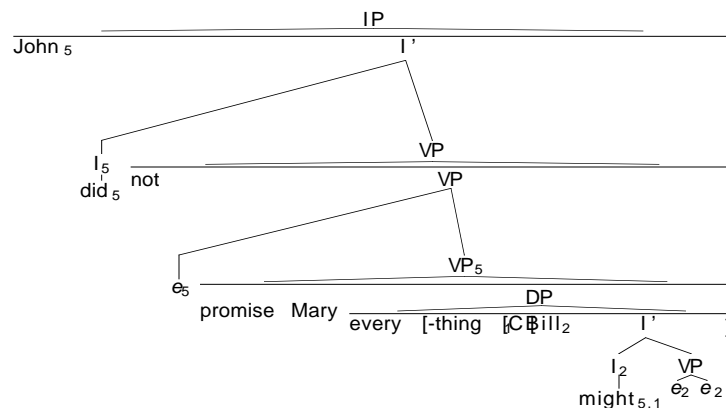
Normally, extraction out of one conjunct of a coordinated structure is prohibited, as in *(31a). But in ellipsis constructions like (30') it should be licensed, since it derives the same “across-the-board” configuration which also licenses (31b) (Ross 1967, Williams 1977b, 1978):

- (31) a. *Which journals_i does John subscribe to e_i and Mary reads long novels?
 b. Which journals_i does John subscribe to e_i and Mary read e_i ?

For antecedent-contained ellipsis, I posit s-structures of the following form:²⁷

(32) John did not promise Mary everything Bill might.

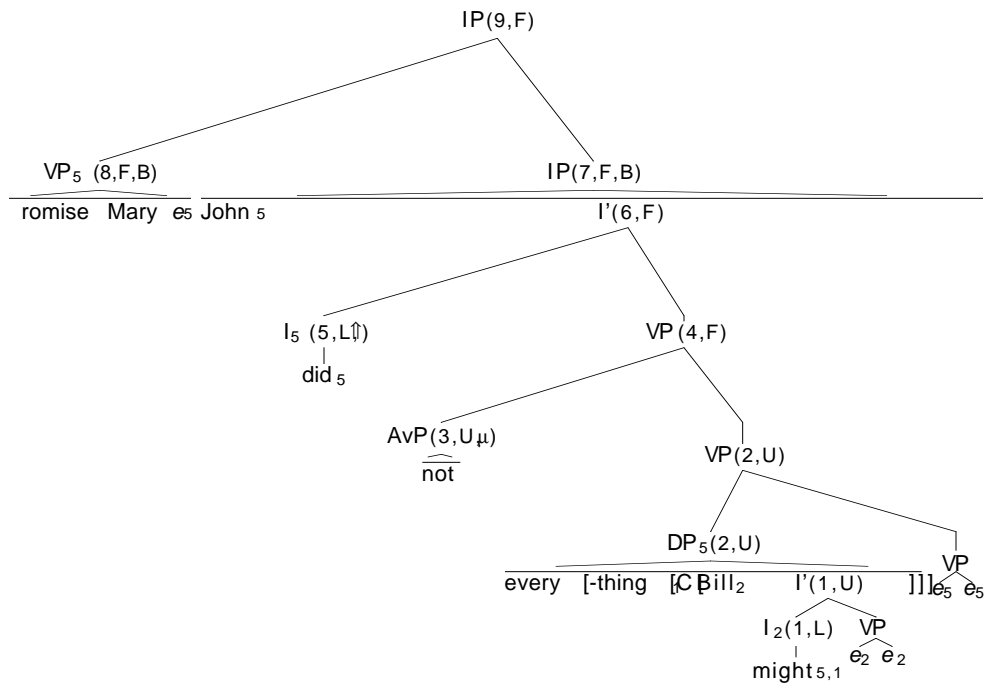
(32')



²⁷ The indices on the auxiliaries (*did*₅, *might*_{5,1}) have no syntactic significance, and could be omitted. The internal structure of the VP headed by *promise* is parallel to that of the VP headed by *tell* in (10”).

