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Editors' Note

The program committee for LFG'04 were Jonas Kuhn and Tara Mohanan. We would like to thank them again for putting together a good program that gave rise to this proceedings. Thanks also go to the executive committee and the reviewers, without whom the conference would not have been possible. We particularly thank Ida Toivonen and Ash Asudeh for the efficient and hospitable local organization (which had to be done around a newborn baby!) and Kate Kearns for pitching in where it was most needed.

The table of contents lists all the papers presented at the conference and some that were accepted but could not be presented. Some papers were not submitted to the proceedings. For these papers, we suggest contacting the authors directly via the e-mail addresses also provided as part of the table of contents.

Hard Copy: All of the papers submitted to the LFG04 proceedings are available in one large pdf file, to be viewed and printed with Adobe Acrobat. Use the Show Bookmarks option to jump between papers in the table of contents.

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PSEUDO NOUN INCORPORATION AND ARGUMENT STRUCTURE IN NIUEAN

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Abstract

Pseudo Noun Incorporation in Niuean appears to be a problematic construction for lexicalist theory because it seems to exhibit both morphological and syntactic properties. After considering the basic data and generalizations, this paper examines two possible Lexical-Functional analyses. The first, the PRED ARG analysis, looks to map the incorporated noun phrase to revised view of a-structure. The second, the Lexical Sharing analysis (extending Wescoat 2002), looks to treat the construction as a combination of both a morphological construction and a syntactic one. After considering both analyses, the paper discusses what each contributes to the understanding of Pseudo Noun Incorporation in Niuean.

1 Introduction

Pseudo Noun Incorporation (Massam 2001) in the Polynesian language, Niuean, poses two immediate problems to a lexicalist syntactic analysis. The first problem is whether to treat incorporation as a morphological construction or as a syntactic one. Pseudo Noun Incorporation has a pair of properties that appear to be morphological: (1) the verb and the incorporated noun must be adjacent and (2) the incorporated noun must not be preceded by any of its otherwise normal prenominal function words. However, Pseudo Noun Incorporation also has an apparent syntactic property: it appears that not just single words can incorporate, but whole phrases. Thus, the question is how to account for these properties in a monostratal theory that assumes lexical integrity (Bresnan and Mchombo 1995).

The second problem this paper will explore concerns the valency of Pseudo Noun Incorporation. Although two nominal expressions appear in this construction – just as two appear in transitive clauses – the case-marking follows that of other less-controversial intransitive clauses in the language. Thus, an analysis of this construction must also account for this property without compromising an analysis of the above phenomena.

In this paper, I will, first, briefly discuss some basic facts about the Niuean language. I will then move to the Niuean Pseudo Noun Incorporation data and establish some basic generalizations about this construction. I will then discuss the first of two analyses, the PRED ARG analysis, which analyzes the incorporated expression as mapping directly into a revised conception of a-structure. I will then examine both its merits and drawbacks. Next, I will look at a second analysis, the Lexical Sharing analysis, which builds on Wescoat 2002. It views the incorporation construction as exhibiting a particular tree geometry. I will likewise discuss its merits and drawbacks. Finally, I will end with a discussion of how each of the two theories contributes to illuminating how Pseudo Noun Incorporation in Niuean works.

1.1 About Niuean

Niuean is natively spoken on Niue Island, an island in the South Pacific south of Samoa and north of Tonga. Politically, the island is in free association with New Zealand (http://www.cia.gov/cia/publications/factbook/geos/ne.html). The Ethnologue estimates the number of Niuean speakers at about 8,000, with communities of speakers in New Zealand, Tonga, and the Cook Islands, in addition to those on Niue Island (http://www.ethnologue.com/show_language.asp?code=NIQ).

Linguistically, Niuean, with Tongan, forms the Tongic subgroup of the Polynesian language family. As a member of the Polynesian family, Niuean is also a member of the much larger Oceanic and Austronesian families (Seiter 1980: xii). Niuean and Tongan are very similar in many respects (especially syntactically) and my own preliminary investigations strongly suggest that Niuean and Tongan have very similar noun incorporation constructions. Thus, in a few cases where the Niuean data is inconclusive, I will bring in Tongan data to inform the discussion.

2 Data

In this section, I will first briefly introduce the basics of Niuean syntax and the kinds of structures that I will be assuming. I will then focus on Niuean incorporation more closely, detailing the properties of this construction.

2.1 Basics of Niuean Syntax

In broad typological terms, Niuean is a head-initial language with a largely isolating morphological profile. In terms of basic clausal syntax, the verb is most often in the first lexical word in a given clause, but the verb is usually preceded by a word expressing the tense or aspect of the sentence. I will regard these preverbal words as members of the category I.[1]

The lexical verb is followed by its nominal arguments, strictly ordered. The ordering of these nominals is given below in (1). The names refer to the case-marking of the nominals and the arrangement from left to right reflects the nominals' order after the verb:

(1) Ergative (if present) < Absolutive < Obliques and Adjuncts

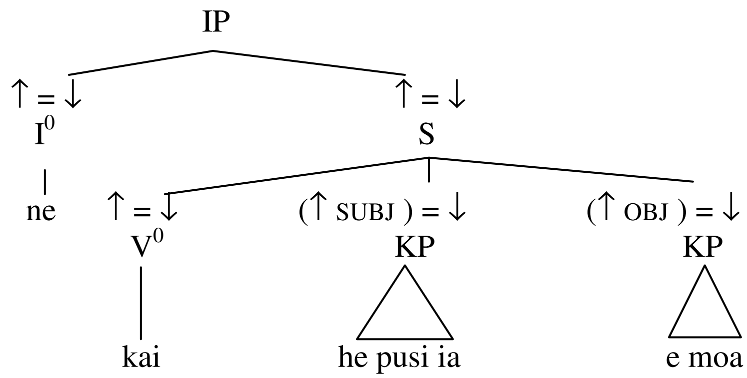
Given below in (2) is an example Niuean sentence with both a preverbal tense/aspect marker and two postverbal nouns.

[1] It is not entirely clear whether this class of words should be regarded as I^0 or C^0. I chose the former, though nothing critical to any analysis presented here rests on this choice.

(2)	**Ne**	**kai**	**he**	**pusi**	**ia**	**e**	**moa.**
	PAST	eat	ERG	cat	that	ABS	bird
	T/A	V	[Erg KP			][Abs KP	]
	That cat ate the chicken.						(Seiter 1980: 29)

Given below in (3) is the annotated c-structure that I am assuming for the sentence in (2). Note that this groups the verb and its nominal arguments into one constituent, the exocentric node, S. This analysis is similar to other LFG analyses of verb-initial languages (see, for example, Kroeger 1993: 119 for Tagalog and Bresnan 2001: 127 for Welsh).

(3)



In addition to the preverbal tense/aspect markers, there is also a collection of "particles" that follow the verb. This includes the question marker, several deictics known in the Polynesianist literature as directionals, and many kinds of adverbials (see the more detailed discussion in Massam 2001: 179-181). Their placement is schematically shown in (4):

(4) Verb "Particles" Nominal Arguments

A small subset of these "particles" is illustrated (and underlined) in (5) below:

(5)	**Takafaga**	**<u>tūmau</u>**	**<u>nī</u>**	**e**	**ia**	**e**	**tau**	**ika.**
	Hunt	always	EMPH	ERG	he	ABS	PL	fish
	V	[postverbal particles		][Erg KP		][Abs KP		]
	He's always fishing.					(Seiter 1980: 69)		

As will be shown below, these "particles" are one useful diagnostic for determining whether incorporation is present.

Turning now to nominal syntax, nominal expressions in Niuean also have an analytic structure. Nouns and pronouns are almost always preceded by words that express case.[2] I will regard these case-marking words as members of the category K, a class of "outer

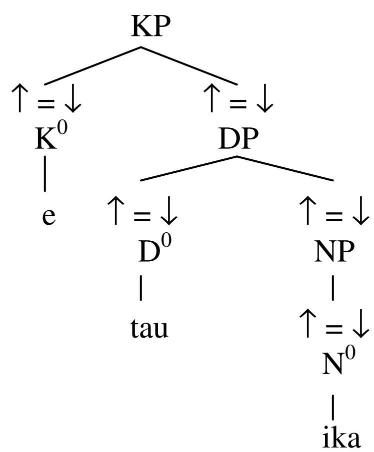
[2] The exceptions with pronouns involve a phonetic or phonological process that deletes the case marker before the pronoun. Most of the exceptions with nouns involve incorporation. For a full discussion, see Seiter 1980: 45-48.

determiners" distinct from the class of prepositions. Independent words that mark number or definiteness/specificity are located between the case markers and nouns. I will regard these as members of the category D.[3] An example noun phrase is given below in (6).

(6) **e** **tau** **ika**
ABS PL fish
the fish (Seiter 1980: 69)

Given the assumptions outlined above, in (7) below is the annotated c-structure I assume for (6).

(7)



Having looked, briefly, at what appears prenominally, I turn now to what appears postnominally. Adjectives, prepositional phrases, relative clauses, and possessors all appear after the noun.[4] I will assume that relative clauses and possessors are attached higher up in the nominal structure; either adjoined to KP or in the rightward-branching specifier of KP. I will assume that adjectives, modifying prepositional phrases, and clauses beginning with the tense/aspect marker **ke**[5] are all adjoined at the NP level.

Given in (8) below is a nominal expression with an adjective. Given in (9) below is its annotated c-structure, given my assumptions outlined above.

(8) **e** **pusi** **uli**
ABS cat black
a black cat (Seiter 1980: 44)

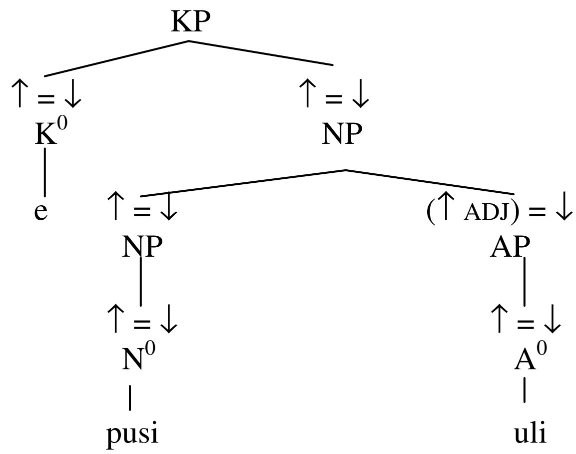
---

[3] Some syntacticians may be inclined to assume that such words are the heads of NumP; I choose D since it makes for a more restricted set of functional categories. However, such a decision does not critically change the following analyses and problems.

[4] This statement is a bit of simplification, since some possessors do appear prenominally, as discussed by Kahnemuyipour and Massam (2004). However, due to the assumption that they are attached above the NP as well as their apparent semantic incompatibility with incorporation, these possessors will not figure in this discussion of noun incorporation.

[5] These clauses seem to be semantically similar to relative clauses, but, I believe, syntactically similar to prepositional phrases.

(9)



Having sketched out the basics of Niuean syntax, I now turn to the details of the incorporation construction.

2.2 Incorporation

Sentences in Niuean with Pseudo Noun Incorporation have a number of interesting differences and similarities from the ordinary sentences and nominals I discussed above. This section will explicate these contrasts.

2.2.1 Basics of Incorporation

The contrast between non-incorporated and incorporated sentences is illustrated by the pair of sentences given in (10a) and (10b), respectively.

(10) a. Non-incorporated:

Takafaga	**tūmau**	**nī**	**e**	**ia**	**e**	**tau**	**ika.**
Hunt	always	EMPH	ERG	he	ABS	PL	fish
V	[postverbal particles		][Erg KP		][Abs KP		]

He's always fishing. (repeats (5))

b. Incorporated:

Takafaga	**<u>ika</u>**	**tūmau**	**nī**	**a**	**ia.**
hunt	fish	always	EMPH	ABS	he
V	IN	[postverbal particles]		[Abs KP	]

He's always fishing). (Seiter 1980: 69)
(≈ *He's always fish-hunting)*

Example (10b) illustrates the three basic formal properties of Pseudo Noun Incorporation. First, the verb and noun are adjacent: the incorporated noun is inside of the "particles," next to the verb, and it is not in the usual clause-final position for non-ergative noun phrases (like its semantic paraphrase is in (10a)). Second, all the words I have previously identified as members of K and D that appear in (10a) do not and must not appear in (10b). Finally, the external, non-incorporated nominal argument is marked with the absolutive case; thus, clauses with incorporation pattern like other intransitive clauses, where the external argument is also marked with absolutive case. An example of such an intransitive clause is given in (11).

(11)	**Ne**	**fano**	**e**	**tehina**	**haaku**	**ke**	**he**	**fale**	**koloa.**
	PST	go	ABS	brother	my	to	CM	house	goods

My little brother went to the store. (Seiter 1980: 28)

However, as noted in initially by Seiter (1980: 69-70) and in more depth by Massam (2001), incorporated expressions have a fourth interesting property: they can include more than just a bare noun (an N^0). These nominals can be expanded in a number of different ways. An incorporated expression can include a noun and adjective. This exemplified in (12).

(12)	**Ne**	**inu**	**kofe**	**kono**	**a**	**Mele.**
	PAST	drink	coffee	bitter	ABS	Mary
	T/A	V	[$_{NI}$ N	A	][Abs KP	]

Mary drank bitter coffee. (Massam 2001: 158)

Incorporated expressions can also include conjoined nouns, as shown in (13).

(13)	**Kua**	**kai**	**ika**	**mo**	**e**	**talo**	**a**	**mautolu**	**he**	**mogonei.**
	PREF	eat	fish	with	ABS	taro	ABS	we(EXCL)	at	now
	T/A	V	[$_{NI}$ N		CONJ	N]	[Abs KP	]	[Adjunct	]

We are eating fish and taro right now. (Seiter 1980: 70)

A noun and modificational prepositional phrase can also be an incorporated expression, as in (14).

(14)	**Kua**	**leva**	**lahi**	**e**	**amaamanaki**	**ke**	**fai**	**pepa**	**pehē**	**nai.**
	PERF	long time	very	ABS	look.forward	SJTV	be	book	like	this
						T/A	V	[$_{NI}$ N	PP	]

There has been a longtime of waiting for there to be a book like this.
(Massam 2001: 160)

And, finally, an incorporated expression can also include a noun with a subjunctive **ke**-clause, as in (15) below:

(15) …**ke**	**kumi**	**mena**	**ke**	**nonofo**	**ai**	**a**	**lautolu.**	
SJTV	seek	thing	SJTV	settle	there	ABS	they	
T/A	V	[$_{NI}$N	[**ke** clause		]]	[Abs KP	]	

…that they would seek a place to settle. (Massam 2001: 169)

While the above four examples show that a fair amount can be incorporated with a noun, there do seem to be limits on what is incorporated. In particular, a given noun cannot incorporate with a “regular” relative clause (i.e. a relative clause not headed by **ke**). This is shown by the ungrammatical example in (16):

(16)	***Ne**	**inu**	**<u>kofe</u>**	**<u>ne</u>**	**<u>taute</u>**	**<u>e</u>**	**<u>au</u>**	**a**	**Sione**
	PAST	drink	coffee	NFUT	made	ERG	I	ABS	(name)
	T/A	V	[$_{NI}$ $_{NP}$N	[RelC				]][Abs KP	]

**Sione coffee that I made-drank* (Massam 2001: 168)

Thus, while all clauses in Niuean with incorporation share the characteristics of the verb-noun adjacency, lack of function words, and the external argument in the absolutive case, they can vary considerably in the size of the incorporated expression.

2.1.2 Other properties of noun incorporation in Niuean

In this final section of this section on the Niuean data, I want to discuss four additional properties of the noun incorporation construction in Niuean. First, although all the preceding examples have been intransitive, there are instances where a clause with incorporation appears to be transitive. However, such clauses seem to be restricted to the valency alternation that Seiter (1980), working in a Relational Grammar framework, called instrumental advancement, where an instrument has become an applied object “after” the object has been incorporated. An example of such a transitive sentence is shown in (17). Note that while the non-incorporated arguments appear with case markers and in the ergative-absolutive order noted in (1), the incorporated noun still is positioned adjacent to the verb and lacks a case marker.

(17)	**Kua**	**tā**	**<u>fakatino</u>**	**he**	**tama**	**e**	**malala**.
	PERF	draw	picture	ERG	child	ABS	charcoal
	T/A	V	NI	[Erg KP		][Abs KP	]

The child has been drawing pictures with charcoal. (Seiter 1980: 267)
(lit. *The child has been picture-drawing charcoal*)

The second property I want to note in this section is, while Niuean does allow phrasal incorporates, they cannot be discontinuous; that is, Niuean does not allow what is commonly referred to in the literature as “stranding” (Rosen 1989). This is shown in (18) below.

(18)	***Ne**	**inu**	**<u>kofe</u>**	**a**	**Sione**	**ne**	**taute**	**e**	**au.**
	PAST	drink	coffee	ABS	(name)	NFUT	made	ERG	I
	T/A	V	[$_{NI}$ $_{NP}$N	][Abs KP	][RelC				]

intended*: Sione drank the coffee that I made.* (Massam 2001: 168)

This lack of discontinuity illustrates a critical contrast between the noun incorporation construction found in Niuean and those found in many other languages with similar constructions (such as Mohawk, as discussed in Baker 1996).

The final two properties of incorporation deal with the kinds of nominals that can be incorporated in Niuean. While the proceeding examples have all dealt with nominal phrases that are instances of incorporation of syntactic objects, other grammatical relations can incorporate.

The first of these is a class of nominals known as middle objects (this term is from Chung 1978). These are internal arguments of verbs of low transitivity that are marked with an oblique preposition. An example is given in (19).

(19)							
Manako	**nakai**	**a**	**koe**	**ke**	**he**	**tau**	**manu?**
like	Q	ABS	you	to	CM	PL	animal
V	Ques	[Abs KP		][PP			]

Do you like the animals? (Seiter 1980:71)

Seiter (1980: 339) argues that middle objects do not behave syntactically as objects in Niuean. However, they do have one property like objects: they can be incorporated, as in example (20), which, aside from the incorporation, is otherwise very similar to (19).

(20)						
Na	**manako**	**manu**	**nakai**	**a**	**koe**	
PAST	like	animal	Q	ABS	you	
T/A	V	NI	Ques	[Abs KP		]

Are you an animal lover? (≈ *Do you animal-like*?) (Seiter 1980:71)

Finally, in a few cases, even adjuncts can incorporate. These incorporating adjuncts seem to be restricted to a particular kind of semantic role, roughly characterized by Massam (2001) as instrument or means of conveyance.[6] An example of this kind of adjunct incorporation is given in (21).

(21) a. Non-incorporated

Fano	**a**	**ia**	**ke**	**he**	**taone**	**he**	**motokā**.
go	ABS	he	to	CM	town	in	car
V	[Abs KP		][PP			][Adjunct PP	]

He went to town in a/the car. (Seiter 1980:71)

b. Incorporated

Fano	**motokā**	**a**	**ia**	**ke**	**he**	**taone.**
go	car	ABS	he	to	CM	town.
V	NI	[Abs KP		][PP		]

He went to town by car. (Seiter 1980:71)
(≈ *He car-went to town*)

So, as this final data section shows, incorporation in Niuean is not solely restricted to putative grammatical objects, but a wide range of argument structure relations, all of which must be taken into consideration when developing an analysis of Niuean incorporation.

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[6] See further discussion in Seiter 1980: 71-73 and Massam 2001: 177-178.

In the next two sections, I will be detailing two possible analyses of Niuean incorporation. I will first discuss each analysis, noting, at the end, the distinguishing qualities of that particular analysis. I will then discuss the various problems of the given analysis, both theory-internal and empirical.

3 The PRED ARG analysis

This first analysis, which I will call the PRED ARG analysis, is a novel analysis receiving its first presentation here. It builds on ideas from Andrews and Manning 1999, Halvorsen and Kaplan 1988, and Kaplan and Maxwell 1996. It is an exemplar of a particular style of analysis where the incorporate is treated as a bare NP and that looks to model the syntactic effect of incorporation using f-structure and a-structure.[7]

3.1 Analysis

This analysis makes two technical augmentations to the theory of f-structures, borrowing and building on Kaplan and Maxwell 1996. First, it views PRED values as being f-structures instead of atomistic values. Second, these PRED-internal f-structures include lexical semantic meaning, in particular a semantic REL attribute, and several ARG_n attributes,[8] a revised view of a-structure. Note that this creates essentially a notational variant of the LCS and TERMS attributes proposed in Andrews and Manning 1999 (see also Alsina 1996 for yet another proposal for revising PRED values). An example of this revised view of f-structures is given below in (22).

(22)
$$\left[\text{PRED} \begin{bmatrix} \text{REL} & \text{‘eat’} \\ \text{ARG}_1 & \_\_\_ \\ \text{ARG}_2 & \_\_\_ \end{bmatrix} \right]$$

I will assume, informally for the moment (though see the discussion in section 3.2.1), that the “outside” grammatical functions (SUBJ, OBJ, OBL, etc.) structure-share with these PRED-internal ARGs.

With this technical augmentation, the core f-structure idea of this analysis is now possible: the incorporated expressions map into the verb’s argument structure – specifically, into the ARGs from above – but do not appear in the f-structure as a grammatical function, such as OBJ. This f-structure idea is coupled with the c-structure idea that the incorporated expression is an NP, not a “full nominal” KP.[9] In particular, I

[7] Another possible analysis in this style would be one that used the restriction operator (see Butt, et al. 2003). However, as section 3.2 will mention, a restriction analysis sharing the PRED ARG analysis’ c-structure assumptions would share the problems with adjacency that the PRED ARG analysis has.
[8] By convention, the lowest numbered argument will correspond to the most prominent semantic argument.
[9] This idea is conceptually very similar to the Massam’s (2001) analysis of Niuean within the Minimalism Program and also to aspects of Asudeh and Mikkelsen’s (2000) analysis of Danish incorporation within the framework of HPSG.

claim that only "full nominal" projections – KP in Niuean – can be linked with a grammatical function. NPs, lacking the proper functional heads, cannot. However, bare NPs can appear (in Niuean) if they link directly to an ARG.

The analysis of the incorporated expression as an NP also rules out ungrammatical incorporated possessors and relative clauses, since these are seen as structurally part of KP, while ruling in the possible incorporated expressions discussed in the section 2.

To implement this analysis, I propose the following annotated phrase-structure rule, given in (23), which allows for the mapping discussed above.

(23)	V′	→	V^0	NP
	↑=↓		(↑ PRED REL) = ↓	(↑ PRED ARG_n) = ↓

(where n = highest numbered ARG in the verb's PRED-internal f-structure[10])

To illustrate this analysis, let us look at an example. Given in (24) is a sentence with an incorporated expression.

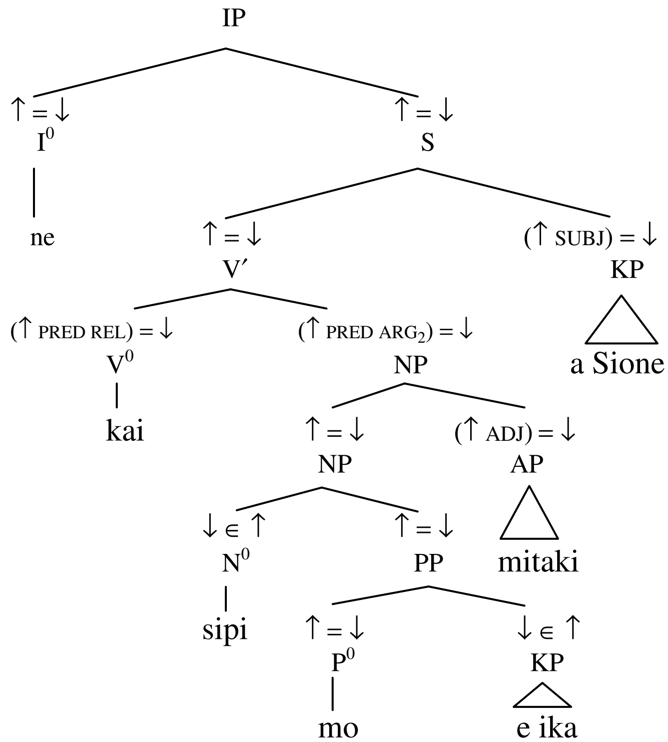
(24)	**Ne**	**kai**	**sipi**	**mo**	**e**	**ika**	**mitaki**	**a**	**Sione.**
	PST	eat	chip	COM	ABS	fish	good	ABS	(name)
	T/A	V	[NI NP					][Abs KP	]
	Sione ate good fish and chips.							(Massam 2001: 160)	

By the rules given in section 2[11] and in (23), it has the c-structure given in (25a) and associated f-structure given in (25b).

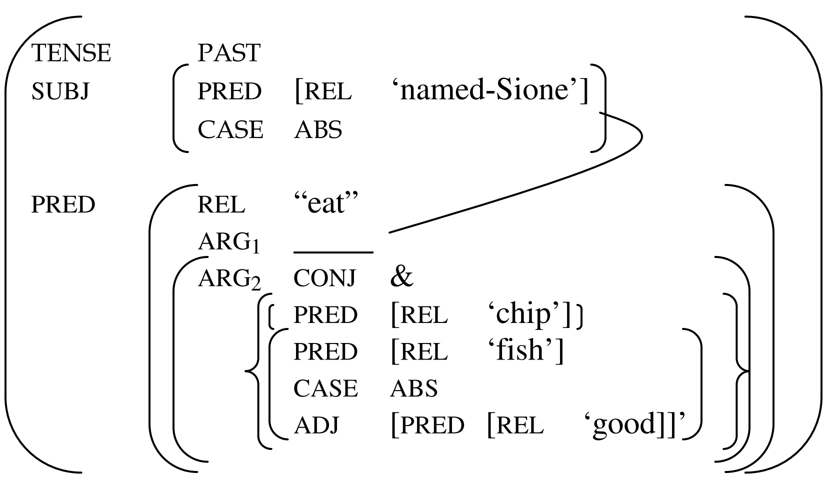
[10] Note that this highest numbered ARG corresponds to what has traditionally been called the lowest argument.
[11] Slightly expanded to include the prepositional phrase-like syntax of coordination in Niuean.

(25)

a. c-structure



b. associated f-structure



Note that the rule in (23) maps the large amount of information within the incorporated NP inside the PRED-internal f-structure.

To conclude this exposition of the PRED ARG analysis, let me summarize the key theoretical features of this analysis. First, it treats Niuean noun incorporation as being entirely syntactic, formally. There is no morphology involved; rather, the verb and incorporated nominal is viewed as a phrasal unit. The valency facts are accounted for through a direct mapping from c-structure to (a revised view) of a-structure, along with the unification of ARGs and GFs. In terms of theoretical architecture, the PRED ARG analysis maintains the existing LFG c-structure architecture, but alters the f-structure architecture.

3.2 Problems

The following sections discuss the problems that the PRED ARG analysis raises, covering both theory-internal and empirical problems.

3.2.1 Theory-internal

In this section, I will discuss three theory-internal problems with the PRED ARG analysis. First, the revision to the f-structures necessitates a need to re-formulate the constraints on valency. Formal implementation of this is actually reasonably straightforward, as the linking of ARGs and GFs can be implemented formally using functional uncertainty, as in (26):

(26) $\text{ARG}_n = ((\text{PRED} \uparrow)\ \text{GF})$

Completeness and Coherence can then apply, requiring that the GFs must be linked to an ARG.

However, even with this technical hurdle cleared, this re-formulation is committed to the view that linking is highly syntacticized, much more so than the existing LFG valency theory. It is not clear that such a highly syntacticized view would be desirable, especially given the success of previous LFG dependency-based analyses.

A second problem is that adjunct incorporation (as shown in example (21)) is problematic if the PRED-internal structure is assumed to be restricted to lexically selected arguments. This problem seems to be a symptom of a more general problem with the PRED ARG analysis: it tries to capture syntactic and semantic features with the same mechanism.

The final problem is not a problem in the syntactic domain, but of the syntax-semantic interface. However, I think this is, nevertheless, an important concern, given the parallel architecture of LFG. This problem is that it is not completely clear how the incorporation semantics might map from the PRED ARG analysis's f-structure to the appropriate σ-structure. Central to this problem is how this f-structure could map into a σ-structure that captures the property-like interpretation of the incorporated expression (as argued for in the semantics literature, see van Geenhoven 1998, Chung and Ladusaw 2003, and Farkas and de Swart 2003 for some proposals). It would seem that the absence of the prenominal function words play a part in this, but it is not clear how the absence of function words can be mapped to the f-structure (and then to σ-structure).

3.2.2 Empirical

There are also two empirical problems that the PRED ARG raises. The first is that it makes the claim that the incorporated expression is neither a syntactic argument nor has a grammatical function. While the intransitive-like case-marking pattern of the incorporation construction cannot be ignored, the case-marking alone is not sufficient evidence that the incorporated expression is not an argument. Furthermore, the incorporated expression can be viewed as still fulfilling the verb's valency requirements; the incorporated expression still seems to fill an internal argument role, even if the incorporated expression itself is an atypical nominal phrase. Thus, it seems that the complete denial of the incorporated expression's argumenthood may not be the most insightful way to analyze this construction.

The second empirical problem comes from comparative evidence. Although Niuean data is inconclusive, data from the closely related and similar behaving Tongan suggests that the true generalization in this construction is that verb and noun must be adjacent, regardless of which part of speech category interceding elements belong to. Thus, the simple solution of analyzing Pseudo Noun Incorporation as incorporation of an NP is not completely accurate.

In Tongan, there is a class of prenominal adjectives, which are absent in Niuean. This exemplified by the underlined word in (27) below.[12]

(27)	**Na'e**	**tō**	**'e**	**Sione**	**'ene**	**<u>ki'i</u>**	**manioke.**
	PAST	plant	ERG	(name)	his	small	cassava
	T/A	V	[Erg Nominal]		[$_{Abs}$ D	A	N]
	Sione planted his small amount of cassava						

These prenominal adjectives cannot incorporate, as shown in (28).

(28)	***Na'e**	**tō**	**<u>ki'i</u>**	**<u>manioke</u>**	**'a**	**Sione**.
	PAST	plant	small	cassava	ABS	(name)
	T/A	V	[$_{NI}$ A	N	][Abs Nominal]	
	intended: *Sione planted a small amount of cassava*.					

However, as (29) shows, a postnominal adjective meaning the same thing as **ki'i** can incorporate.

(29)	**Na'e**	**tō**	**<u>manioke</u>**	**<u>iiki</u>**	**'a**	**Sione.**
	PAST	plant	cassava	small	ABS	(name)
	T/A	V	[$_{NI}$ N	A	][Abs Nominal]	
	Sione planted a small amount of cassava.					

So, not just function words are eliminated to achieve the verb-noun adjacency, and thus, the PRED ARG analysis clearly makes the wrong predictions about the Tongan (and

[12] All Tongan examples are from my own fieldnotes.

possibly, by implication, Niuean as well). This empirical issue also raises questions about the validity of Massam's (2001) analysis and any other analyses that also predict that the verb-noun adjacency is merely coincidental.

Thus, the PRED ARG analysis seems both undesirable from an f-structural standpoint, where it complicates the theoretical architecture with only minimal empirical gain, and from a c-structural standpoint, where it does not quite capture the appropriate level of adjacency.

4 The Lexical Sharing analysis

Given the problems outlined above for the PRED ARG analysis, let look us to a second analysis, the Lexical Sharing analysis, and see how it might handle the facts of Niuean Pseudo Noun Incorporation. In contrast to the PRED ARG analysis and other analyses like it, the Lexical Sharing analysis is analytically centered on the c-structure.

4.1 Analysis

The Lexical Sharing analysis takes Wescoat's (2002: ch. 4) analysis of Hindi and applies it to Niuean.[13] It views verb and noun (but not the rest of the incorporated expression) as a single, morphologically created lexical item. Under this analysis, this verb + noun unit is seen as having an atypical tree geometry: this unit projects both to a V^0 and to an N^0, which can then project to higher projections. This kind of geometry, termed lexical sharing by Wescoat (2002), requires that shared nodes be adjacent (Wescoat 2002: 20), and thus this can account for why (28) is not grammatical, but (29) is.

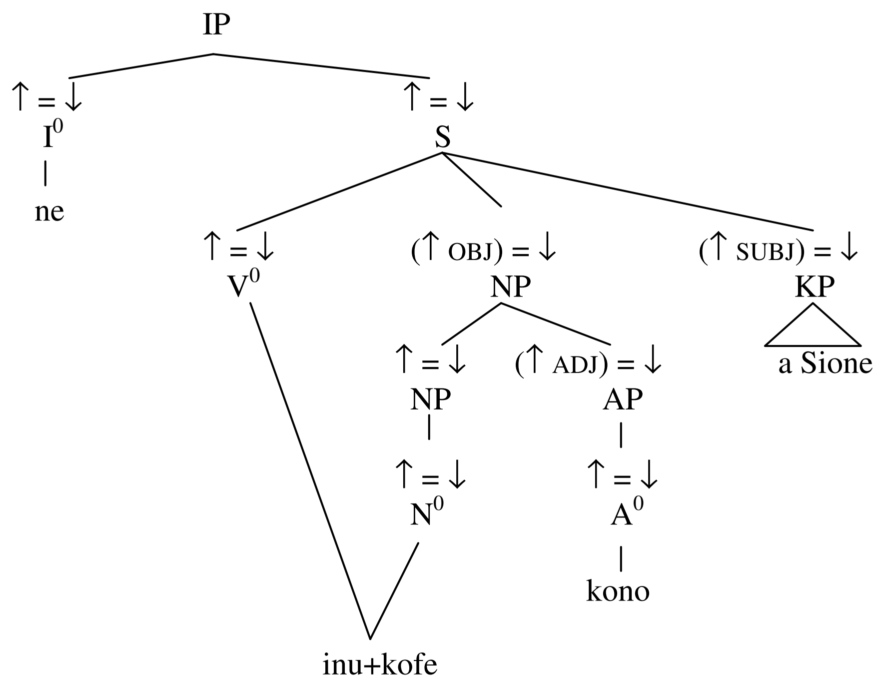
To make the lexical sharing proposal clearer, let us look at an example. In (30) is an example of a Niuean sentence with an incorporated nominal.

(30)	**Ne**	**inu**	**<u>kofe</u>**	**<u>kono</u>**	**a**	**Mele**	
	PAST	drink	coffee	bitter	ABS	Mary	
	T/A	V	$[_{NI\ NP}$N	A	][Abs NP	]	
	Mary drank bitter coffee.						(repeats (12))

Under the Lexical Sharing view,[14] the sentence in (30) has the annotated c-structure in (31).

[13] Modulo the differences in head-directionality.
[14] And the phrase structure assumptions given in section 2.

(31)



In this analysis, the sequence *inu kofe* is analyzed as a single word, one that exhibits the lexical sharing structure, projecting both to the V^0 (and beyond) and to the N^0 (and beyond). The additional phrasal elements that can appear in incorporated structures are thus just c-structurally adjoined to the NP whose head is involved with the lexical sharing. Also, the Lexical Sharing analysis requires no changes with regard to the theory of valency: the verb can still take an OBJ in an incorporation structure, just as it would in an ordinary transitive sentence.

Finally, since Lexical Sharing analyzes the incorporated expression as an OBJ, under this analysis, the incorporation interpretation must come from some particular treatment of certain OBJs at σ-structure. I leave it open what the best way to do this, since this seems to be a purely semantic problem, but I do wish to mention this, since like the PRED ARG analysis, the Lexical Sharing analysis does still require some additional mechanism to properly link it to a semantic structure.

To summarize the theoretical features of the Lexical Sharing analysis, I first note that Lexical Sharing accounts for the adjacency and loss of function words facts by viewing the verb + noun as a single lexical item. Since the verb and noun form a morphological compound, the prenominal words cannot appear, due to lexical integrity assumptions. Second, Lexical Sharing's view on the morphology-syntax question is that Pseudo Noun Incorporation has elements of both morphology and syntax: a morphological verb-noun compound and syntactically adjoined modifiers. Finally, unlike the PRED ARG analysis, this analysis keeps the existing f-structure principles and f- to c-structure mapping principles, but requires a re-conception of what are permitted tree structures.

4.2 Problems

Like the PRED ARG analysis, the Lexical Sharing analysis also raises some problems, which I discuss the following section. Like my earlier discussion, I will begin with theory-internal problems and then proceed to empirical problems.

4.2.1 Theory-internal

The Lexical Sharing analysis raises some problems through its analysis of the incorporated expression as an OBJ, since there is some evidence that the incorporated expression is not an OBJ. In examples with both noun incorporation and instrumental advancement (as in (20)), there is both an applied object and an incorporated expression. In this construction, the applied object has the object properties – it has the absolutive case marking and appears in the usual object position, after the ergative KP – whereas the incorporated expression does not show any object properties. Thus, the Lexical Sharing analysis, while seeming to straightforwardly handle valency by analyzing the incorporated expression as a OBJ in examples like (31) above, runs into problems with the OBJ analysis in these more complex valency interactions.

Further problems for the view that the incorporated expression is an OBJ come from the middle object incorporation, as in (20), and the adjunction incorporation, as in (21). Here not only does the incorporated expression not have OBJ properties like case or post-ergative KP position, but it lacks the kind of semantic patient/theme role typically associated with OBJs. While it is true that these incorporated expressions have a semantic relation close to the meaning of the main predicate, it is not clear that they should be analyzed with an OBJ function or, especially in the case of adjunct incorporation, any governable grammatical function. Thus, these kinds of incorporation possibilities also pose problems for Lexical Sharing's analysis of the incorporated expression as an OBJ.

A final theoretical problem for the Lexical Sharing analysis is that it violates the Single Mother Condition, which most LFG researchers (as well as those in many other frameworks) have assumed is universal. While such an assumption has provided a useful constraint on tree structures, it seems a bit hasty to rule out structures such as (31) solely on such theoretical grounds. Thus, it would seem to be better to sort these questions out based upon empirical grounds, an area I turn to below.

4.2.2 Empirical

The Lexical Sharing analysis also faces two possible empirical challenges, although, admittedly, the evidence is not entirely clear in either direction. The first challenge comes from the fact that there is no clear phonological evidence for the verb and noun as a unit. For what it's worth, neither Seiter nor Massam write the verb and the noun as a unit.[15] However, this may reflect orthographic convention and not phonological structure. Also, Fitzgerald (2001), in her survey of noun incorporation in Oceanic languages, also claims

[15] This orthographic decision also holds in descriptions of similar constructions in other Polynesian languages: Maori in Chung and Ladusaw 2003 and Tahitian in Lazard and Peltzer 2000.

that Niuean noun incorporation does not involve a phonological unit of any sort (in her discussion of Niuean in Appendix 1), but it is not clear from what she makes that judgment.