Here, the complement of the second I(nfl) does not originate entirely empty. At d-structure, it contains the VP-internal subject, *Bill*₂, which is adjoined to an empty phrasal head, *e*₂, representing the elided (predicative) VP₂. From this standard VP-internal position, the subject is raised to (Spec,IP) at s-structure, for the usual Case-related reasons, leaving a coindexed trace (the leftmost *e*₂). While the s-structure (32') is not interpretable as it stands, because the elided VP cannot be anaphorically linked to any overt VP, it can be transformed into an interpretable LF by means of two applications of QR. The first extracts the object DP containing the elliptical material, and adjoins it to the containing small clause. The second instance of QR extracts the resulting residue of VP₅—including the trace of the object, which crucially must be coindexed with VP₅—and adjoins it to the matrix IP. The resulting LF can then be interpreted as follows:

(32')



Ref.	ϵ	Type of ϵ	σ
1.	$\lambda x[\text{might}'(\sim R_5(x_1)(x))]$	$\langle e, t \rangle$	$\{R_5, x_1\}$
2.	$\lambda P[\forall y(\text{might}'(\sim R_5(y)(b)) \rightarrow \sim P(y))]$	$\langle T(P), t \rangle$	$\{R_5\}$
3.	$\lambda \emptyset \lambda Q[\sim \emptyset(Q)]$	$\langle T(\emptyset), \langle T(P), t \rangle \rangle$	\emptyset
4.	$\lambda Q[\sim \forall y(\text{might}'(\sim R_5(y)(b)) \rightarrow \sim Q(y))]$	$\langle T(P), t \rangle$	$\{R_5\}$
5.	$\lambda \emptyset \lambda x[\sim \emptyset(\sim \lambda y[\text{PST}'(\sim R_5(y)(x))])]$	$\langle T(\emptyset), \langle e, t \rangle \rangle$	$\{R_5\}$
6.	$\lambda x[\sim \forall y(\text{might}'(\sim R_5(y)(b)) \rightarrow \text{PST}'(\sim R_5(y)(x)))]$	$\langle e, t \rangle$	$\{R_5\}$
7.	$\lambda R_5[\sim \forall y(\text{might}'(\sim R_5(y)(b)) \rightarrow \text{PST}'(\sim R_5(y)(j)))]$	$\langle T(R), t \rangle$	\emptyset
8.	$\lambda x_5 \lambda x[\text{promise}'(x_5)(m)(x)]$	$\langle e, \langle e, t \rangle \rangle$	\emptyset
9.	$\sim \forall y(\text{might}'(\sim \text{promise}'(y)(m)(b)) \rightarrow \text{PST}'(\sim \text{promise}'(y)(m)(j)))$	t	\emptyset

This interpretation is possible only if the language has a lexical process which applies to ordinary auxiliaries and derives related indexed auxiliaries. The former are basically interpreted as predicate operators with no free variables in the store, while the latter are basically open predicates containing free variables which are stored. For example, from the ordinary auxiliaries *did* and *might*, with the basic translations $\langle \lambda P \lambda x [\text{PST}'(\sim P(x))], \emptyset \rangle$ and $\langle \lambda P \lambda x [\text{might}'(\sim P(x))], \emptyset \rangle$ (cf. (30', Ref. 1)), it must be possible to derive indexed auxiliaries like did_5 and $might_{5,1}$, interpreted as $\langle \lambda y \lambda x [\text{PST}'(\sim R_5(y)(x))], \{R_5\} \rangle$ and $\langle \lambda x [\text{might}'(\sim R_5(x_1)(x))], \{R_5, x_1\} \rangle$, respectively. The fact that antecedent-contained ellipsis is restricted to a proper subset of the languages which allow ellipsis of the type represented by (30) may be due to the fact that only some languages have lexical processes of this kind.

Assuming that English has the requisite lexical process, the ILF (32'') can be derived essentially like (30'). Thus, in both ILFs, the extracted "antecedent" VP_i contains a coindexed trace in an ARG-position (VP-internal subject in (30'), object in (32'')). From the basic translation of this VP_i , the variable-binding rule B can therefore derive a property or relation which can serve as the argument of the higher order predicate which the same rule obtains, by binding a stored functional variable, from the sister IP. Since the latter contains two sources of the functional variable which gets bound, the apparent "VP-copying" effect is accounted for.