The second possible problem the Lexical Sharing faces is that there may not be any morphological evidence for treating the noun and verb as a single unit. Following in the discussion of Hindi noun incorporation in Mohanan 1995, a likely place to look for morphological evidence is in the ability of the verb-noun unit to nominalize. While the evidence from Niuean on this kind of nominalization is presently unknown, if subsequent investigation found that the verb and noun could not be nominalized together, and also that there was no other evidence for the verb-noun unit to be considered a morphological unit, it would be very problematic for the Lexical Sharing analysis.

So, we see from this discussion of theoretical and empirical problems that the Lexical Sharing analysis might not capture the Niuean Pseudo Noun Incorporation data either.

5 Conclusions

Having forged through the data and looked at two analyses with both promising insights and noteworthy theoretical and empirical problems, what can be concluded about Pseudo Noun Incorporation in Niuean? To return to the areas with which I sought to frame this paper in the introduction, I first want to talk about the issues of morphology vs. syntax and the issue of lexical integrity. The above discussion reveals that it is possible (twice over) to analyze this construction without violating lexical integrity. Also, due to the possibility of nominal modifiers in the incorporated expression, it seems desirable to treat this construction, at least in part, as a syntactic construction. However, although the data in this paper suggest that the simple solution of analyzing the incorporated expression as an NP appears to be problematic, the data do not resolve a second question that these two analyses bring out – whether to characterize the verb-noun adjacency as an entirely syntactic constraint (akin to the PRED ARG analysis) or as the result of a hybrid of morphological and syntactic constructions (as in the Lexical Sharing analysis). Some preliminary investigation suggests that the former might be a better solution, but more definitive evidence needs to be brought to bear on this question.

Second, in the area of valency, it seems that neither PRED ARG analysis nor the Lexical Sharing analysis captures the right generalizations. The PRED ARG analysis seems to go too far in denying that the incorporated expression has a grammatical function, in the process muddling syntactic and semantic valency, as well as committing itself to a problematic, highly syntacticized view of argument structure. The Lexical Sharing analysis, on the other hand, seems to not go far enough. It seems to present too simple of a solution, in which non-object properties of the incorporated expressions are not carefully considered. Thus, it would seem to point to the need for less extreme approach than either taken here. One possibility, as pursued by Asudeh and Ball (2005), is to introduce a new kind of grammatical function (called INCORPORATE in their paper), that interfaces with the incorporation semantics, but leaves the sentence intransitive. However, given the above discussion, it would seem crucial to any subsequent analyses of Pseudo Noun Incorporation in Niuean to give a more sophisticated treatment of the interaction between the syntactic valency and the semantics, and, given the middle object and adjunct incorporation data, to give a more prominent role for the lexical semantics in the analysis.

Notes on Orthography and list of abbreviations

All examples are in given the practical orthography of the language of the example. The Niuean and Tongan orthographies follow the standard IPA representations of the phonemes of their respective languages except that Niuean **g** = Tongan **ng** = /ŋ/,
Tongan **‘** = the glottal stop, and macrons mark long vowels.

Abbreviations from interlinear glosses:
ABS = absolutive, CM = case-marking particle, COM = comitative, ERG = ergative, EMPH = emphatic, NFUT = non-future, PERF = perfect, PL = plural, Q = question particle, SJTV = subjunctive

References

Alsina, Alex. 1996. *The Role of Argument Structure in Grammar*. Stanford, California. CSLI Publications.

Andrews, Avery and Christopher Manning. 1999. *Complex Predicates and Information Spreading in LFG*. Stanford, CA: CSLI Publications.

Asudeh, Ash and Line Hove Mikkelsen. 2000. Incorporation in Danish: Implications for interfaces. In Ronnie Cann, Claire Grover, and Philip Miller (eds.), *Grammatical interfaces in HPSG*. Stanford, CA: CSLI Publications.

Asudeh, Ash and Douglas Ball. 2005. Niuean incorporated nominals as non-projecting nouns. Paper presented at the 2005 LSA Annual Meeting.

Baker, Mark C. 1996. *The Polysynthesis Parameter*. Oxford: Oxford University Press.

Bresnan, Joan. 2001. *Lexical Functional Syntax*. Oxford: Blackwell Publications.

Bresnan, Joan and Sam Mchombo. 1995. The Lexical Integrity Principle: Evidence from Bantu. *Natural Language and Linguistic Theory* 12:181-254.

Butt, Miriam, Tracy Holloway King, and John T. Maxwell III. 2003. Complex Predicates via Restriction. In Miriam Butt and Tracy Holloway King (eds.), *Proceedings of the LFG03 Conference*. CSLI Publications. Online at http://csli-publications.stanford.edu/.

Chung, Sandra. 1978. *Case Marking and Grammatical Relations in Polynesian*. Austin, Texas: University of Texas Press.

Chung, Sandra and William Ladusaw. 2003. *Restriction and Saturation*. Linguistic Inquiry Monograph 42. Cambridge, Massachusetts.: MIT Press.

Farkas, Donka and Henriëtte de Swart. 2003. *The Semantics of Incorporation: From Argument Structure to Discourse Transparency*. Stanford, California: CSLI Publications.

Fitzgerald, Marguerite. 2001. *Noun Incorporation in Oceanic Languages*. Melbourne, Victoria: University of Melbourne BA Honours Thesis.

Halvorsen, Per-Kristian, and Ronald M. Kaplan. 1988. Projections and Semantic Description in Lexical-Functional Grammar. In *Proceedings of the International Conference on Fifth Generation Computer Systems*, 1116-1122. Tokyo. Institute for New Generation Computer Technology.

Kaplan, Ronald M. and John T. Maxwell. 1996. *LFG Grammar Writer's Workbench*. Technical Report, Xerox PARC.

Kroeger, Paul. 1993. *Phrase Structure and Grammatical Relations in Tagalog*. Stanford California: CSLI Publications.

Kuhnemuyipour, Arsalan and Diane Massam. 2004. Deriving the Order of Heads and Adjuncts: The Case of Niuean DPs. Paper Presented at AFLA XI.

Lazard, Gilbert and Louisa Peltzer. 2000. *Structure de la langue tahitienne [Structure of the Tahitian language]*. Paris: Peeters Press.

Massam, Diane. 2001. Pseudo Noun Incorporation in Niuean. *Natural Language and Linguistic Theory* 19: 153-197.

Mohanan, Tara. 1995. Wordhood and Lexicality: Noun Incorporation in Hindi. *Natural Language and Linguistic Theory* 13: 75-134.

Rosen, Sara Thomas. 1989. Two Types of Noun Incorporation: A Lexical Analysis. *Language* 65: 294-317.

Seiter, William. 1980. *Studies in Niuean Syntax*. New York: Garland Publications.

Van Geenhoven, Verle. 1998. *Semantic Incorporation and Indefinite Descriptions: Semantic and Syntactic Aspects of Noun Incorporation in West Greenlandic*. Stanford, California: CSLI Publications.

Wescoat, Michael. 2002. *On Lexical Sharing*. Stanford, California: Stanford University Ph.D. dissertation.

ACTOR-EMPHATIC SENTENCES IN MĀORI

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Abstract

The purpose of this paper is to provide enough coverage of the basics of Māori syntax to enable the reader to understand why the actor-emphatic construction of Māori is so problematic, and to provide enough data about the construction to enable the reader to participate in the arguments about the possible derivation of the construction. It is not written within the LFG framework; the author was given the brief of providing basic data, rather than an LFG paper.

1 Basic Syntax

1.1 Phrases

The basic unit for the description of Māori syntax is the phrase. Phrases in general conform to the schema in (1):

(1) Phrase-type marker + lexical nucleus + (modifier(s))

Three types of phrases are important for our purposes.

1.1.1 Verb Constituents

I have deliberately not called these verb phrases, because I am not describing here the VP (or predicate) of standard linguistic theory, but just that part of the predicate which contains the lexical verb. In the verb constituent, the Phrase-type marker is a Tense-Aspect-Mood marker (TAM), and the modifiers include a large array of aspectual-type particles as well as lexical modifiers. Examples of verb constituents are given in (2), with the TAM underlined. Note the complex TAM in (2)(b), and the discontinuous TAM in (2)(c):

(2) (a) kua mate
PERF dead
'has died', 'is dead'

(b) kei te haere tonu
PROG go still
'am/is/are still going'

(c) e waiata ana
PROG- sing -PROG
'am/is/are/was/were singing'

1.1.2 Noun/Determiner Phrases

The Phrase-type marker for a noun phrase is a determiner which is the locus for number marking in Māori, as in (3):

(3) (a) te tangata
DEF SG man
'the man'

(b) ngā pukapuka nei
DEF PL book PROX
'these books'

(c) t-a-ku waiata hou
SG-A-1SG song new
'my new song'

(d)	-<u>a-ku</u>	waiata	hou	
	PL-A-1SG	song	new	
	'my new songs'			

The morph glossed A in the determiners in (c) and (d) will be explained shortly.

Māori has a special determiner for use with personal names in certain grammatical contexts, usually called the 'personal article', with the form *a*. It appears in (19) below, for example.

1.1.3 Prepositional phrases

The Phrase-type marker in a prepositional phrase is a preposition, and the nucleus is a noun phrase. Prepositions in Māori may be marked for tense, as in the first two examples in (4):

(4)	(a)	<u>i</u>	te	Mane
		at.PAST	DEF SG	Monday
		'on Monday (past)'		
	(b)	<u>a</u>	te	Mane
		at.FUT	DEF SG	Monday
		'on Monday (next)'		
	(c)	<u>ki</u>	taku	whare
		to	my	house
		'to my house'		

1.2 Basic Sentence Types

Māori has sentences with verbs, but also sentences with non-verbal predicates, as it has no copula verb.

1.2.1 Verbal sentences

These have the surface order VSO. The Subject of any Māori sentence is an NP with no preposition, which distinguishes it from all other nominal sentence constituents. Other NP functions are marked by prepositions, so the usual DO preposition is *i*, and the passive agent marker is *e*, as in (5):

(5)	(a)	Kei te	haere	te	tangata	ki	te	one
		PROG	go	DEF SG	man	to	DEF SG	beach
		'The man is going to the beach.'						
	(b)	Kei te	whāngai	te	tangata	i	ngā	ngeru
		PROG	feed	DEF SG	man	ACC	DEF PL	cat
		'The man is feeding the cats.'						
	(c)	I	whāngai-a	ngā	ngeru	e	te	tangata
		PAST	feed-PASS.	DEF PL	cat	AG	DEF SG	man
		'The cats were fed by the man.'						

It is not just by chance that the passive example (5c) is in the past tense, while the active example (5b) is in the present tense: one of the interesting facts about Māori is that completed events with directly affected patients are usually expressed using the passive (or the actor-emphatic) in Māori, so that native-speaking consultants judge it unacceptable to use the active to translate 'the man fed the cats'.

Adverbials of time, reason and sometimes place may go first, before the verb, or at the end (or both), as in (6). The unmarked position for adverbials is sentence final.

(6) (a) I te Mane ka haere ahau ki Taupō
at.PAST DEF SG Monday REL TAM go 1SG to Taupo
'I went to Taupo on Monday.'

(b) Nā te ngāwhā ka waikura ngā whare
by DEF SG sulphur REL TAM rust DEF PL house
'Because of the sulphur, the buildings rusted.'

(c) Nā te mahi rātou i hoki ai ki Pōneke
by DEF SG work 3PL PAST return PART. to Wellington
'They returned to Wellington because of the work.'

(6c) calls for some further comment. Notice that the Subject, *rātou*, appears between the fronted adverbial and the verb constituent. This is a very common word order in such sentences. Second, notice the particle *ai* which follows the verb *hoki*: this is introduced when an adverbial is moved in front of a verb with certain TAMs. *Ka* in (6b) does not require *ai*, but *i* in (6c) does. Lastly, by using the gloss 'by' for the preposition *nā*, I have glossed over a whole chapter in the syntax of Māori, though some of the issues will be addressed below.

1.2.2 Non-verbal Sentences

There are several sub-types of these, and some of them are more important for the concerns of this paper than others. However, all share the basic word order of Predicate – Subject.

(a) Equational sentences

These have their predicate introduced by the preposition *ko*, and equate the Subject and the predicate, as in (7):

(7) Ko te pahi o te kura tēnei
PREP DEF SG bus of DEF SG school this
'This is the school bus.'

(b) Classifying (or attributive) sentences

These have predicates introduced by *he* (or in future contexts, *hei*), as in (8):

(8) He tino kino tēnei pahi
CL very bad this bus
'This bus is really terrible.'

The predicate particle *he* is identical to one of the indefinite determiners of Māori, but there is room for argument about whether the particle *he* in classifying sentences is a determiner, a preposition, a TAM marker, or something else!

(c) Locational sentences

Sentences specifying the temporal or spatial location of an object are introduced by one of the tense-marked locative prepositions of Māori, as in (9).

(9) Kei roto ngā tamariki i te whare kura
at.PRES inside DEF PL children at.NEUT DEF SG house school
'The children are in the school building.'

Notice the position of the Subject in (9), which has a complex predicate: it is placed after the first phrase of the predicate, in the same way that the Subject of a verbal sentence appears after the first phrase of the verbal predicate. The predicate illustrated in (9) is a very common type of locational phrase in Māori. *Roto* is one of a class of relational (usually called 'local') nouns which are very widely followed by prepositional phrases as here. These 'prep + local noun + prep' (e.g. 'at the inside of') combinations serve the purpose of many of the more specific locational prepositions of English, like *over, under, above*, etc. Māori makes do with a very economical array of prepositions.

(d) Specific Ownership sentences

These are very important for the exposition of the syntactic problem addressed in this paper, and they are accordingly treated in a little more detail.

Māori differentiates between ownership and temporary possession (which is expressed as location), and within the field of ownership, between the ownership of a specific object (e.g. *This book is John's, John owns this book*) and ownership of a non-specific object (e.g. *John has a book*).

Specific ownership sentences are introduced by one of the four prepositions *mā, nā, mō, nō*. These are all morphologically complex. The *n-* morph encodes actual ownership, while the *m-* encodes future/intended/irrealis ownership.

The *–ā* and *–ō* morphs encode a distinction between two different modes of ownership, somewhat akin to the alienable/inalienable distinction found elsewhere in the Pacific. *A*-possessives are used for the relationship where the possessor is dominant in relation to the possessum, and *O*-possessives are the 'elsewhere' form. Thus there are *A*-relationships with portable property and with actions over which one has control. There is much more to be said about this distinction, but that will suffice for now.

Specific ownership sentences are illustrated in (10):

(10)(a)	N-ā	te	kaiako	tēnei	pukapuka
	ACTUAL-A.POSS	DEF SG	teacher	this	book

'This book belongs to the teacher.'

(b)	M-ā	Pani	ēnei	pukapuka
	IRR-A.POSS	Pani	these	book

'These books are for Pani.'

(c)	Mō	Pani	tēnei	hōiho
	IRR-O.POSS	Pani	this	horse

'This horse is for Pani.'

While it is possible to interpret the *n-* vs. *m-* distinction as one of tense, my glosses deliberately imply something different. The reason for this will become clear later.

2 Actor-Emphatic Sentences

2.1 Basic Characteristics of Actor-Emphatic Sentences

Māori has another sentence type, usually called the actor-emphatic or the agent-emphatic. The basic construction of these sentences is illustrated in (11):

(11)(a)	N-ā	te	kaiako	ia	i	whaka-oho
	ACTUAL-A.POSS	DEF SG	teacher	3 SG	PAST	CAUSE-wake

'**The teacher** woke him/her up.'

(b) M-ā Rewi e tuhituhi he reta ki
IRR-A.POSS Rewi NONPAST write INDEF letter to
te Pirimia
DEF SG Prime Minister
'**Rewi** will write a letter to the Prime Minister.'

First, I will draw attention to the surface characteristics of this construction:

The actor/agent is marked by a possessive preposition. *Nā* is used in past-time contexts (as in (11a)) and *mā* in future-time contexts (as in (11b)). There is no present-tense actor-emphatic.

The actor/agent phrase is in initial position.

The TAM is always *i* 'past' after *nā* and always *e* 'non-past' after *mā.*

The verb is almost exclusively transitive, although there are a few intransitive or semi-transitive examples. The intransitive examples are probably only apparent exceptions, accounted for by the treatment of certain locatives with certain verbs as DOs. The semi-transitive examples usually involve cognate object verbs, and again are only apparent exceptions.

The verb is active in form, never passive.

The patient is expressed as a simple NP.

The patient may follow the verb as in (11b), or occur after the possessive phrase and before the verb, as in (11a). The latter order is obligatory if the patient is a personal pronoun, and normal for a short NP.

This construction emphasises the actor/agent, which I have shown by the boldface in the translations – hence the name of the construction. It is often most appropriately translated by English cleft constructions: "It was the teacher who woke her" for (11a).

2.2 The Use of the Actor-Emphatic

In the text that follows, the actor-emphatic sentences/clauses are in bold. (The entire text is not glossed, out of consideration for space, but the translation will serve to give a good idea of the sort of context which calls for the actor-emphatic.)

Ko Māui tētahi o ngā tīpuna Māori rongonui. He maha ngā mahi whakamīharo i mahia e ia. **Nāna i here te rā kia āta haere ai. Nāna anō hoki i hī te ika e kīa nei ko Te Ika a Māui.** Ko te ahi i riro mai i a ia i tōna tipuna i a Mahuika.

Nā, ko te Māui nei te tamaiti whakamutunga a Makea-tūtara rāua ko tōna hoa wahine ko Taranga. Tokorima ōna tuākana, ā, kotahi o rātou he wahine. Ka puta a Māui ki waho, kāore tōna whaea i pīrangi ki a ia. Kātahi ka whiua e ia tāna mōkai ki te moana. Kāti, **nā ngā ngaru o te moana ia i whakahoki mai ki uta.** I a ia e takoto ana, ka kitea ia e tōna tipuna, e Tama-nui-ki-te-rangi, ka haria e ia ki tōna whare. **Nāna i whakatipu te tamaiti nei, ā, nāna hoki i ako ki te waiata, ki te haka, ki te whakapapa.**
(Source: Waititi, 1969, 188)

Translation:
Maui is one of the famous Maori ancestors. He did many wonderful things. (More lit.: Very many are the wonderful deeds which were done by him.) ***He* tied up the sun so that it would go slowly. It was also *him* who fished up the fish which is now called Maui's fish.** Fire was fetched by him from his ancestor, Mahuika.
Now, this Maui was the youngest child of Makea-tutara and his wife Taranga. They had five children, and one of them was a female. When Maui arrived in this world, his mother didn't want him. Then her youngest was thrown by her into the sea. **However, *the waves of the sea* returned him to shore.** While he was lying there, he was found by his grandfather, Tama-nui-ki-te-rangi, and was carried by him to his house. **It was *he* who brought up this child, and *he* who taught him to sing, do the haka, and recite genealogies.**

Whenever the actor-emphatic is used, the emphasis is clearly on the actor, and the construction implies intentional involvement on the part of the actor. This is the significance of using the actor-emphatic for 'The waves of the sea returned him to shore' – this did not happen just by accident, but was a deliberate intervention by the sea. The last sentence of paragraph 1 is also instructive: the verb *riro* is not a transitive verb, but a neuter verb (a type of intransitive), and so the actor-emphatic construction was not an option for that sentence.

The actor-emphatic is the normal construction for questioning the Subject of transitive verbs, which reflects this emphasis on the actor, as in (12):

(12) N-ā wai tērā i kī?
ACTUAL-A.POSS who that past say
'Who said that?'

The future A-E can also be used with the force of a command, because it focuses on the actor, e.g. (13):

(13) M-ā-u e horoi ngā rīhi!
IRR-A.POSS-2SG NONPAST wash DEF PL dishes
'**You** are to wash the dishes.'