The difference between these two kinds of ellipsis concerns the syntactic source of the functional variable involved as well as its semantic type. In VP ellipsis of the garden variety, represented by (30'), the functional variable is of the property type, $\langle s, \langle e, t \rangle \rangle$, and its two occurrences are introduced by rule E applied to empty complements of two ordinary (possibly non-overt) auxiliaries. Though one of these complements is underlyingly empty, and the other created at LF by applying QR to the "antecedent" VP, both are treated on a par by rule E, since that rule is sensitive only to the presence of empty nodes at LF, and not their derivational history. However, to satisfy the Store Filter, the two empty complements must be coindexed.

In antecedent-contained ellipsis, on the other hand, the corresponding empty nodes (eg., in (32''), the phrase-final e_2 and e_5) are more deeply embedded, functioning as empty phrasal heads of VP complements of auxiliaries. Since rule E does not apply to phrasal head positions, these empty nodes are not assigned any translations, and therefore neither are the VP-internal traces of the associated subjects (the non-final e_2 and e_5). Furthermore, since QR only extracts the predicative VP_i , leaving the adjoined subject trace behind, the "antecedent" expression derived by rule B is of a relational of type $\langle e, \langle e, t \rangle \rangle$ (Ref. 8). To match the corresponding modally closed expression (derived by

rule F in (Ref. 9)), the functional variable must therefore be of the corresponding intensional type, $\langle s, \langle e, \langle e, t \rangle \rangle \rangle$.

Given the requisite lexical process, stored free occurrences of such a variable can be contributed by lexically derived indexed auxiliaries (here, *did*₅ and *might*_{5,1}). The choice of these auxiliaries is entirely determined by the semantics.

In particular, the free variables they contribute must be chosen so as to satisfy the Store Filter and other semantic filters. Their indices need not be constrained by any syntactic mechanism.

6. CONCLUSION

This completes my discussion of the cross-linguistic semantics I propose, and of some of the phenomena which it is designed to explain. Pending further research, I tentatively conclude that the theory of natural language semantics need not contain any language-specific or construction-specific semantic rules. The particular theory proposed here is organized in the same way as the syntactic GB theory developed by Chomsky (1981, 1986a,b, 1989) and others. Just like the latter, it includes a generative component which consists of local rules and whose output is assessed for overall acceptability by a filtering component. The empirically testable predictions are based on the output of the filtering component. The cross-linguistic semantics proposed here also parallels the syntactic GB theory in that the rules of the generative component, as well as the filters, are very general, few in number, and largely or wholly universal. While each rule and filter is simple, the multiplicity of possible interactions accounts for the multiplicity and complexity of the possible final outputs.

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REFERENCES

- Abney, S.: 1987, *The English Noun Phrase in its Sentential Aspects*, Ph.D. dissertation, MIT, Cambridge, MA.
 Andrews, A. D.: 1975, *Studies in the Syntax of Relative and Comparative Clauses*, Ph.D. dissertation, MIT. Published in 1985 by Garland, New York.