These uses are clearly related to the semantic characteristics of the construction.

However, it is also used to enable the patient NP to occur in certain constructions it would otherwise be excluded from, and in these contexts the actor is often not in focus. This is particularly true in relative clauses like that in (14). (The relative clause is underlined.)

(14) Ko ēnei ngā pukapuka <u>n-ā-ku i tuhituhi</u>
EQ these DEF PL book ACTUAL-A.POSS-1SG PAST write
'These are the books I wrote.'

The matrix sentence here is an equative sentence, *Ko ēnei ngā pukapuka* 'These are the books'. The relative clause is related to the actor-emphatic sentence in (14a):

(14a) N-ā-ku i tuhituhi ngā pukapuka
ACTUAL-A.POSS-1SG PAST write DEF PL book
'I wrote the books.'

The process of relative-clause formation illustrated here is the one which is normal for Subject relativisation in Māori, and involves simply the deletion of the Subject, with no marking of the consequent gap.

Here, the attention is on the books, rather than on the writer of them, and it is the grammatical relations in the actor-emphatic construction which are responsible for its use here, rather than its semantics.

In order to consider what those grammatical relations are, there are a number of other facts about the actor-emphatic that must be considered.

2.3 Grammatical Relations in the Actor-Emphatic

Three different analyses have been suggested for the actor-emphatic, each specifying different grammatical relations between the constituents. One analysis holds that the grammatical relations are essentially the same as in a standard transitive sentence: actor-emphatic sentences are simple sentences (i.e. they consist of just one clause), the actor is the Subject, and the patient is the DO; the Subject-actor is fronted for emphasis. Both the alternative analyses hold that actor-emphatic sentences are bi-clausal. The second analysis holds that the patient is the Subject of the actor-emphatic, and that the actor is part of a complex predicate which includes the verb constituent. The third analysis holds that the actor is the predicate in a specific ownership sentence, and the Subject of that sentence is a subordinate clause, with the patient NP as the Subject of that subordinate clause.

We will now consider some of the evidence which might support these positions.

2.3.1 Evidence that the patient NP is a Subject in the Actor-Emphatic

(a) The form of the patient NP

The patient NP has the form of a Subject: it is an NP with no preposition. The only other NPs in Māori which are not introduced by prepositions are sentential constructions or de-sentential constructions (e.g. indirect speech functioning as a DO).

(b) The distribution of the determiner *he*

The patient NP may be a *he*-phrase as in (15a):

(15a)	N-ā	Rewi	**he**	pukapuka	i	hari
	ACTUAL-A.POSS	Rewi	INDEF	book	PAST	carry
	'Rewi carried a book.'					

He-phrases are very strongly restricted in their distribution in Māori, a topic which has been well explored in Chung et al, 1995. *He*-phrases cannot occur in the DOs of canonical transitive verbs as in (15b), because *he* cannot follow a preposition in Māori. They do not normally occur in the Subjects of transitive verbs, either, so (15c) is also ungrammatical, though they are common in the Subjects of most intransitives, including passives e.g. (15d) and state intransitive verbs e.g. (15e), and they also occur in the Subjects of some non-verbal sentences e.g. (15f). (15f) is locational, and has the *he*-phrase topicalised, a process which consists of putting it first, before the predicate. (Definite NPs when topicalised are preceded by the preposition *ko*.) Topicalisation in Māori is normal to mark a change of topic, and because indefinites often introduce new topics, they are frequently topicalised:

(15)(b) *Kei te tuhituhi te tangata i **he** pukapuka
PROG write DEF SG man ACC INDEF book
('The man is writing a book.')
(c) *I te horoi **he** tangata i te whare
PASTPROG clean INDEF man ACC DEF SG house
('A man was cleaning the house.')
(d) Ka kite-a e ia **he** pounamu i Arahura
REL TAM see-PASS. AG 3 SG INDEF greenstone at Arahura
'Greenstone was found by him at Arahura.'
(e) E tangi **he** pū i ngā pō katoa
HABIT sound INDEF flute at DEF PL night all
'A flute played every night.'
(f) **He** rua i raro
INDEF hole at. PAST below
'Below [it] was a cavern.'

(c) Topicalisation

The patient NP may be topicalised by being fronted with *ko*, e.g. (16c), though this is rather rare, as it is marked to topicalise the patient and emphasize the actor at the same time. The most basic version is given first as (16a), with the alternative, and more natural word-order in (16b):

(16)(a) N-ā Koro i tarai te waka
ACTUAL-A.POSS Koro PAST shape DEF SG canoe
'**Koro** shaped the canoe.'
(b) N-ā Koro te waka i tarai
ACTUAL-A.POSS Koro DEF SG canoe PAST shape
'**Koro** shaped the canoe.'
(c) Ko te waka n-ā Koro i tarai
TOP DEF SG canoe ACTUAL-A.POSS Koro PAST shape
'The canoe, **Koro** shaped.'

This topicalisation process applies almost exclusively to Subjects in Māori. It applies to all Subjects of both verbal and non-verbal sentences (as in (16d), which is transitive), but not to DOs, so (16e) is ungrammatical. The untopicalised version of (16d) and (16e) is given as (16f) for comparison.

(16)(d) Ko Rewi kei te waha i te pēke kina
TOP Rewi PROG carry on back ACCDEF SG bag sea-egg
'Rewi is carrying the bag of sea-eggs on his back.'
(16)(e) *Ko te pēke kina kei te waha a Rewi
TOP DEF SG bag sea-egg PROG carry on back PERS ART Rewi
('The bag of sea-eggs, Rewi is carrying on his back.')
(16)(f) Kei te waha a Rewi i te pēke kina
PROG carry on back PERS ART Rewi ACC DEF SG bag sea-egg
'Rewi is carrying the bag of sea-eggs on his back.'

The Subjects of subordinate clauses cannot in general be made the topics of the matrix sentence, though they are occasionally topicalised within the subordinate clause. This is an argument against the position that the patient NP is the Subject of a subordinate clause in the actor-emphatic, although the objection may be countered by arguing that the most natural word-order (as in (16b)) involves raising the patient NP out of the subordinate clause into Subject position in the matrix clause, when it would then be eligible for topicalisation in the matrix sentence.

(d) Relativisation strategy

The strategy used to relativise on the patient NP of the actor-emphatic is the strategy used for Subjects, i.e. simple deletion. The construction has already been illustrated in (14). This strategy is ungrammatical for relativising on the DOs of canonical transitive verbs.

(e) Use of the actor-emphatic for relativisation of DOs

The DO of canonical transitive verbs in older Māori could not be relativised on directly (though many younger speakers today extend the strategy for oblique NPs to DOs). The two most common ways to relativise on the patient NP (i.e. the NP which occurs in the DO of an active transitive sentence) are through promotion of the patient to be the Subject of a passive verb, and by use of the actor-emphatic. The most obvious explanation of why the actor-emphatic construction can be used to relativise on patients is that in this construction, the patient is a Subject.

2.3.2 Evidence that the agent phrase is a predicate in the Actor-Emphatic

(a) Negation

Hohepa has argued convincingly that negatives in Māori are constructed with a higher negative verb (Hohepa, 1969). There are three main negative verbs, *kore*, *hore* and *hara*. The first gives emphatic negatives, and we will ignore it here. The other two are each associated with one TAM only, and the TAM + negative verb is normally written as one word, giving the more familiar forms *kāhore* (or *kāore*) and *ēhara*. The positive proposition to be negated is the Subject of these negative verbs. As in other subordinate clauses in Māori, only a sub-set of the TAMs can appear in these Subject clauses: *i, e, e…ana, i te* and *kia*. The Subject of the subordinate clause usually appears immediately following the negative verb. The usual explanation is that it is raised out of the subordinate clause, and is the surface Subject of the negative verb. (While there are occasional textual examples without Subject raising, it is clearly the norm.) To illustrate, consider (17), which is the negative of (5a), repeated here for convenience:

(17)	Kāhore	te	tangata	i te	haere	ki	te	one
	NEG	DEF SG	man	PROG	go	to	DEF SG	beach

‘The man is not going to the beach.’

(5)	(a)	Kei te	haere	te	tangata	ki	te	one
		PROG	go	DEF SG	man	to	DEF SG	beach

‘The man is going to the beach.’

(Note the change of TAM in the subordinate clause from *kei te* to *i te*, and the raising of *te tangata* (which can now be topicalised with *ko*)).

The negator *kāhore* is used for all verbal sentences, and for non-verbal locational sentences. It will be recalled that the latter have tense-marked prepositions, and it seems likely that the proper generalization is that *kāhore* negates all tense-marked sentences.

The negator *ēhara* is used for most non-verbal sentences, notably equational and classifying ones. However, *ēhara* negatives involve further changes to the positive sentence. Consider (18), which is the negative of the equational (7):

(18)	Ēhara	tēnei	i	te	pahi	o	te	kura
	NEG	this	PREP	DEF SG	bus	of	DEF SG	school

‘This is not the school bus.’

(7)	Ko	te	pahi	o	te	kura	tēnei
	PREP	DEF SG	bus	of	DEF SG	school	this

‘This is the school bus.’

The equational predicate preposition *ko* is replaced by the particle *i*. Just which of the several homophonous *i*’s of Māori this *i* is, is open to question, but my best guess is that it is the neutral locative preposition. (18) also has the Subject in second position (i.e. raised to be the Subject of the negative verb), which is normal for Subjects in these negatives.

It is *ēhara* which negates the actor-emphatic, as in the following, where (19a) is the positive (without Subject raising), and (19b) the negative (with an abbreviated positive tacked on):

(19)(a)	N-ā	Mere	i	whaka-pai	te	tēpu
	ACTUAL-A.POSS	Mere	PAST	CAUSE-good	DEF SG	table

‘It was Mere who set the table.’

(b)	Ēhara	n-ā	Mere	i	whaka-pai
	NEG	ACTUAL-A.POSS	Mere	PAST	CAUSE-good
	te	tēpu,	n-ā	Marama	kē
	DEF SG	table	ACTUAL-A.POSS	Marama	CONTR

‘It wasn’t Mere who set the table, it was Marama.’

Notice that this simply embeds the positive actor-emphatic under the negative. This is always the way these negatives are constructed in the future A-E, but some older speakers prefer to use a construction like (18) for the past A-E, as in (19c):

(19)(c)	Ēhara	i	a	Mere	i	whaka-pai	te	tēpu
	NEG	PREP	PERS ART	Mere	PAST	CAUSE-good	DEF SG	table

‘It wasn’t Mere who set the table.’

There are some alternative word-orders for (19)(b): the patient NP (*te tēpu*) can appear between the possessive phrase and the verb: *Ēhara nā Mere te tēpu i whakapai*, or it can appear immediately following the negative: *Ēhara te tēpu nā Mere i whakapai*. Alternative word-orders for (19)(c) are much less well liked, though I suspect that the parallel possibilities would be accepted in appropriate contexts.

If the principle given above governing the choice of negator is correct, this suggests that the predicate in the actor-emphatic is non-verbal. However, it depends on the analysis of the distinction between the *n*- and *m*- morphs of the possessive prepositions (*nā, mā*) as not being a tense distinction. It is difficult to find good evidence for or against this. It is also possible that the generalization about the distribution of the two negators is not correct. (Waite (1990, 404) takes this view, but does not provide any alternative generalization.)

(b) Relativisation of the actor NP

The actor NP can be relativised on. However, this requires the use of a pronoun in the relative clause in place of the relativised NP. To understand the significance of this, it is necessary to know a little more about relativisation strategies in Māori. Māori uses the pronoun strategy for relativisation in the following cases:

(1) It **must** be used for relativising on the predicate of locational sentences (the only other type of predicate NP that can be relativised on)

(2) It **can** be used for (animate) non-predicate oblique NPs, but is not the only possibility (nor even the most common possibility) for those.

Sometimes a deictic particle *(nei, nā, rā)* is used as well as the pronoun in the actor-emphatic. If so, the deictic follows the pronominalised agent NP; in the locational constructions where the predicate is not in doubt, it follows the predicate. If the actor NP is the predicate of the actor-emphatic, one rule will account for the relativisation of both types of sentence.

The normal oblique strategy involves the use of a post-**verbal** particle, which may be *ai* or a deictic. This strategy is not available for non-verbal predicates. While it is clear that *ai*, which can only occur in verb constituents, could not be used to relativise on a non-verbal sentence, that alone cannot account for the ungrammaticality of this strategy for non-verbal predicates, since the deictic particles which are an alternative to *ai* can appear in nominal constituents.

These points are illustrated by the following examples. In all examples, the matrix sentence is an equational sentence.

(20a) shows a relative clause (underlined) on an actor-emphatic actor NP. The unembedded sentence corresponding to the relative clause is given in (20b). The actor (*te tangata*) is replaced by the clitic personal pronoun *–na*, and the deictic particle *nei* is optionally added. (There is no significance to the fact that a special clitic pronoun form is used here – the independent singular personal pronouns cannot be used after possessive prepositions.)

(20)(a)

Ko	tēnei	te	tangata	n-ā-**na**	(**nei**)
EQ	this	DEF SG	man	ACTUAL-A.POSS-3SG	PROX
i	tuhituhi	te	pukapuka	rā	
PAST	write	DEF SG	book	DIST	

'This is the man who wrote that book.'

(b)

N-ā	te	tangata	i	tuhituhi	te
ACTUAL-A.POSS	DEF SG	man	PAST	write	DEF SG
pukapuka	rā				
book	DIST				

'The man wrote that book.'

(21a) is a relative clause on a locational predicate, and (21b) the corresponding unembedded sentence.

(21)(a)

Ko	tēnei	te	whare	kei	**reira**	taku	whaea
EQ	this	DEF SG	house	at.PRES	there	my	mother

'This is the house where my mother is.'

(b) Kei te whare taku whaea
at.PRES DEF SG house my mother
'My mother is at the house.'

The locative pronoun *reira* replaces the locational NP *te whare*. I have no examples of deictic particles following the locational pronoun.

(22a) shows the *ai* strategy for an oblique locative phrase, with the corresponding unembedded sentence in (22b).

(22)(a) Ko tēnei te whare <u>i moe **ai** taku whaea</u>
EQ this DEF SG house PAST sleep PART. my mother
'This is the house where my mother slept,'

(b) I moe taku whaea i roto i te whare
PAST sleep my mother at inside at DEF SG house
'My mother slept in this house.'

In (22a) the entire locational prepositional phrase *i roto i te whare* is deleted (notice that the preposition is not deleted in (20) and (21)), and *ai* is placed following the verb, i.e. not in the position occupied by the oblique phrase.

While it is possible to use the pronoun strategy for an oblique phrase if its head is a human N, it is by no means the normal strategy in such cases.

The fact that the actor phrase of the actor-emphatic uses the pronoun strategy exclusively argues that it is not oblique, and not a Subject, and is compatible with it being a predicate.

(c) Emphatic stress

The actor NP in the actor-emphatic normally has emphatic stress. I have argued elsewhere that this is usually restricted to predicates in Māori (Bauer, 1991). (Other emphatic constructions in Māori encode the emphasized constituent as the predicate.) If my observation about emphatic stress is correct, this is a strong argument for the actor NP being the predicate in the actor-emphatic.

(d) Fronted adverbials

When certain types of adverbials are fronted in Māori, the particle *ai* is usually required after the verb. However, *ai* occurs only with verbs (i.e. not with nominal predicates), and so is not used if the main predicate is non-verbal. When such an adverbial occurs before an actor-emphatic sentence, no *ai* appears. That is an argument that the actor-emphatic involves a non-verbal predicate. (23a) shows an *ai*-introducing adverbial before an actor-emphatic sentence. (23b) shows it before a standard verbal sentence, and the expected *ai* appears after the verb. (23c) shows it before a locational predicate (a non-verbal sentence type) – with no *ai*.

(23)(a) Kia tae mai ia, m-ā-ku e
SUBJ arrive hither 3SG IRR-A.POSS-1SG NONPAST
whaka-atu (***ai)** te reta ki a ia
CAUSE-away PART. DEF SG letter to PERS ART 3SG
'When she arrives, **I** will show her the letter.'

(b)

Kia	tae	mai	ia	ka	whaka-atu			
SUBJ	arrive	hither	3SG	NONPAST	CAUSE-away			
ai	ahau	i	te	reta	ki	a	ia	
PART.	ISG	ACC	DEF SG	letter	to	PERS ART	3SG	

'When she arrives, I will show her the letter.'

(c)

Kia	tae	mai	ia	hei	te	marae
SUBJ	arrive	hither	3SG	at.FUT	DEF SG	marae
(***ai)**	ahau					
PART.	DEF SG					

'When she arrives, I will be at the marae.'

Thus the actor-emphatic behaves like sentences with non-verbal predicates rather than sentences with verbal predicates.

2.3.3 Evidence that the actor-emphatic involves a subordinate clause

The evidence for this is not very strong, and this is part of the problem.

(a) TAMs

The TAMs of Māori fall into two groups – those that can be used readily in subordinate clauses (those are the ones that appear in negative sentences), and those that are extremely restricted in subordinate clauses: *ka, kua, kei te*. In Modern Māori, *e* is used primarily (but not exclusively) in subordinate clauses. *I* is common in both matrix and subordinate clauses. The TAMs in the actor-emphatic are are thus compatible with the subordinate clause analysis, but do not exclude the single-clause analysis.

(b) Parallels with the negative

The parallels between the negative construction and the actor-emphatic construction suggest that a parallel analysis would be nice. In particular, the normality of Subject raising makes a subordinate clause analysis plausible. However, this word-order might also be accounted for by the normal rule which places the Subject in second position in Māori.

3 Recapitulation

Here are the three analyses that have been proposed.

1. The agent NP is a non-verbal predicate, the rest a (mutilated) Subject clause, as in Fig 1. This type of analysis is espoused by Chung (1978, 175ff), and Bauer (1997, 501ff).
2. The TAM+V is the predicate; the sentence is verbal; the agent is oblique; see Fig 2. This analysis is espoused by Waite (1990).
3. The actor-NP + TAM + V is predicate, the patient is Subject, as in Fig 3. This analysis is espoused by Clark (1976, 111ff) and Harlow (1986).