- Awóyalé, Y.: 1988, "Complex Predicates and Verb Serialization", *Lexicon Project Working Papers* 28, MIT, Cambridge, MA.
- Baker, M.: 1988, *Incorporation*, The University of Chicago Press, Chicago.
- Baker, M.: 1989, "Object Sharing and Projection in Serial Verb Constructions", *Linguistic Inquiry* 20, 513–554.
- Bamgbose, A.: 1974, "On Serial Verbs and Verbal Status", *Journal of West African Languages* 9.1, 17–48.
- Bamgbose, A.: 1982, "Issues in the Analysis of Serial Verb Constructions", *Journal of West African Languages* 12.2, 3–21.
- Barrs, A.: 1986, *Chains and Anaphoric Dependence*, Ph.D. dissertation, MIT, Cambridge, MA.
- Bird, C.: 1968, "Relative clauses in Bambara", *Journal of West African Languages* 5, 35–47.
- Bittner, M.: 1994, *Case, Scope, and Binding*, Kluwer, Dordrecht.
- Brame, M.: 1981, "The General Theory of Binding and Fusion", *Linguistic Analysis* 7.3.
- Brame, M.: 1982, "The Head-Selector Theory of Lexical Specifications and the Nonexistence of Coarse Categories", *Linguistic Analysis* 10.4.
- Campbell, R.: 1989, *The Grammatical Structure of Verbal Predicates*, Ph.D. dissertation, UCLA, Los Angeles.
- de Carrico, J.: 1983, "On Quantifier Raising", *Linguistic Inquiry* 14, 343–346.
- Chomsky, N.: 1981, *Lectures on Government and Binding*. Foris, Dordrecht.
- Chomsky, N.: 1986a, *Knowledge of Language*. Praeger, New York.
- Chomsky, N.: 1986b, *Barriers*. MIT Press, Cambridge, MA.
- Chomsky, N.: 1989, "Some Notes on Economy of Derivation and Representation", in I. Laka and A. Mahajan (eds.), *MIT Working Papers in Linguistics* 10, Department of Linguistics and Philosophy, MIT, Cambridge, MA, pp. 43–47.
- Cole, P.: 1987, "The Structure of Internally Headed Relative Clauses", *Natural Language & Linguistic Theory* 5, 277–302.
- Cooper, R.: 1975, *Montague's Semantic Theory and Transformational Syntax*, Ph.D. dissertation, University of Massachusetts, Amherst.
- Cooper, R.: 1983, *Quantification and Syntactic Theory*, D. Reidel, Dordrecht.
- Culy, C.: 1990, *The Syntax and Semantics of Internally Headed Relative Clauses*, Ph.D. dissertation, Stanford University, Stanford.
- Dalrymple, M., S. Shieber, and F. Pereira: 1991, "Ellipsis and Higher-Order Unification", *Linguistics and Philosophy* 14, 399–452.
- Diesing, M.: 1990, "Verb Movement and the Subject Position in Yiddish", *Natural Language & Linguistic Theory* 8, 41–80.
- Emonds, J.: 1976, *A Transformational Approach to English Syntax*, Academic Press, New York.
- Frege, G.: 1892, "Über Sinn und Bedeutung", *Zeitschrift für Philosophie und Kritik*, vol. 100, pp. 25–50. English translation in *Translations from the Philosophical Writings of Gottlob Frege*, edited by P. Geach and M Black, Blackwell, Oxford, 1960, pp. 56–78.
- Fukui, N.: 1986, *A Theory of Category Projection and Its Applications*, Ph.D. dissertation, MIT, Cambridge, MA.
- Fukui, N. and M. Speas: 1986, "Specifiers and Projections", in N. Fukui, T. Rapoport, and E. Sagey (eds.), *MIT Working Papers in Linguistics* 8, Department of Linguistics and Philosophy, MIT, Cambridge, MA, pp. 128–172.
- Gazdar, G.: 1980, "A cross-categorical semantics for coordination", *Linguistics and Philosophy* 3, 407–409.
- Gorbet, L.: 1974, *Relativization and Complementation in Diegueño*, Ph.D. dissertation, UCSD.
- Hale, K.: 1976, "The adjoined relative clause in Australia", in R. M. Dixon (ed.), *Grammatical Categories in Australian Languages* (Linguistic Series No. 22, Australian Institute of Aboriginal Studies, Canberra), Humanities Press Inc., New Jersey, USA.
- Hale, K. and P. Platero: 1974, "Aspects of Navajo Anaphora: Relativization and Pronominalization", *Diné Bizaad Náníl'ih* (The Navajo Language Review) 1,9–25.
- Heim, I.: 1982, *The Semantics of Definite and Indefinite Noun Phrases*, Ph.D. dissertation, University of Massachusetts, Amherst.
- Hellan, L.: 1986, "The Headedness of NPs in Norwegian", in P. Muysken and H. van Riemsdijk (eds.), *Features and Projections*, Foris, Dordrecht.
- Hoeksema, J.: 1983, "Plurality and Conjunction", in A. ter Meulen (ed.), *Studies in Modeltheoretic Semantics*, Foris, Dordrecht.
- Jeanne, L.: 1978, *Aspects of Hopi Grammar*, Ph.D. dissertation, MIT, Cambridge, MA.
- Joseph, B. and A. Zwicky: 1990, *When Verbs Collide: Papers from the 1990 Ohio State Mini-Conference on Serial Verbs* (OSU WPL 39), Ohio State University, Columbus.
- Kalish, D., R. Montague, and G. Mar: 1980, *Logic: Techniques of Formal Reasoning*, Harcourt Brace Jovanovich, San Diego.
- Kamp, H.: 1981, "A theory of truth and semantic representation", in J. Groenendijk *et al.* (eds.), *Formal Methods in the Study of Language*, Mathematical Centre, Amsterdam. Reprinted in J. Groenendijk, T. Janssen and M. Stokhof (eds.), *Truth, Interpretation and Information*, Foris, Dordrecht, 1983, pp. 1–42.
- Kayne, R.: 1983, *Connectedness and Binary Branching*, Foris, Dordrecht.
- Keenan, E.: 1985, "Relative clauses", in T. Shopen (ed.), *Language typology and syntactic description*, vol. II, Cambridge University Press, Cambridge, pp. 141–170.
- Kitagawa, Y.: 1986, *Subjects in Japanese and English*, Ph.D. dissertation, University of Massachusetts, Amherst.
- Kitagawa, Y.: 1991, "Copying Identity", *Natural Language & Linguistic Theory* 9, 497–536.
- Klein, E. and I. Sag: 1985, "Type-Driven Translation", *Linguistics and Philosophy* 8:163–202.