Figure 1: The possessive predicate with subordinate clause as Subject analysis

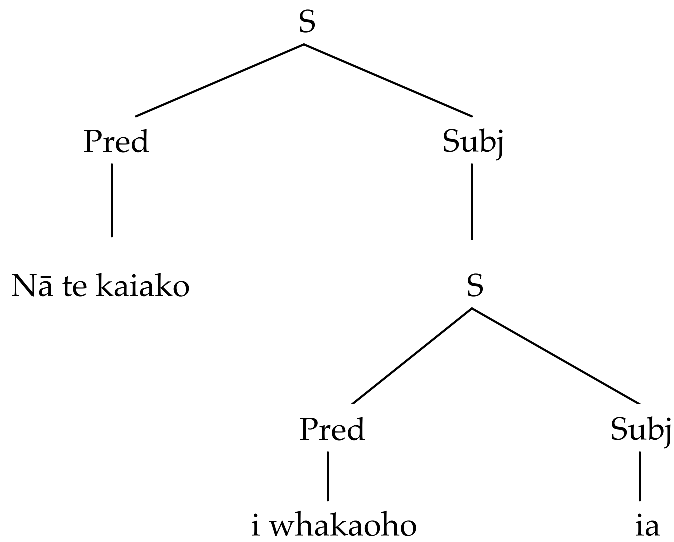


Figure 2: The single-clause analysis

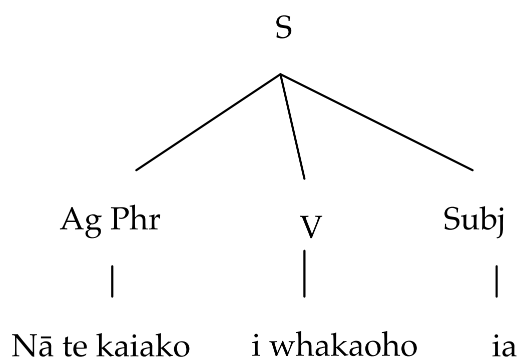
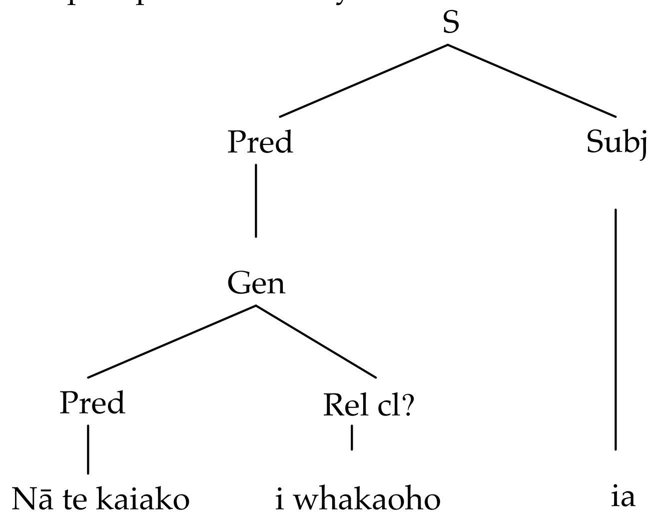


Figure 3: The complex predicate analysis



3.1 The problems with these analyses

If the actor (possessive) NP is the predicate, and the tensed verb + patient NP is an embedded sentence (analysis 1), then there is no particularly well-motivated explanation for the fact that the patient NP is not an accusative-marked phrase (marked with the preposition *i*). (Alternatively, there is no motivation for the fact that the verb is not passive, which would take a patient as Subject.) One possible explanation might lie in the ergative structures of Proto Polynesian: perhaps this is some remnant of the former ergative syntax still found in Western Polynesian languages like Samoan. Alternatively, perhaps the rule for assigning case in Māori simply says 'If the clause has just one NP, make it a plain NP'. The fact that the patient NP in the actor-emphatic can have the indefinite determiner *he* argues that the verb is intransitive. Unfortunately, there is nothing to suggest that this rule operates elsewhere in Māori. This analysis has to involve Subject raising (of the patient NP) to account for topicalisation with *ko*, which could not otherwise be topicalised from within a subordinate clause.

The problem about the form of the patient NP is best explained by the third analysis in which the complex of agent-NP + TAM + V is the predicate, because in that analysis, the patient NP is the Subject, and thus its form is the regular and expected one. However, neither proponent of this analysis has put forward a plausible analysis of their proposed predicate.

The simple-sentence analysis also faces the problem of the form of the verb/ patient NP: if the actor-phrase is an oblique phrase, then it might be expected that the changed status of the NPs would be marked by some change in the verb, as it is in the Māori passive. The evidence adduced that the possessive NP is a predicate is counter-evidence to this analysis.

Thus none of these analyses offers an entirely satisfactory analysis of this construction.

4 Postscript

In addition to the clear-cut actor-emphatic sentences illustrated above, there is a large range of sentences which seem to form a continuum between the actor-emphatic and sentences like (6b) and (6c). This data is illustrated at length in Bauer (1997, 507ff). Here I will merely raise the possibility that (6b) might simply involve the fronting of an adverbial, while (6c) might involve the embedding of a clause as the Subject of a possessive predicate, in a manner akin to the first analysis of the actor-emphatic. Tantalised? That was the purpose of my paper.

Abbreviations

A	A-category possessive
ACC	accusative preposition (DO preposition)
A-E	actor-emphatic
AG	agent preposition (in passive)
CL	classifying predicate marker; clause
CONTR	particle marking information contrary to expectations
DEF	definite
DIST	distant
DO	direct object
EQ	equational predicate preposition
FUT	future
GEN	genitive
HABIT	habitual
INDEF	indefinite
IRR	irrealis
NEG	negative verb
NEUT	neutral
NP	noun phrase
O	O-category possessive
PART.	particle
PASS.	passive suffix
PERF	perfect
PERS ART	personal article
PHR	phrase
PL	plural
POSS	possessive
PRED	predicate
PREP	preposition
PRES	present
PROG	progressive
PROX	proximate
REL	relative (clause, tense marker)
S	sentence
SG	singular

SUBJ	subjunctive; subject (in tree diagrams)
TAM	tense, aspect, mood marker
TOP	topicalising preposition
V	verb
VP	verb phrase
VSO	verb-subject-object constituent order
X- … -X	discontinuous X
1,2,3	first, second, third person

References

Bauer, W.A. (1991) 'Māori *ko* again' *Te Reo*, 34, 3-14

Bauer, W.A. (1993) *Maori,* Descriptive Grammar Series, Routledge, London

Bauer, W.A. (1997) *The Reed Reference Grammar of Māori*, Reed Publishing, Auckland

Chung, S. (1978) *Case Marking and Grammatical Relations in Polynesian*, University of Texas Press, Austin and London

Chung, S., T. H. Mason & J. W. Milroy (1995) 'On Maori *he* and the Uses of Indefinites' *Journal of the Polynesian Society*, 104, 429–459

Clark, R. (1976) *Aspects of Proto-Polynesian Syntax, Te Reo Monograph*, Linguistic Society of New Zealand, Auckland

Harlow, R.B. (1986) 'The Actor-Emphatic construction of the Eastern Polynesian languages' in Geraghty, P., L. Carrington, S.A. Wurm (eds) (1986) *FOCAL 1: Papers from the Fourth International Conference on Austronesian Linguistics. Pacific Linguistics*, Series C No 93, ANU, Canberra

Hohepa, P.W. (1969a) '*Not* in English and *kore* and *eehara* in Maori' *Te Reo*, 12, 1–34

Waite, J. (1990) 'Another look at the Actor-emphatic' *Journal of the Polynesian Society*, 99, 395–413

Waititi, H. R. (1969) *Te Rangatahi, Vol 2*, A.R. Shearer, Government Printer, Wellington

ARGUMENT ORDER ALTERNATIONS IN DUTCH

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Abstract

We investigate the factors that influence argument order variations in Dutch, focusing on ditransitive verbs. Evidence from grammaticality judgments is complemented with evidence from the distributions of the alternants in corpora of spoken and written Dutch. We find that while the NP/PP alternation is influenced by weight, the direct object shift (DOS) in the dative alternation is bound to certain types of pronouns. Additional evidence for our account for the DOS is found in the Dutch AcI construction. Our findings are modeled within the framework of Optimality Theoretic syntax, allowing for violable and ranked constraints, as well as a stochastic interpretation of the analysis.

1 Introduction

Even a relatively fixed word-order language like Dutch allows for some word order variation. The scrambling data discussed in for example de Hoop (2003) are a well known example. In addition to the variable placement of objects with respect to adverbial phrases, Dutch permits some variation in the relative order of verb arguments. The examples (1)-(2) illustrate two of these argument order alternations.

(1) Ditransitive Verbs

a. Jo gaf de student een boek.
   Jo gave the student a book

b. Jo gaf een boek aan de student.
   Jo gave a book to the student

(2) Accustivus cum Infinitivo

a. Jo zag de student een boek lezen.
   Jo saw the student a book read

b. Jo zag het de student lezen.
   Jo saw it the student read

In this paper we try to answer the question which factors determine the choice of one argument ordering over the other and how we can capture the influence of those factors in a grammar model. We will take the ditransitive construction in (1) as our explanatory example, and turn to the AcI construction in (2) for additional evidence.

We try to identify the most important influences on word order by looking at the distribution of the various alternants in corpora of spoken and written Dutch. Not only does this provide us with real world data, but it also gives us information about the frequency of a particular realization, and the context in which an alternant most often occurs. We thus find that some relevant distinctions are (near) categorical, while others only give rise to preferences for one of the alternants. We model our findings in the framework of Optimality Theoretic (OT) syntax

The rest of this paper is structured as follows. We introduce the Dutch ditransitive constructions in section 2, as well as the differences between the Dutch and the English construction. Section 3 discusses the influences of several (morpho-syntactic) features on the dative alternation, based on the results of our corpus study. In this section we also introduce the constraints that are employed to formalize these results in the OT syntax framework. We provide some additional evidence for an important part of our analysis based on the Accusativus cum Infinitivo (AcI) construction in section 4. Finally, we present our conclusions and discuss some open ends in 5.

2 The dative alternation in Dutch

2.1 Differences between Dutch and English

The dative alternation is by no means specific to Dutch. Much work has been done on the dative alternation in English, illustrated in (3) (Pinker, 1989; Levin, 1993; Krifka, 2001; Bresnan and Nikitina, 2003, for example).

(3) a. Jo gave the student the book
b. Jo gave the book to the student

In Dutch, the alternation is more complex, though. In addition to the regular double object construction and the dative PP construction ((1-a) and (1-b), repeated here as (4-a) and (4-b)), we have two more variants: both the double object construction and the PP construction occur with non-canonical word orders. In (4-c) we find the direct object shifted in fronted of the indirect object. In (4-d) we see that the 'dative' PP is shifted and precedes the direct object. Both variations violate the canonical argument order SUBJ<OBJ2<OBJ1<OBL,XCOMP for Dutch.[1]

The Direct Object Shift (DOS) differs from object shift in Scandinavian languages in that only the direct object shifts, and the shift is independent of the position of the verb: it occurs both in V2 main clauses and verb final subordinate clauses. DOS differs from Wackernagel movement in German in that it does not allow 'movement' of OBJ2 and it does not allow movement over the subject.

(4) a. Jo gaf de student een boek.
Jo gave the student a book

b. Jo gaf een boek aan de student.
Jo gave a book to the student

c. Jo gaf het de student.
Jo gave it the student

d. Jo vroeg aan de student het antwoord op de vraag wanneer WOII eindigde.
Jo asked to the student the answer to the question when WWII ended

[1]Throughout this paper, we will use both 'indirect object' and OBJ2 to refer to the grammatical role to which the recipient argument is mapped, contrary to much work in Lexical Mapping Theory on English, where the recipient is assumed to map to OBJ1. There is reason to assume that English and Dutch differ in this respect, e.g. Dutch does not allow the recipient to be mapped onto the subject function in passive sentences and does allow passive sentences with theme subjects and recipient objects.

The existence of the non-canonical variants in Dutch teases apart two distinctions that are merged together in the English situation: where English has two variants which differ with respect to both the syntactic category and the order of the arguments, Dutch has both an alternation between NP and PP recipients and argument order variations, resulting in a total of four different realizations.

2.2 Previous approaches

Analyses of the dative alternation in English have employed both the difference in ordering and the difference in grammatical role. General alignment principles have been applied to explain the distribution of the dative alternation. For example, although the double NP construction is generally favored, heavy recipients may be realized as (right-aligned) PPs in order to avoid a violation of the general principle on word order that says that heavy constituent align right. On the other hand we find analyses of the dative alternation that focus on the NP/PP alternation specifically, arguing that the two constructions have a different semantics or are selected by different lexical items.

Representatives of the first class are Behaghel (1909/10), Wasow (1997) and Arnold et al. (2000), among many others. They all argued that long and complex phrases tend to occur at the right edge of a clause. Gundel (1988) and Prince (1992) showed that the same holds for new information: it prefers the right edge, following the old, topic information. In addition, Arnold et al. (2000) showed that although weight and givenness are not independent of each other, they do have distinct effects on word order.

The main representative of the first class in German linguistics is Uszkoreit (1987). He identified several word order principles for German, e.g. the unmarked word order is SUBJ<IOBJ<DOBJ, personal pronouns precede other NPs, definite NPs precede non-definite NPs and light constituents precede heavy constituents. These principles are rephrased for Dutch as the Inherence Principle (canonical word order), the Left-Right Principle (constituents that are rich in information align right) and the Complexity Principle (heavy constituents align right) (Haeseryn and others, 1997).

The second class has focused more specifically on the NP/PP alternation. For example, Krifka (2001) and Pinker (1989) have tried to identify distinct meanings for the two realizations of ditransitive verbs. According to this line of explanation, there is no dative alternation proper: the double object construction and the PP construction are not alternative ways of expressing the same meaning, but they are expressions of different meanings. Bresnan and Nikitina (2003) provide examples of alternating dative syntax in contexts of repetition, which form a challenge for this approach.

Others have tried to classify verbs into classes that select for one construction or the other (Levin, 1993). Although statistically significant differences in the frequencies of certain verbs occurring with the two constructions exist (see Lapata (1999) for corpus methods to test the empirical value of the semantic verb classes described by Levin (1993)), Bresnan and Nikitina (2003) convincingly showed that these are mere tendencies, indicating improbability, rather than categorical differences.

Finally, Bresnan and Nikitina (2003) argued that it is the recipient argument that puts constraints on the grammatical role that it is mapped to. They claimed that local person NPs should be realized as objects, not obliques. Therefore, local recipients will lead to double object constructions instead of dative PP constructions.

In Dutch, one might expect to find a differentiation between NP vs. PP recipients on the one hand and canonical vs. non-canonical argument order on the other hand, where construction specific constraints determine the grammatical role of the recipient argument, and general alignment constraints determine the order of the arguments.

The next section discusses some corpus data that show that the predicted differentiation between construction specific constraints and general alignment constraints is not borne out. Instead we find that both the grammatical function of the recipient and the order of the arguments are influenced by constraints that apply to other constructions as well. As we will see, the direct object shift in ditransitive constructions as well as AcI constructions is triggered by certain types of (direct) object pronouns and weight influences both the NP/PP alternation and word order in the dative PP construction. The analysis presented below does leave open the possibility to incorporate lexically encoded preferences of verbs for one construction or the other.

3 Distribution of the alternants: a corpus study

3.1 Preliminaries

Corpora contain valuable information about the distribution of different realizations of the dative construction. A potential problem is that the various alternants are specific and complex syntactic structures, which cannot be retrieved from corpora on the basis of simple pattern recognition. Therefore, we used syntactically annotated and automatically parsed data in our corpus study. Both annotated corpora, the annotated part of the Corpus of Spoken Dutch (CGN, about 1M words (Levelt, 1998)) and the Alpino Treebank (the annotated cdbl newspaper part of the Eindhoven Corpus, about 150K words (van der Beek et al., 2002)) are annotated with dependency structures (Moortgat, Schuurman, and van der Wouden, 2001).

When the annotated corpora proved too small for statistically relevant results, we used a corpus of about 75M words of newspaper text (CLEF) that was automatically parsed by the Alpino parser (Bouma, van Noord, and Malouf, 2001; van der Beek, Bouma, and van Noord, 2002). Alpino outputs the same dependency structures as those used in the annotated corpora. In particular, data sparseness occured when looking for pronouns in double object construction. With a 85.5% parsing accuracy (measured over the dependency relations), the quality of the annotation in the automatically parsed corpus is lower than the manually annotated corpora. The handwritten Alpino grammar overgenerates, always allowing both the canonical and the shifted word order in double object constructions. The resulting OBJ1/OBJ2 ambiguity is resolved by a Maximum Entropy disambiguation model. Although the data will some contain parse errors and there is always a chance that the disambiguation system does not pick up on a certain phenomenon, manual inspection of (samples of) the data did not show signs of systematic errors.

The corpora were queried using DT_SEARCH (Bouma and Kloosterman, 2002), a tool which allows us to query the treebank on dependency relations, syntactic category and linear order.

	NP $NP_{unshift}$	NP NP_{shift}	NP PP	PP NP	TOTAL
CGN	226	33	63	8	334
Alpino	122	7	43	10	182

Table 1: Distribution of the three alternants of the dative alternation in Dutch

We excluded from our search all instances of (in)direct object topicalization, all (wh)relativizer direct and indirect objects and all clausal objects such as that-clauses because in these sentences, the order of the arguments is determined by other factors. Also excluded were passive sentences and instances of the *krijgen*-passive (the 'get-passive'). The motivation for this is that the direct object (in the regular passive) or the indirect object (in the *krijgen*-passive) surfaces as the subject of the matrix clause, therefore the word order for subjects applies here. Finally, we excluded all instances of 'split' dative PPs. In these sentences, illustrated in examples (5), the recipient argument is third person, inanimate and singular and realized as a pronoun inside a PP. In these cases, a so-called R-pronouns (*er, daar, hier* (there, here)) is used instead of the regular third person neuter singular *het* (it) and this pronoun is often fronted. The preposition stays in position, resulting in a split PP. The alignment of *er* is a characteristic of R-pronouns, not a characteristic of the dative construction.

(5) Ik geef daar geen les aan.
I give there no class to
I won't teach those.

3.2 The general distribution

The four alternants are not represented equally in the corpus. In table 1, the distribution of the different realizations is given . As expected, the canonical argument orders (NP $NP_{unshift}$ and NP PP) are much more frequent than the non-canonical variants. Furthermore, the double object construction is much more frequent than the PP construction. This corresponds to the idea that the PP construction is somehow marked.

In an Optimality Theoretic Syntax framework we can model the canonical word order by the f-precedence[2] constraint CANON ((6)). The preference for the double object construction is modeled by the markedness constraint *STRUCT, familiar from Bresnan and Nikitina (2003).

(6) CANON: SUBJ$<_f$ OBJ2$<_f$ OBJ1$<_f$ OBL

*STRUCT: avoid syntactic structure, here: PP.

[2]For two f-structures f_1 and f_2, $F_1 f{-}precedes f_2$ if and only if all the nodes that map onto f_1 c-precede all the nodes that map onto f_2 (Zaenen and Kaplan, 1995).

	NP $NP_{unshift}$	NP NP_{shift}	NP PP	PP NP	TOTAL
CGN	143	33	57	3	247
Alpino	45	6	21	3	83

Table 2: Distribution of dative alternation realizations with one word themes.

3.3 Direct Object Shift

This distribution changes drastically if we control for weight by restricting the object to one lexical item only (we do allow additional function words such as determiners). While the numbers for the shifted double object construction hardly change, the numbers for the unshifted and PP variants drop by 10-70%. This is caused by the fact that DOS almost exclusively occurs with direct object pronouns.

We did in fact find one example in which a full NP shifted (7), but here we find the archaic dative marking on the indirect object. We assume that it is this overt dative marking that makes available the freer word-order and that DOS is generally restricted to pronouns. [3]

(7) [daar] heeft Paul Badura-Skoda het nieuwe pianoconcert van Frank Martin
there has Paul Badura-Skoda the new piano_concert of Frank Martin
den muzikale volke voorgesteld.
the_{dat} $musical_{dat}$ $people_{dat}$ presented
there, Paul Badura-Skoda presented the Frank Martin's new piano concert to the musical people.

It is not the case that all direct object pronouns always shift. While the pronoun *het* (it) usually shifts irrespectively of the category of the indirect object, most other personal pronouns and the demonstratives shift if the indirect object is a full NP, but stay in their canonical position if the indirect object is a personal pronoun (8-a). First and second person pronouns do not shift. Made up examples of local pronoun DOS lead to ungrammaticality under the intended reading (in (9), the sentence is grammatical under the reading without DOS, i.e. the reading with a recipient *jou* (you)).

(8) a. De student geeft dat de student.
the student gives that the student
The student gives that to the student.
b. De student geeft hem dat.
the student gives him that
The student gives that to him.