- Koopman, H.: 1983, *The Syntax of Verbs*, Foris, Dordrecht.
- Koopman, H. and D. Sportiche: 1985, "Theta-Theory and Extraction", *GLOW Newsletter* 14, 57–58.
- Koopman, H. and D. Sportiche: 1991, "The Position of Subjects", in J. McCloskey, ed. *The Syntax of Verb-Initial Languages*, Elsevier. [Published as a special issue of *Lingua*.]
- Kuroda, Y.: 1988, "Whether We Agree or Not", *Linguisticae Investigationes* 12, 1–47.
- Lasnik, H. and J. Uriagereka: 1988, *A Course on GB Syntax*, MIT Press, Cambridge, MA.
- Larson, R.: 1988, "On the Double Object Construction", *Linguistic Inquiry* 19, 335–392.
- Lewis, D.: 1975, "Adverbs of quantification", in E. Keenan (ed.), *Formal Semantics of Natural Language*, Cambridge University Press, Cambridge, pp. 3–15.
- Link, G.: 1983, "The Logical Analysis of Plurals and Mass Terms: A Lattice-theoretical Approach", in R. Bäuerle, C. Schwarze, and A. von Stechow (eds.), *Meaning, Use, and Interpretation of Language*, de Gruyter, Berlin.
- Lord, C.: 1974, "Causative Constructions in Yoruba", *Studies in African Linguistics*, supplement 5, 195–204.
- May, R.: 1977, *The grammar of quantification*, Ph. D. dissertation, MIT. Distributed by the Indiana University Linguistics Club, Bloomington, Indiana.
- May, R.: 1985, *Logical Form*, MIT Press, Cambridge, MA.
- Milsark, G.: 1974, *Existential Sentences in English*, Ph.D. dissertation, MIT, Cambridge, MA.
- Milsark, G.: 1977, "Toward and Explanation of Certain Peculiarities of the Existential Construction in English", *Linguistic Analysis* 3, 1–29.
- Mohammad, M.: 1988, "On the Parallelism Between IP and DP", in H. Borer (ed.), *Proceedings of WCCFL 7*, SLA, Stanford, pp. 241–254.
- Montague, R.: 1973, "The Proper Treatment of Quantification in Ordinary English", in J. Hintikka, J. Moravcsik, and P. Suppes (eds.), *Approaches to Natural Language: Proceedings of the 1970 Stanford Workshop on Grammar and Semantics*. D. Reidel, Dordrecht. Reprinted in *Formal Philosophy: Selected Papers of Richard Montague*, edited and with an introduction by R. Thomason, Yale University Press, New Haven and London, 1974, pp. 247–270.
- Partee, B.: 1973, "Some Transformational Extensions of Montague Grammar", *Journal of Philosophical Logic* 2, 509–534. Reprinted in B. Partee (ed.) *Montague Grammar*, Academic Press, New York, 1976, pp. 51–76.
- Partee, B.: 1986a, "Ambiguous pseudoclefts with unambiguous *be*", in S. Berman, J.-W. Choe, and J. McDonough (eds.), *Proceedings of NELS 16, 1985*. GLSA, University of Massachusetts, Amherst, pp. 354–366.
- Partee, B.: 1986b, "Noun Phrase Interpretation and Type-Shifting Principles." In J. Groenendijk, D. de Jongh, and M. Stokhof (eds.) *Studies in Discourse Representation Theory and the Theory of Generalized Quantifiers*, pp. 115–144. Dordrecht: Foris.
- Partee, B. and E. Bach: 1981, "Quantification, Pronouns and VP Anaphora", in J. Groenendijk *et al.* (eds.), *Formal Methods in the Study of Language*, Mathematical Centre, Amsterdam. Reprinted in J. Groenendijk, T. Janssen and M. Stokhof (eds.), *Truth, Interpretation and Information*, Foris, Dordrecht, 1983, pp. 99–130.
- Partee, B. and M. Rooth: 1983, "Generalized Conjunction and Type Ambiguity", in R. Bäuerle, C. Schwarze, and A. von Stechow (eds.), *Meaning, Use, and Interpretation of Language*, Walter de Gruyter, Berlin, pp. 361–383.
- Platero, P.: 1974, "The Navajo Relative Clause", *International Journal of American Linguistics* 40, 202–246.
- Ritter, E.: 1987, "NSO Noun Phrases in Modern Hebrew", in J. McDonough and B. Plunkett (eds.), *Proceedings of NELS 17*, GLSA, University of Massachusetts, Amherst, pp. 521–538.
- Rooth, M. and B. Partee: 1982, "Conjunction, Type Ambiguity, and Wide Scope *or*", in D. P. Flickinger, M. Macken, N. Wiegand (eds.), *Proceedings of WCCFL 1*, Linguistics Department, Stanford University, Stanford, CA 94305, pp. 353–362.
- Ross, J.: 1967, *Constraints on Variables in Syntax*, Ph.D. dissertation, MIT, Cambridge, MA.
- Sag, I.: 1976, *Deletion and Logical Form*, Ph.D. dissertation, MIT, Cambridge, MA.
- Srivastav, V.: 1991a, *WH Dependencies in Hindi and the Theory of Grammar*, Ph.D. dissertation, Cornell University, Ithaca.
- Srivastav, V.: 1991b, "The Syntax and Semantics of Correlatives", *Natural Language & Linguistic Theory* 9, 637–686.
- von Stechow, A.: 1974, "ε-λ kontextfreie Sprachen: Ein Beitrag zu einer natürlichen formalen Semantik", *Linguistische Berichte* 34, 1–33.
- Stowell, T.: 1981, *The Origins of Phrase Structure*, Ph.D. dissertation, MIT, Cambridge, MA.
- Travis, L.: 1984, *Parameters and Effects of Word Order Variation*, Ph.D. dissertation, MIT, Cambridge, MA.
- Williams, E.: 1977a, "Discourse and Logical Form", *Linguistic Inquiry* 8, 101–139.
- Williams, E.: 1977b, "Across-the-Board Application of Rules", *Linguistic Inquiry* 8, 419–423.
- Williams, E.: 1978, "Across-the-Board Rule Application", *Linguistic Inquiry* 9, 31–43.
- Williams, E.: 1980, "Predication", *Linguistic Inquiry* 11, 203–238.
- Williams, E.: 1981, "Argument Structure and Morphology", *The Linguistic Review* 1, 81–114.
- Williamson, J.: 1984, *Studies in Lakhota Grammar*, Ph.D. dissertation, University of California at San Diego, La Jolla.
- Williamson, J.: 1987. "An Indefiniteness Restriction for Relative Clauses in Lakhota", in E. Reuland and A. ter Molen (eds.) *The Representation of (In)definiteness*, MIT Press, Cambridge, MA.
- Woolford, E.: 1991, "VP-Internal Subjects in VSO and Nonconfigurational Languages", *Linguistic Inquiry* 22, 503–540.
- Zagona, K.: 1982, *Government and Proper Government of Verbal Projections*, Ph.D. dissertation, University of Washington, Seattle.