[3]However, Zwart (1997) presents examples that show that NP-DOS with definite NPs is not impossible:

(i) dat Jan het boek Marie terug gegeven heeft.
that Jan the book Marie back given has
that Jan gave the book back to Marie.

No examples of this kind were found in the corpus. We suspect the exceptional definite NP shift to be a focus effect and leave this and other effects of focus on word order for future research.

Shifted		Canonical	
542	het (it)	372	dat (that)
45	dat (that)	83	dit (this)
21	't (it$_{reduced}$)	51	het (it)
19	ze (them)	28	die (that)
7	dit (this)	24	hem (him/it)
4	u[4](you$_{honorific}$)	14	zich (himself/herself)
4	hem (him/it)	8	hetzelfde (it_same)
4	die (that)	4	me (me)

Table 3: Direct object pronouns in constructions with two pronominal objects

c. De student geeft het hem.
the student gives it him
The student gives it to him.

(9) a. De student wijst 'm de student aan.
the student points him the student at
The student points him out to the student.

b. %De student wijst jou de student aan.
the student points jou the student at
The student points you out to the student.

Table 3 shows the most frequents direct object pronouns in double object constructions where both arguments are pronominal. The data are based on the automatically parsed CLEF corpus. The frequency lists confirm the intuition that *het* shifts while demonstratives usually do not shift in front of another pronoun. Importantly, the table shows that the distinctions are not categorical: we do find *het* (it) in the canonical object position, although ten times less frequently than in the shifted position. The one place where we would not expect any variation is with the local pronouns, as even made up examples were ungrammatical. Nevertheless, we do find four occurrences of *u* (you$_{honorific}$). Further inspection showed that these are the result of parse errors.

We conclude from the examples and the corpus data that pronouns prefer to align left. Furthermore, this tendency is stronger for *het* than for personal pronouns and demonstrative pronouns. A similar differentiation among the pronouns is found in German with respect to Wackernagel movement (Müller, 2001).

We model these restrictions with the constraints PRO$_{it}$-L and PRO-L, stating that *het* and other pronouns should align left (10) in the clause. The constraints are in competition with the constraint on canonical word order: only subject pronouns can simultaneously satisfy PRO-L and CANON. Although each constituent that separates the pronoun from the left edge of the clause incurs one violation, the tableaux show only the crucial violations.

A local constraint conjunction (Smolensky, 1995) of the constraint on canonical word

[4] All occurrences of the local pronoun *u* result from parse errors.

Input: *gives*(<SUBJ><OBJ1><OBJ2>)			*STRUC	*LOL	PRO$_{it}$-L	PRO-L	CANON
OBJ1='the book'	☞	NP NP$_{unshift}$					
OBJ2='de student'		NP NP$_{shift}$					*!
		NP PP	*!				
ex.(4-a)		PP NP	*!				*
OBJ1='it'		NP NP$_{unshift}$			*!	*	
OBJ2='de student'	☞	NP NP$_{shift}$					*
		NP PP	*!				
ex.(4-c)		PP NP	*!		*	*	*
OBJ1='it'		NP NP$_{unshift}$			*!	*	
OBJ2='him'	☞	NP NP$_{shift}$				*	*
		NP PP	*!			*	
ex.(8-c)		PP NP	*!		*	*	*
OBJ1='that'		NP NP$_{unshift}$				*!	
OBJ2='the student'	☞	NP NP$_{shift}$					*
		NP PP	*!				
ex.(8-a)		PP NP	*!			*	*
OBJ1='that'	☞	NP NP$_{unshift}$				*	
OBJ2='him'		NP NP$_{shift}$				*	*!
		NP PP	*!			*	
ex.(8-b)		PP NP	*!			*	*
OBJ1='you'	☞	NP NP$_{unshift}$				*	
OBJ2='the student'		NP NP$_{shift}$		*!			*
		NP PP	*!				
ex.(9-b)		PP NP	*!			*	*

Table 4: Shifted vs. canonical double object constructions

order and the constraint on local objects (Aissen, 2003) models the fact that local objects do not shift. This constraint conjunction is a formalization of the intuition that local direct objects are an instance of 'the worst of the worst' (Lee, 2003): a combination of a marked category and a marked word order.

(10) PRO$_{it}$-L: the pronoun *het* (it) aligns left.

PRO-L: personal and demonstrative pronouns align left.

*LOCAL OBJECT LEFT (LOL): CANON&*OBJ1$_{local}$

Table 4 shows how the constraints interact to account for various example sentences. Pronominal direct objects will shift if the indirect object is a full NP, in order to avoid a violation of the constraint on the alignment of pronouns, which is higher ranked than CANON. If both objects are pronominal (but not *het* or local), CANON is the highest ranked constraint that is violated by one argument order but not the other and thus determines the optimal candidate: OBJ2 precedes OBJ1. *Het*, on the other hand, will always shift, because a violation of PRO_{it}-L is worse than any other right aligned pronoun or a non-canonical word order. All alignment constraints are outranked by LOL, preventing local pronouns from shifting.

Our findings contradict the claim in Zwart (1996) that only reduced direct object pronouns can shift: the demonstratives were among the most frequently shifted pronouns and we also found non-reduced examples of third person pronouns. We do see a tendency, though, of the reduced pronouns *'m* (him, it) and *ze* (them) to group with *het* if the antecedent is inanimate. In this case, they tend to shift, even if the indirect object is a pronoun. We do not have enough data for a quantitative evaluation of this intuition, but integration of it in our model is straightforward if it proves correct.

Data sparseness also prevented further research into the relative ordering of two animate personal pronoun objects. In our model, the animate personal pronouns form one homogenous group. If both objects are from the same group, canonical word order is always predicted to be more optimal. In both annotated corpora, no sentences were found with two objects consisting of pronouns referring to humans. The unannotated part of the CGN corpus (9M words) was parsed to obtain more spoken language data. In this corpus and the 75M word automatically parsed CLEF corpus together, we found only three sentences, two of which were canonical and one of which was an instance of DOS. This lack of data is due to the fact that animate direct objects are marked and thus generally sparse. This tendency is even stronger in ditransitive sentences: even when we included all ditransitive sentences, with pronominal and with full NP indirect objects, we found no animate direct objects in either CGN or the Alpino Treebank. The situation is further complicated by the fact that people hesitate and disagree about their grammaticality judgments for this type of sentence. We leave this issue for future research.

In this model, the DOS is driven by the syntactic category of the objects: NPs, personal or demonstrative pronouns or *het*. Pronominality is not independent of syntactic weight: pronouns are the lightest possible NPs. Thus, the pronominal DOS is in line with the Complexity Principle and Uszkoreit's weight principle. But we did not differentiate between heavy NP recipients and light NP recipients, although the weight principles would predict the former to allow DOS more easily than the latter. Table 5 lists the average weight (in number of words) of the direct and indirect object in all four variants of the dative alternation, as well as the OBJ1/OBJ2 weight ratios. We see that the average weight of the indirect object in shifted double NP constructions (1.09 and 1.71) is *lower* than in the canonical double object construction (1.40 and 2.43), contrary to what the Complexity Principle would predict. We assume syntactic weight not to be of influence on the DOS.

3.4 The NP/PP alternation

Although syntactic weight does not have a direct effect on DOS, it does seem to influence the NP/PP alternation. The effect is not very clear if we look at the ratios of

			OBJ1	OBJ2	OBJ1/OBJ2
CGN	NP $NP_{unshift}$	(N=231)	3.75	1.40	2.68
Alpino	NP $NP_{unshift}$	(N=123)	5.87	2.43	2.42
CGN	NP NP_{shift}	(N=33)	1.03	1.09	0.94
Alpino	NP NP_{shift}	(N=7)	1.71	1.71	1.00
CGN	NP PP	(N=63)	1.62	2.57	0.63
Alpino	NP PP	(N=43)	3.70	5.21	0.71
CGN	PP NP	(N=8)	5.63	1.63	3.45
Alpino	PP NP	(N=10)	4.80	3.30	1.45

Table 5: Average weight per grammatical role in number of words.

		Weight
NP $NP_{unshift}$	(N=126)	3.02
NP NP_{shift}	(N=9)	1.89
NP PP	(N=55)	5.00
PP NP	(N=17)	3.71

Table 6: Average weight of non-pronominal indirect objects

the direct and indirect objects weight in table 5, but this ratio is distorted by the light, pronominal direct objects in the DOS. If we only look at the indirect objects, we see that the recipient arguments that are realized in PPs are much heavier than those that are realized as NPs.

This difference in weight may be a result of a constraint blocking pronominal recipients in a PP. This would increase the average weight of the PP variant in the same way the pronouns in the DOS lower the average object weight. We therefore looked at the average weight (in number of words, in both corpora together) of the indirect objects in the various ditransitive constructions excluding all pronominal recipients. The results are listed in table 6. Although the numbers are too small for drawing definite conclusions, we see that the PP recipients in the corpus are still heavier than their NP counterparts. We conclude that heavy recipient arguments prefer realization as a PP, even though obliques are generally more marked than objects.

Note also that in the Alpino Treebank, which consists of written language, the constituents are on average heavier than in CGN, which is a corpus of spoken Dutch. At the same time, the proportion of PP constructions is larger: 53 PPs and 130 NPs in the Alpino Treebank, versus 71 PPs and 264 NPs in CGN.

The question is what triggers the non-canonical dative PP construction which has both the marked grammatical function and the marked order. Looking at table 5 we see that the direct objects in the shifted canonical constructions are heavier than the direct objects in both construction where OBJ1 precedes OBJ2. This indicates another instance of the Complexity Principle, that states that heavy constituents align right. If the indirect object is realized as a PP (either because of its weight or because of other factors, which we will discuss in 3.5), this results in the non-canonical dative PP

Input: example (12-a)		HEAVY-PP	*STRUC	*LOL	PRO_{it}-L	PRO-L	HEAVY-R	CANON
	NP $NP_{unshift}$	*!					*	
	NP NP_{shift}	*!						
☞	NP PP		*					
	PP NP		*				*!	

Table 7: Optimization for ditransitives with heavy recipients

construction as in example (12-b).

To model both effects of weight, two constraints are introduced: HEAVY-PP and HEAVY-R. HEAVY-PP is violated by heavy recipients that are realized as NPs in a double object construction. In an implementation of this model, one would have to set a critical value, which indicates how many words a light NP may maximally have. Alternatively, one could envisage a stochastic OT syntax model that allows for cumulativity effects (Jäger and Rosenbach, 2003). In such a model, the heavier a recipient argument, the higher the probability that it is realized as an oblique argument.

HEAVY-R is the constraint that makes possible the shifted PP construction by saying heavy constituents should align right. However, the PP recipients are usually heavy, too. This means that both the canonical ordering and the shifted PP construction would violate this constraint once, in which case the canonical word order is optimal. This problem is circumvented by defining HEAVY-R in such a way that it applies to the heaviest argument only, or by having heavier constraints violate the constraint more often.

(11) HEAVY-R: heavy constituents align right.

HEAVY-PP: heavy recipient arguments are realized as obliques

(12) a. Ik vraag het aan iemand die in de Vlaamse Beweging actief is.
I ask it to someone who in the Flemish Movement active is
I will ask it to someone who is active in the Flemish Movement.

b. Niemand kan aan de Westduitse bondskanselier de heen- en terugreis voorschrijven.
nobody can to the West German president the to and from_journey prescribe
Nobody can prescribe both ways of the journey to the West German chancellor.

We have seen how the Inherence Principle and the Complexity Principle (or canonical word order and syntactic weight) influence the dative alternation in Dutch. The third principle assumed to have an influence on word order is the Left-Right Principle that states that constituents that are rich in (new) information follow constituents that carry

Input: example (12-b)	HEAVY-PP	*STRUC	*LOL	PRO$_{it}$-L	PRO-L	HEAVY-R	CANON
NP NP$_{unshift}$	*!						
NP NP$_{shift}$	*!					*	*
NP PP		*				*!	
☞ PP NP		*					*

Table 8: Optimization for ditransitives with both heavy recipients and heavy themes

			OBJ1	OBJ2	OBJ1/OBJ2
CGN	NP NP$_{unshift}$	(N=231)	40	163	0.25
Alpino	NP NP$_{unshift}$	(N=123)	2	32	0.06
CGN	NP NP$_{shift}$	(N=33)	32	27	1.19
Alpino	NP NP$_{shift}$	(N=7)	6	2	3.00
CGN	NP PP	(N=63)	30	13	2.31
Alpino	NP PP	(N=43)	4	1	4.00
CGN	PP NP	(N=13)	0	3	0.00
Alpino	PP NP	(N=10)	0	0	-

Table 9: Number of pronominal (in)direct objects

less new information. As (personal and demonstrative) pronouns are by definition given and indefinite NPs are by definition new, Uszkoreit's principles 'pronouns before full NPs' and 'definite NPs before indefinite NPs' both fall under the Left-Right Principle.

A first influence of the pronoun principle was seen in our account of the DOS, which is restricted to (certain types of) pronouns and can be modeled by constraints that are violated if pronouns are not aligned left. The question is whether there are similar alignment constraints on pronouns in the dative PP construction. Although table 9, listing the number of pronouns per grammatical function in the four alternants, shows the expected pattern of pronouns preferring the first argument position over the second argument position, it is hard to find evidence for *independent* influence of pronominality on the NP/PP alternation in Dutch. After all, pronouns are extremely light NPs, which are not expected to show up as PPs anyway because they do not fall under the scope of the HEAVY-PP constraint. Note that table 9 does not list any instances of third person singular inanimate pronouns in the PP alternant, because these are realized as R-pronouns, which we excluded from our search. In CGN, 6 R-pronoun obliques were found, in Alpino 1.

More reliable evidence of a Left-Right Principle effect may be expected from the definite/indefinite distinction. A first attempt at the identification of a definiteness effect was made by counting the number of direct and indirect objects with the indefinite article *een* (a) and those with the definite article *de* (the). For both corpora together, we find a 1.68 indefinite/definite ratio (84/50) for the direct object and a 0.10 ratio (6/58) for the indirect object in the (unshifted) double object construction. For the (unshifted) PP construction, we find 1.38 (18/13) for the direct object and 0.09 (3/32) for the indirect object.These numbers do not differ significantly (p=0.05), but further research should be carried out to confirm and explain these preliminary results.

3.5 More factors in the dative alternation

We have discussed the influences of canonical word order, pronominality, weight and definiteness on the dative alternation in Dutch and we have identified several constraints on this alternation. We have no doubt that there are many more factors that co-determine which alternant is realized. First of all, we excluded various constructions from our research for the very reason that they would introduce other constraints that would interfere with the constraints on the dative alternation proper, such as the passive constructions and constructions with R-pronouns.

Secondly, we ignored lexical preferences. Bresnan and Nikitina (2003) showed that many verbs that were thought to categorically select for the NP or the PP construction, do in fact alternate. Nevertheless many verbs do show preferences for one realization over the other. In Dutch, the verb *verhuren* (to let) has a preference for the PP construction, while for example *aanwijzen* has a preference for the double object construction.[5]

Bresnan and Nikitina (2003) argued that the person feature influences the dative alternation in English through the constraint HARMONY(1,2), which penalizes local PPs and third person NP recipients. In English, it is unclear whether this is a constraint on the grammatical function of the local recipient or an alignment constraint, as English does not allow for non-canonical word orders. The Dutch data show that person does not effect the NP/PP alternation. Table 10 shows the distribution of local and 3rd person recipients over the four constructions. We restricted our search to pronominal recipients, because local recipients can only be realized by a pronoun and we want to measure an effect of person independent of the influences of weight and pronominality. The results for both corpora were combined to get more representative numbers and to generalize over the differences between spoken and written language (with local recipients generally being more frequent in spoken language). The distribution of local and third person pronouns is not significant (p=0.05).

The data on DOS in section 3.3 showed, on the other hand, that person does have an influence on argument order: the constraint conjunction LOL penalized shifted first and second person direct objects.

One may suggest that the relevant feature is not person but animacy. Unfortunately, none of the available corpora of Dutch is annotated with information about animacy. Within the restricted search space of the pronominal recipients, there were too few inanimate recipients to draw any conclusions. That being said, it does seem to be the

[5]These lexical preferences form a problem for OT systems. Two ways of implementing them are by language particular constraints, that block a particular construction for a particular verb (Bresnan and Nikitina, 2003) or as a lexical feature. The latter would save the principle of a universal set of constraints, but crucially depends on a lexicon friendly OT system, as in van der Beek and Bouma (2004).

	local	3rd person
NP NP$_{unshifted}$	101	52
NP NP$_{shifted}$	13	9
NP PP	7	3
PP NP	2	1

Table 10: Person features of pronominal indirect objects

case that with (marked) inanimate recipients, the DOS is ungrammatical and the PP-construction is preferred (example (13)).

(13) a. Ik geef dit boek een tien.
I give this book a ten
I give this book ten out of ten.
b. ?Ik geeft dat geen enkel boek
I give that no single book
I do not give that to any book.
c. En toch geef ik dat wel aan dit boek.
and still give I that indeed to this book
But I still do give that to this book.

Besides (morphosyntactic) feature driven constraints on the dative alternation, we also suspect some influence from the surface string. Among the sentences with PP recipients, for example, we find many that have proper name recipients, proper name agents and non-pronominal themes. As DOS is only available for pronouns, a double object construction would lead to two proper names in a row (example (14-a)). Realizing the recipient as a PP argument successfully avoids this sequence of proper names (example (14-b)).

(14) a. Daar gaf volgens de overlevering God Mozes het gebod
there gave following the tradition God Moses the commandment
"Gij zult niet stelen".
thou shalt not steal
b. Daar gaf volgens de overlevering God aan Mozes het
there gave following the tradition God to Moses the
gebod "Gij zult niet stelen".
commandment thou shalt not steal
Tradition has it that this is the place where God gave Moses the commandment "Thou shalt not steal".

Finally, a radically different approach on word order is taken by Reinhart (1996). She argues that the sentence focus is determined by the position of the main stress: the focus of IP is a(ny) constituent containing the main stress of IP. Usually, main stress falls on the right edge of the middle field in Dutch. If the focus of IP is a constituent that does *not* contain the rightmost phrase in the middle field, there are two options:

stress shift or scrambling. Reinhart claims that scrambling is more economical than stress shift and therefore the preferred strategy for stress (and thus focus) assignment.

The non-canonical versions of the double object construction and the dative PP-construction could be regarded as scrambling and even the NP/PP alternation could be regarded as a means of avoiding stress shift. It would nicely explain why the phonologically weak pronoun *het* almost always shifts and why we find so few emphasized forms of the pronouns (e.g. *hijzelf*, 'he himself') in shifted position. However, the data in (15), on which Reinhart (1996) bases her theory, are not uncontroversial.

(15) a. *Ik heb de krant nog niet gelezen, maar ik heb het boek al
I have the newspaper yet not read but I have the book already
wel gelezen.
indeed read

b. Ik heb nog niet de krant gelezen, maar ik heb al wel het
I have yet not the newspaper read but I have already indeed the
boek gelezen.
book read
I haven't read the newspaper yet, but I did read the book already.

In any case, focus cannot be the full explanation for the DOS: the alternation between canonical and non-canonical orderings persists even if both arguments are red uced pronouns and therefore necessarily unstressed ((16)).

(16) a. Jo wees ze 'm aan.
Jo pointed them him on
Jo pointed them out to him.

b. Jo wees me ze aan.
Jo pointed me them on
Jo pointed them out to me.

4 Additional evidence: the AcI construction

In this section we illustrate that the various constraints for aligning different sorts of NPs can also be applied to other word order alternations. We show how these detailed constraints account for the distribution of embedded object shift (EOS) in the Accusativus cum Infinitivo (AcI) construction.

The AcI construction illustrated in examples (17) and figure 1 is headed by a sensory verb, the verb *laten* (to let) or the verb *helpen* (to help). The verb takes an object and an XCOMP. The embedded subject is functionally controlled by the object.

(17) a. Ik zag Jo een boek lezen.
I saw Jo a book read
I saw Jo reading a book.

b. Ik zag jou Jo helpen zwemmen.
I saw you Jo help swim

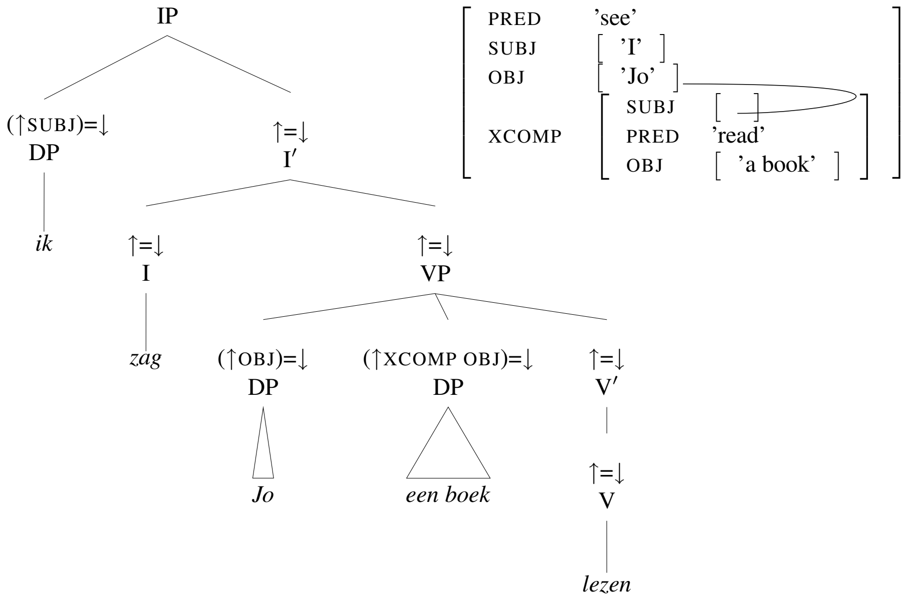

Figure 1: C-structure and f-structure for an AcI-construction in Dutch

I saw you helping Jo to swim.

Several LFG analyses of this construction exist, e.g. Bresnan et al. (1982), Zaenen and Kaplan (1995) and Kaplan and Zaenen (2003). All nominal arguments (also the embedded ones) are selected for in the VP, all verbal arguments in V', thus accounting for the crossing dependencies that occur when one AcI constructions is embedded in another, as illustrated in (17-b):

(18) C-structure rules for the AcI-construction (Kaplan and Zaenen, 2003)

$$\mathrm{VP} \rightarrow \underset{(\uparrow \textsc{xcomp}^{*}\ \textsc{obj}) = \downarrow)}{\mathrm{NP}^{*}} \quad \mathrm{V}'$$

$$\mathrm{V'} \rightarrow \mathrm{V} \left(\begin{array}{c} \mathrm{V}' \\ (\uparrow \textsc{xcomp}) = \downarrow) \\ (\uparrow \textsc{xcomp}^{+}\ \textsc{obj}) \not<_f (\uparrow \textsc{obj}) \end{array} \right)$$

The order of the nominal arguments is restricted to the canonical word order in (17-a) and (17-b) by the f-precedence requirement $(\textsc{xcomp}^{+}\textsc{obj}1)\ \neg<_f\ (\uparrow \textsc{obj}1)$ (Kaplan and Zaenen, 2003). This constraint says that the constituent that maps onto the embedded OBJ1 in the f-structure cannot precede the constituent that maps onto the f-structure of the main clause direct object. However, under certain conditions, the embedded object can shift over the higher object (or embedded subject) (19). In other words: the f-precedence constraint is violable. The conditions under which we find EOS resemble the conditions on DOS. A difference is that DOS was only blocked with local person pronouns, while EOS is blocked with all animate pronouns. This is best illustrated with animate and inanimate examples of the weak pronoun *ze* (them) ((20-b)-(20-a)). Note that inanimate objects are very unmarked. More marked objects have to stay in their canonical object position.

(19) a. Ik zag 't Jo doen.
I saw it Jo do
I saw Jo doing it.
b. Ik zag dat haar ouders doen.
I saw that her parents do
I saw her parents doing that.
c. Ik zag ze dat doen.
I saw then that do
I saw them doing that.
d. Ik zag het ze doen.
I saw it them do
I saw them doing it.

(20) a. Ik heb ze Jo door zien slikken.
I have them you seen swallow
I saw you swallowing them.
b. %I heb ze Jo zien zoenen.
I have them Jo seen kiss
I saw Jo kissing them.

We can model the restrictions on the argument ordering in the AcI with a set of OT constraints similar to the one used for the OS in the double object construction. The only difference is that we have to exclude third person animate pronouns and that CANON now applies to OBJ1 and XCOMP OBJ1, instead of OBJ1 and OBJ2. For this purpose, we adapt the definition of CANON and formulate the constraint conjunction LAX.

(21) CANON: SUBJ $<_f$ OBJ2 $<_f$ OBJ1 $<_f$ OBL, XCOMP OBJ1

*LEFT ANIMATE XCOMP OBJ1 (LAX): *OBJ1$_{anim}$&CANON

The rest of the analysis works as for the OS in the double object construction, as illustrated in table 11.

5 Conclusion and discussion

We investigated the influence of various alignment principles on the dative alternation: canonical word order, light precedes heavy and pronouns precede full NPs. We found the influence of word order reflected in the general distribution of the four realizations of the dative alternation. Weight proved an important factor for both the NP/PP alternation and the ordering of the arguments in the PP construction. The principle 'pronouns precede full NPs' was made more specific to account for the direct object shift in the double object construction and the AcI.

Input: *saw*(<SUBJ><OBJ1><XCOMP>)				LAX	PRO$_{it}$-L	PRO-L	CANON
OBJ1='Jo'		☞	OBJ1 XOBJ1				
XOBJ1='a book'	ex.(17-a)		XOBJ1 OBJ1				*!
OBJ1='Jo'			OBJ1 XOBJ1		*!	*	
XOBJ1='it'	ex.(19-a)	☞	XOBJ1 OBJ1				*
OBJ1='her parents'			OBJ1 XOBJ1			*!	
XOBJ1='that'	ex.(19-b)	☞	XOBJ1 OBJ1				*
OBJ1='them'		☞	OBJ1 XOBJ1			*	
XOBJ1='that'	ex.(19-c)		XOBJ1 OBJ1			*	*!
OBJ1='Jo'		☞	OBJ1 XOBJ1			*	
XOBJ1='them'	ex.(20-b)		XOBJ1 OBJ1	*!			*

Table 11: Embedded Object Shift in the AcI

No evidence was found for independent influence of person or definiteness on the dative alternation or for independent influence of pronominality on the NP/PP alternation. This is contrary to the work of Bresnan and Nikitina (2003) for English (with regard to person) and the predictions of the Left-Right Principle (with regard to definiteness and pronominality). The extent and nature of the influence of several other factors was left for further investigation.

The model presented in this paper accounts for the most frequent patterns. The corpus data clearly showed, however, that variations on these patterns occur. One would need a stochastic implementation (Boersma and Hayes, 2001) of the constraint ranking to account for those less frequent outputs. It would be interesting to see whether such an implementation would predict the frequency distributions that we observed in the corpora.

References

Aissen, Judith. 2003. Differential object marking: Iconicity vs. economy. *Natural Language & Linguistic Theory*, 21(3):435–483.

Arnold, Jennifer E., Thomas Wasow, Anthony Losongco, and Ryan Ginstrom. 2000. Heaviness vs. newness: The effects of complexity and information structure on constituent ordering. *Language*, 76:28–55.

van der Beek, Leonoor and Gerlof Bouma. 2004. The role of the lexicon in optimality theoretic syntax. In Miriam Butt and Tracy Holloway King, editors, *The Proceedings of the LFG '04 Conference*. CSLI Publications.

van der Beek, Leonoor, Gosse Bouma, and Gertjan van Noord. 2002. Een brede computationele grammatica voor het nederlands. *Nederlandse Taalkunde*, 7(4):353–374.

van der Beek, L., G. Bouma, R. Malouf, and G. van Noord. 2002. The alpino dependency treebank. In *Computational Linguistics in the Netherlands (CLIN) 2001*, Twente University.

Behaghel, Otto. 1909/10. Beziehungen zwischen umfang und reihenfolge von satzgliedern. *Indogermanischen Forschungen*, 25:110–42.

Boersma, Paul and Bruce Hayes. 2001. Empirical tests of the gradual learning algorithm. *Linguistic Inquiry*, 32(1):45–86.

Bouma, Gosse and Geert Kloosterman. 2002. Querying dependency treebanks in XML. In *Proceedings of the Third international conference on Language Resources and Evaluation (LREC)*, Gran Canaria.

Bouma, Gosse, Gertjan van Noord, and Rob Malouf. 2001. Alpino: Wide coverage computational analysis of dutch. In *Computational Linguistics in the Netherlands CLIN 2000*.

Bresnan, Joan, Ronald. M. Kaplan, Stanley Peters, and Annie Zaenen. 1982. Cross-serial dependencies in dutch. *Linguistic Inquiry*, 13:613–635.

Bresnan, Joan and Tatiana Nikitina. 2003. On the gradience of the dative alternation. `http://www-lfg.stanford.edu/bresnan/new-dative.pdf`.

Gundel, Jeanette K. 1988. Universals of topic-comment structure. In Michael Hammond, Edith A. Moravcsik, and Jessica R. Wirth, editors, *Studies in syntactic typology*. Amsterdam: John Benjamins, pages 209–39.

Haeseryn, W. et al., editors. 1997. *Algemene Nederlandse Spraakkunst*. Nijhoff, Groningen.

de Hoop, Helen. 2003. Scrambling in dutch: Optionality and optimality. In S. Karimi, editor, *Word Order and Scrambling*. Blackwell Publishers, Oxford, pages 201–216.

Jäger, Gerhard and Anette Rosenbach. 2003. The winner takes it all - almost. cumulativity in grammatical variation. University of Potsdam and University of Dsseldorf.

Kaplan, Ronald M. and Annie Zaenen. 2003. West-germanic verb clusters in lfg. In Pieter A.M. Sueren and Gerard Kempen, editors, *Verb Constructions in German and Dutch*. John Benjamins, pages 127–150.

Krifka, Manfred. 2001. Lexical representations and the nature of teh dative alternation. Available on his webpage, November 9. University of Amsterdam.

Lapata, Maria. 1999. Acquiring lexical generalizations from corpora: A case study for diathesis alternations. In *Proceedings of the 37th Meeting of the North American Chapter of the Association*, pages 397–404, College Park, MD.

Lee, Hanjung. 2003. Prominence mismatch and markedness reduction in word order. *Natural Language & Linguistic Theory*, 21(3):617–680.

Levelt, Pim. 1998. Corpus gesproken Nederlands. zie ook www.elis.rug.ac.be/cgn/.

Levin, Beth. 1993. *English Verb Classes and Alternations. A Preliminary Investigation*. The MIT Press, Cambridge, Massachusetts.

Moortgat, Michael, Ineke Schuurman, and Ton van der Wouden. 2001. CGN syntactische annotatie. internal report corpus Gesproken Nederlands.

Müller, Gereon. 2001. Harmonic alignment and the hierarchy of pronouns in german. In Horst Simon and Heike Wiese, editors, *Pronouns - Grammar and Representation*. Amsterdam: Benjamins, pages 205–232.

Pinker, Steven. 1989. *Learnability and Cognition. The Acquisition of Argument Structure*. The MIT Press, Cambridge, Massachusetts.

Prince, Ellen. 1992. The ZPG letter: Subjects, definiteness, and information status. In Sandra Thompsons and William Mann, editors, *Discourse Description: Diverse analyses of a fundraising text*. Amsterdam: John Benjamins, pages 295–325.

Reinhart, Tanya. 1996. Interface economy: Focus and markedness. In C. Wilder, H.M. Geartner, and M. Bierwisch, editors, *The role of economy principles in Linguistic Theory*. Akademic Verlag, Berlin.

Smolensky, Paul. 1995. On the internal structure of the constraint component Con of UG. online. ROA-86-0000, http://roa.rutgers.edu.

Uszkoreit, Hans. 1987. *Word order and constituent structure in German*. CSLI.

Wasow, Thomas. 1997. Remarks on grammatical weight. *Langauge Variation and Change*, 9:81–105.

Zaenen, Annie and Ronald M. Kaplan. 1995. Formal devices for linguistic generalizations: West germanic word order in lfg. In Mary Dalrymple, Ronald M. Kaplan, John T. Maxwell III, and Annie Zaenen, editors, *Formal Issues in Lexical-Functional Grammar*. CSLI Publications, pages 215–239.

Zwart, C. Jan-Wouter. 1996. Clitics, scrambling, and head movement in dutch. In *Approaching Second: Second Position Clitics and Related Phenomena*. CSLI Publications, pages 579–612.

Zwart, C. Jan-Wouter. 1997. *Morphosyntax of Verb Movement; A Minimalist Approach to the Syntax of Dutch*. Dordrecht: Kluwer.

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THE ROLE OF THE LEXICON IN OPTIMALITY THEORETIC SYNTAX

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Abstract

Research in Optimality Theoretic syntax tends to focus on language universals and the prediction of systematic language-particular properties by means of constraint interaction, often appealing to the principle of *Richness of the Base*. However, this has left the role and formal status of the lexicon in such models largely uninvestigated.

In this paper we look at some existing architectures for OT syntax, notably the LFG based OT-LFG, and the consequences of these approaches for the syntax-phonology interface, lexical lookup, computational properties of the system and the ability to deal with non-systematic language particularities.

On the basis of this exposition we argue that the lexicon should be modeled as an extra argument of GEN, the universal function from inputs to candidate sets. This setup is able to deal with phenomena that were problematic for other architectures, while still respecting core aspects of Richness of the Base.

1 Introduction

Research in Optimality Theoretic (OT) syntax has largely focused on language universals and the prediction of systematic language-particular properties by means of constraint interaction. For example, the constraint ranking determines which contrasts in the paradigm of *to be* are expressed (Bresnan, 2002; Bresnan, 1999). The lexicon is assumed to have no influence on these phenomena. The morpho-syntactic features that we find in the lexical entries of *to be* are there *because* the constraint interaction determined that these contrasts are expressed.

Similarly, it is the language particular ranking of universal constraints that determines whether or not to leave the content of a pronominal unparsed – resulting in an expletive (Grimshaw and Samek-Lodovici, 1998) – not the presence or lack of an expletive lexical item in the lexicon.

The motivation for this line of research is found in the principle of *Richness of the Base* (RotB, Prince and Smolensky (1993). RotB is rooted in OT phonology and tells us that systematic differences between languages arise from different constraint rankings. This effectively bans the lexicon as a source of syntactic variation – which is in sharp contrast to lexicalist theories of language, such as GPSG (Gazdar et al., 1985), HPSG (Pollard and Sag, 1994) and LFG (Bresnan, 2001), that assume that lexical contrasts drive syntactic variation. As a result, the role and formal status of the lexicon, which maps sets of morpho-syntactic features to arbitrary phonological strings, have been largely left uninvestigated.

In this paper we explore the possibilities for encoding and accessing lexical information in current implementations of OT syntax that are in line with RotB, OT-LFG (Bresnan, 1999) in particular. We argue that these possibilities are not sufficient for accounting for syntax-phonology interface phenomena and unsystematic language particularities. Furthermore, we will look closer at the decidability of the OT-LFG system and some predictions made by the OT syntax model of Grimshaw and Samek-Lodovici (1998). Based on our findings we conclude that the lexicon is best modeled as an extra argument of GEN, the universal function from inputs to candidate sets. Such a setup weakens RotB, but it facilitates accounts for phenomena that were problematic for the discussed models while respecting some of the core aspects of RotB.

The setup of this paper is as follows. We start with a brief discussion of RotB in its original form in OT phonology and its applications in OT syntax in section 2. We then discuss the consequences of marginalizing the lexicon (section 3). In section 4, we first discuss a possible solution for some of the problems that was suggested in the literature and then present our more general and principled solution of modeling the lexicon as an argument of GEN. Finally, we discuss the consequences of our proposal for RotB in section 5 and conclude in section 6.

2 Richness of the Base

Richness of the Base was originally formulated in the OT phonology literature to prevent analyses that appeal to systematic differences in the input. If a language only has .CV. syllables, then this is not because the input is restricted to that type of syllable but because the grammar thus restricts the output:

> [Under] *Richness of the Base*, which holds that *all* inputs are possible in all languages, distributional and inventory regularities follow from the way the universal input set is mapped onto an output set by the grammar, a language-particular ranking of the constraints. (Prince and Smolensky, 1993, p209)

Furthermore, it was assumed in the original OT phonology framework that the candidate generating function GEN and the constraint set CON are both universal. The universal input combined with a universal function from underlying phonetic representations to surface phonetic representations results in a universal set of possible candidates. This leaves only one source of linguistic variation: the ranking of the constraints. RotB thus became equivalent to 'all systematic differences between languages arise from differences in constraint ranking'. The RotB hypothesis has been widely accepted within OT phonology (but see van Oostendorp (2000) for some critical remarks). With the application of the OT framework to syntax, RotB had to be 'translated' to the field of syntax. As phonology and syntax are concerned with different types of objects, this translation is not straightforward.

2.1 RotB & OT syntax

In an OT syntax framework, the input consists of some semantic representation.[1] The output consists of a structured string and some link to the interpretation of that string. GEN in OT syntax thus differs crucially from GEN in OT phonology in that it is a function that changes the type of the object. This raises the question whether we can still conclude from the universal input and a universal function from inputs to candidate

[1]The formalization depends on the OT syntax implementation, but it is supposed to contain at least a predicate and argument structure as well as the information or discourse status of elements (Bresnan, 2002; Smolensky and Legendre, 2005; Grimshaw and Samek-Lodovici, 1998)

sets GEN that the set of all possible candidates is universal. Smolensky and Legendre (2005) answer this question affirmatively. They present a uniform treatment of phonology and syntax within the OT framework. The definition of RotB is the same for both modules:

> *Richness of the Base:* The space of possible interpretations – inputs to the production function f_{prod} – is universal. Thus all systematic language particular restrictions on what is grammatical must arise from the constraint ranking defining the grammar [...]. (Smolensky and Legendre, 2005, ch12)

This is a direct translation of RotB to OT syntax, which has been widely adopted by OT syntacticians and which has led to analyses of for example resumptive pronouns (Legendre, Smolensky, and Wilson, 2001), expletive pronouns, *pro* (Grimshaw and Samek-Lodovici, 1998), *do* (Grimshaw, 1997) and the paradigm of *to be* (Bresnan, 1999) in terms of constraint interaction. With respect to the role of the lexicon, Smolensky and Legendre (2005) say that "in any OT theory of syntax, [...] the lexicon is not an independent site of variation". In actual linguistic analyses, this has led to a conception of grammar in which lexical lookup takes place after optimization, thus excluding any influence of the lexicon on the selection of the optimal candidate.

Bresnan (2002) captures RotB by "viewing the morpho-syntactic input as arbitrary points in an abstract multidimensional space of dimensions". This input takes the form of the f-structures familiar from classical LFG. Both the candidates and the output consist of c-structure/f-structure pairs. In contrast to classical LFG, where the phonological string is read of the leaves of the c-structure, the candidates and the output do not include phonological material. Only optimal candidates are mapped onto a phonological string: "[...] it is the job of the lexicon to pair the inventory of abstractly characterized candidates selected by the constraint ranking with the unsystematic language-particular pronunciations by which they are used" (Bresnan, 1999). Instead of lexical or phonological material, the c-structure leaves consist of feature bundles, similar (but usually not identical) to the input feature bundles.

To illustrate, an input feature bundle may look like this: [BE PRES 1 SG] for the first person singular slot in the paradigm for the present tense of *to be*. These features may not be realized, violating FAITH constraints. In those cases, a more general form is realized, such as *are*: [BE PRES]. On the other hand, if the features *are* realized, they may violate certain markedness constraints, such as *SG or *1. The relative ranking of these markedness and faithfulness constraints determines which contrasts are expressed in a particular language. The tableaux in (1a) and (1b) illustrate how the constraint ranking for standard English correctly predicts that [BE PRES 1 SG] is realized with perfect faithfulness as *am*, while [BE PRES 2 SG] is realized as the more general *are*.[2]

[2]The constraint ranking in the tableaux is not fully fixed and effectively specifies a set of rankings. Strict domination is indicated by a vertical line between the constraints. A '!' indicates that a violation is fatal under at least one of the compatible rankings.

(1) a.

	[BE PRES 1 SG]	*PL	*2	FAITH$^{P\&N}_{be}$	*SG	*1	*3
☞	‘am’: [BE PRES 1 SG]				*	*	
	‘is’: [BE PRES 3 SG]			*!	*		*
	‘are’: [BE PRES]			*!			
	‘art’: [BE PRES 2 SG]		*!	*	*		

b.

	[BE PRES 2 SG]	*PL	*2	FAITH$^{P\&N}_{be}$	*SG	*1	*3
	‘am’: [BE PRES 1 SG]			*	*!	*!	
	‘is’: [BE PRES 3 SG]			*	*!		*!
☞	‘are’: [BE PRES]			*			
	‘art’: [BE PRES 2 SG]		*!		*		

Legendre, Smolensky, and Wilson (2001) are less explicit about the formal status of the lexicon. They assume that the input contains at least a target predicate-argument structure and note that arguments in an input structure are best viewed as bundles of features. Furthermore, they claim that the presence or absence of a lexical item in some particular language is a consequence of output of the grammar. Nevertheless, some lexical material seems to be present in the candidates: “In faithful parses [...] one position in a chain contains the *overt* lexical material of the corresponding element of the Index” (italics from the original). But if the candidates contain lexical material, the presence or absence of lexical items co-determines the candidate space and thus the output (which is supposed to determine the contents of the lexicon): RotB and pre-optimization lexical look-up do not go together.

Samek-Lodovici (1996) appears to assume that the input does not contain lexical material, but the candidates do. In other words, GEN introduces lexical items. He states: “[...] different lexicons give rise to distinct candidate sets language-wise” (Samek-Lodovici, 1996, p9). This is very much like our proposal in section 4.2. However, he follows Prince and Smolensky (1993) in that the lexicon should be derived from the grammar. In his analysis of expletives, he assumes that no language has a lexical entry for expletives: if constraint interaction determines that violating faithfulness constraints is better than not filling a certain position, than that will result in the expletive use of some pronoun (see section 3.4 for discussion on this topic).

The following section discusses various problems that follow from a direct translation of RotB from phonology to OT syntax. We will focus on the model described in Bresnan (1999;2002) because it is most explicit in its assumptions about the formal status of the lexicon.

3 Problematic consequences

In this section we discuss some consequences of a strict interpretation of Richness of the Base in OT syntax. We start with some syntax-phonology interface phenomena in section 3.1, which pose a problem for models with lexical look-up after morpho-syntactic optimization. We argue that these are counterexamples to the 'Principle of Phonology-free Syntax' (Zwicky, 1969; Zwicky and Pullum, 1986), and that these phenomena can only be modeled correctly by having phonological constraints influence syntactic optimization. In section 3.2, we discuss some linguistic phenomena that one may classify as unsystematic linguistic variation. As RotB in both its original phonological form and in the interpretations for syntax focuses on systematic variation, these issues are often set aside as uninteresting. We will argue that the topics under consideration are linguistically relevant and need explanation, even if the language model was designed to optimally account for systematic variation. A computational disadvantage of the absence of a finite lexicon that restricts the candidate set is discussed in section 3.3. Finally, we turn to a very specific piece of OT syntax research that builds on RotB, namely the work by Grimshaw and Samek-Lodovici (1998) on expletives, showing that some of their predictions are not borne out.

3.1 Syntax-phonology interface phenomena

Tromsø Norwegian V3 Standard Norwegian is, like most Germanic languages, a V2 language. This shows up for instance in sentences with a fronted non-subject. The subject then follows the verb. Consider the case of a wh-question with the wh-word in first position:

(2) a. Du sa noe.
you said something
'You said something.'
b. Hva sa du?
what said you
'What did you say?'
c. *Hva du sa?
what you said

However, several dialects of Norwegian allow for V3 word order in wh-questions. In such a dialect, not only the parallel to (2b), but also to (2c) is grammatical (Rice and Svenonius, 1998; Westergaard, 2003; Vangsnes, 2004).

One dialect in point is the Tromsø variety of the North Norwegian dialect. Interestingly, in Tromsø North Norwegian, the grammaticality of V3 co-varies with the prosodic features of the question word. Polysyllabic question words require V2. Monosyllabic question words, however, allow V3. The pattern for Tromsø North Norwegian thus is (from Rice and Svenonius (1998)):

(3) a. Koffor skrev han / *han skrev ikkje?
why wrote he he wrote not
'Why didn't he write?'

b. Ka du fikk?
what you got
'What did you get?'

Any way of making the wh-constituent prosodically heavier, whether it adds to *syntactic* weight or not, makes the V3 construction ungrammatical. So variations on (3b) with *kem eller ka* ('Who or what'), *ka slags* ('What kind') or *KA* ('WHAT', stressed), are ungrammatical.

Rice and Svenonius (1998) argue that this behavior is really due to the prosodic features of the wh-words in question,[3] and analyze it in terms of unstressed, monosyllabic wh-words not being able to support a foot on their own. They propose an architecture in which syntax remains indifferent to the V2/V3 constructions, and both are passed to the phonology component. So, as far as word order is concerned, syntax acts as a generator for phonology.

This setup requires that syntax is in fact indifferent to the two constructions. Using an universalist OT framework, in a somewhat more comprehensive grammar, this seems hard to accomplish, because it would require that the two candidates look the same to each and every constraint. Alternatively, one might consider an OT version that allows for variation in a more controlled way, that is by combining the outputs of different rankings (Anttila (1997) or Stochastic OT, Boersma and Hayes (2001)). But these versions of OT often relate the output-sets to occurrence frequencies. A phonological filter on these sets – the phonological optimization that comes after syntax – would disturb this correlation, and, in the case of Stochastic OT render the associated learning algorithm useless.

We conclude that a phenomenon like this is best modeled in OT by letting the interface constraints interact directly with the constraints of syntax. This means that the phonological string has to be present during optimization, and this, in turn, means that lexical lookup cannot occur only after optimization.

Dutch verb clusters In Dutch, all verbs of a subordinate clause and all non-finite verbs in a main clause reside in the verb cluster at the end of the clause. Non-verbal material related to a verb, in e.g. verb-PP or verb-adjective collocations, generally appears to the front of the verb cluster. However, to a limited extent, the non-verbal material is allowed to appear among the verbs in the cluster. The acceptability of this construction depends on the number of syllables, and therefore the *phonological heaviness* of the intervening material. For instance, from (4a)–(4c) acceptability is reduced.[4]

(4) a. Ik heb het niet **los** kunnen / kunnen **los** maken.
I have it not loose can.INF can.INF loose make.INF
'I didn't manage to loosen it'

b. Hij had haar **gerust** willen / ?willen **gerust** stellen.
he had her at ease want.INF want.INF at ease put.INF
'He meant to comfort her.'

[3] See (Vangsnes, 2004) for a different analysis.
[4] The non-verbal material concerned is highlighted.

c. ... dat hij zich **ongerust** ging / *ging **ongerust** maken.
that he REFL worried went went worried make.INF
'... that he was getting worried.'

Diachronically, this effect can be seen even more clearly. Corpus study shows that there is a clear correlation between time and the average number of syllables of the non-verbal material in the verb cluster (Jack Hoeksema, p.c.). Over time, Dutch has become more intolerant of this material. To illustrate, the counterpart of (5) would be fully ungrammatical in modern Dutch.

(5) gewis hij zoude zijn heerlijk ontwerp hebben **ten uitvoer** gebragt.
certain he would his wonderful design have.INF to the execution brought
'He would have certainly implemented his wonderful design.' (*De werken van Jacob Haafner*, part 1, p336, ∼1810)

Phonology driven non-agreement in English Bresnan (1999) accounts for various neutralization effects in the paradigm of *to be* by means of universal constraints on the realization of morpho-syntactic features. These constraints do not explain why the synthetic negation *amn't* is ungrammatical in standard English (see example (6)). Something else is needed to account for the absence of this form. A possible explanation is offered by Dixon (1982). Dixon suggests that *am* is reduced to [ɑː] before *n't* as to avoid the consonant sequence *-mn-* (subsequently leading to reanalysis and spelling of the sequence as an instance of *aren't*).

(6) a. I am silly. / I'm silly.
b. Aren't I silly?

(7) a. The lions are / 're / *is / *'s in the compound
b. Where are / 're / *is / 's the lions?

A similar phonological markedness constraint can explain the contrast between (7a) and (7b) (grammaticality judgments from Dixon): the infelicitous phonological sequence *where're* must be avoided and this may be done by using the copula *'s* with a plural subject (Dixon, 1982).

If we translate these phonological constraints into OT style constraints, we need them to interact with morpho-syntactic constraints. This means importing the lexical string into syntax, leading to a grammar that is no longer independent of the lexicon.

Alternatively, one could envisage an approach in the style of Rice and Svenonius (1998), where both alternatives are produced and a phonological filter prevents *amn't* and *where're* from surfacing. However, such an approach should also explain why the *are* is not allowed for first person singular elsewhere, and why *'s* for third plural can only occur after *where, there* and *here*.

The Dutch modifier *hoogst* A fourth and final example of phonology driven syntax is found in Dutch modification by intensifiers. The intensifiers *heel* and *erg* (Dutch, 'very') do not pose constraints on the modified adjective. In contrast, the intensifier *hoogst* (Dutch, 'highly') occurs with polysyllabic adjectives (Klein, 1998). Compare

heel+ADJ		*erg*+ADJ		*hoogst*+ADJ	
645	goed	98	goed	13	onwaarschijnlijk
330	erg	70	moeilijk	11	onzeker
214	lang	53	groot	10	ongebruikelijk
147	moeilijk	48	belangrijk	7	twijfelachtig
119	belangrijk	44	hoog	7	ongelukkig
106	snel	34	klein	6	noodzakelijke
94	klein	32	lang	6	irritant
89	hard	28	leuk	5	waarschijnlijk
80	mooi	26	populair	5	persoonlijke
75	sterk	24	sterk	5	merkwaardige

Table 1: Most frequent adjectives modified by *heel* (very), *erg* (very) *hoogst* (highly)

the co-occurrence data in the Volkskrant-newspaper 1998 volume ($\sim$ 17 mln words) for the three intensifiers in table 1. While many monosyllabic adjectives are extremely frequent, we did not find any occurrence of a monosyllabic adjective modified by *hoogst* in the Volkskrant corpus. Even on the web it is hard to find examples: of all monosyllabic adjectives in table 1, Google returned only one occurrence of one combination with *hoogst*: *hoogst leuk* (Dutch, 'very nice').

Like the previous examples, the distribution of the intensifiers in Dutch shows that the phonological form of a word – which is stored in the lexicon – influences more than just the phonological shape of the sentences: it influences at least the word order and the combinatory possibilities of the clause. That is, the lexicon influences grammar and therefore cannot be entirely derived from it.

3.2 Non-systematic language particularities

Smolensky and Legendre (2005), as well Bresnan (2002) and earlier formulations of RotB, make it very clear that the principle is concerned with systematic variation only. There are many (unsystematic) linguistic phenomena for which constraint re-ranking is an implausible explanation. Should we for instance conclude from the introduction of the word *hamburger* into the English language that its grammar changed as to the effect of suddenly disfavoring *ground beef sandwich*? What constraints prevented the single noun realization from becoming optimal before the noun was introduced? Similar questions can be asked for accounts of syntactically distinct realizations of a concept in different languages (Swedish *professorskan* vs *the professor's wife*), and syntactically distinct realizations of closely related concept within one language (*cause to die* vs *kill*). Why is it that the meaning of *cause to die (unvoluntarily)*, which is so close to *kill*, cannot be expressed by a single lexical item? Why does this pattern not extend to other lexical entries, i.e. why does *cause to sleep* not imply involuntariness and how could constraint ranking account for the correlation with the lack of a lexical entry for 'voluntarily cause to sleep'? The same line of reasoning can be applied to larger units such as idioms. Since these are semantically atomic but syntactically complex, the full construction has to be available at syntactic optimization.

These are examples of unsystematic linguistic particularities, just as arbitrary as phonological form. The lexicon is the ideal locus for such unsystematic information.[5] Only, this unsystematic information interacts with the grammar and thus has to be available before optimization takes place. This is problematic for OT syntax models that assume optimization takes place over sets of morpho-syntactic feature bundles. But *any* OT syntax model that claims that the lexicon is derived from the output of the grammar needs to say something more about these language particular, unsystematic properties that influence grammar. Smolensky and Legendre (2005, ch12) are willing to weaken the principle that all constraints are universal, in order to account for idiosyncratic language-specific phonological alternations. Other solutions that are more specifically aimed at OT syntax are discussed in section 5.1.

3.3 Decidability of OT-LFG generation

Kuhn (2003, and earlier work) develops a formalization of the OT-LFG framework and investigates its computational properties. Following Bresnan (2000), he models GEN as an over-generating LFG-grammar, taking an f-structure as input and specifying a set of c- and f-structure pairs with ϕ-mappings. This set is used as the candidate set. Kuhn also provides a syntax for specifying constraints in the formalization. One of Kuhn's important results is the *decidability of generation*. The generation task – for an underlying form, what is the optimal candidate according to an OT system? – is not trivial, because GEN may be unfaithful to the input, resulting in the infamous infinite candidate set.

We will gloss over the technical details of the decidability proof here. Suffice it to say that it involves factoring in the constraints into the LFG-grammar describing GEN, G_{base}. The result is also an LFG grammar, to which existing decidability of generation results can be applied.

The reason we can omit going into the algorithm here, is that the problem already arises in a preprocessing step. G_{base}, being a classic LFG grammar, is a set of annotated c-structure rules and a set of lexical entries. It is normalized to an equivalent G'_{base}, partly by moving the lexical entries into the c-structure descriptions; the lexical strings in G_{base} become terminals in G'_{base}. This crucially relies on having a finite lexicon. If the lexicon is infinite, we would end up with an infinite number of c-structure rules, and this step would never terminate. Note that the *base* lexicon needs to be finite. If aspects of morphology – say, compounding – can be captured in the c-structure rules, a *derived* lexicon may be infinite with decidability still holding.

The observation that the lexicon in such a system needs to be finite seems rather trivial. But some assumptions have to be made, or made explicit, in order to assure decidability and little attention has been paid to this fact.

Let us look at Bresnan's (2002) proposal, predicting the paradigma of *to be*. In order to preserve the universality of the candidate set, the trees describing the candidates have morpho-syntactic feature bundles as their leaves. This means that the terminals in

[5] Smolensky and Legendre (2005) state that learning *systematic* language particular grammatical information is 'utterly unlike' learning the phonological shape of a word, but ignore the role of the lexicon in the acquisition of *unsystematic* language particular grammatical information and do not offer alternative solutions for the problems described above.

the normalized grammar are also these morpho-syntactic feature bundles. The question is, therefore, whether one can make sure that the set of these bundles is finite. Because we are interested in the base lexicon, we will ignore features which have feature structures as their values.

So, is this set of *flat* feature bundles finite? Bresnan (2002) does not provide us with enough information to decide that for a general setting. However, we *can* specify the sufficient and necessary conditions. To have a finite set you need a finite number of features and a finite number of values. To have a finite number of values, they need to be discrete and to be drawn from a limited domain. In Bresnan's view, the features represent 'dimensions of possible grammatical or lexical contrast' (Bresnan and Deo, 2001, p6). It seems fairly uncontroversial to assume that there is only a certain number of these. And perhaps, for some of these dimensions it could be argued that only a finite number of contrasts has to be made. But for other features, such as PRED, this is less obvious. See Mohanan and Mohanan (2003) for some discussion of related issues.

3.4 Lexical expletives

As a final example we will look at the analysis of the distribution of expletive subjects in Samek-Lodovici (1996) and Grimshaw and Samek-Lodovici (1998). More specifically, we will argue that some of their predictions with respect to the lexicon are not borne out.

Grimshaw and Samek-Lodivici follow the approach to *do*-support in Grimshaw (1997). The distribution of other semantically empty or impoverished items has been analyzed in the same fashion (see e.g. Sells (2003)). Grimshaw and Samek-Lodovici assume that the lexicons of languages do not differ in ways relevant to expletives. Instead, an expletive is an unfaithfully used referential element. So, in English there is no difference between referential *it* as in "it howled" and the expletive *it* as in "it rained", the difference is that in the referential case the lexical meaning of the pronoun contributes to the meaning of the construction, whereas in the expletive case it does not. Whether a language allows such use of lexical resources is a matter of constraint ranking. As Grimshaw and Samek-Lodovici (1998, p205) write:

> [T]here cannot be a language which lexically lacks an expletive, any more than there can be a language which lexically lacks an epenthetic vowel. The occurrence of such items is not regulated by lexical stipulation; instead, the visible lexical items are the result of constraint interaction.

To illustrate, consider the case of English. The constraint SUBJECT, requiring sentences to have overt subjects, outranks the constraint FULL-INTERPRETATION, that puts a ban on using words that do not contribute their lexical meaning to the compositional meaning of the construction. The optimization of the input *rain*′, is summarized in the following tableau:

(8)

	rain′	SUB	F-INT
☞	it rains		*
	he rains		**!
	John rains		**!*
	rains	*!	

In the model, all NP's in the tableau are expletive NP's: their lexical content is ignored. That F-INT is a gradient constraint is highly relevant. Given some sufficient notion of information, the constraint is violated more when using an element of higher content. Presumably, in English, the third-person, singular, neuter pronoun carries the least content, resulting in its use in the winner *it rains*. This way, both the distribution and the choice of lexical elements is captured by the model.

'Expletiveness' not being part of the lexical specification also means that there cannot exist a language with *lexical expletives* – elements that are only used as an expletive. This prediction is borne out if we e.g. look at the main Germanic languages: the expletives are also used as referential third person pronouns or as locative adverbs.

In the South Norwegian dialect of Lyngdal, Vest-Agder, too, there is an expletive that is homophonous with the third-person, singular, neuter pronoun: *det*. However, a second expletive does not use the form for the locative adverb *der* ('there'), but has a similar but distinct form *dar* (Pål Kristian Eriksen, p.c.).[6] For instance:

(9) a. Dar snø. (Weather verbs)
dar snow.PRES
'It is snowing.'

b. Dar blei skutt ein rev (Impersonal passives)
dar became shot a fox
'Someone shot a fox.'

c. Der e dar ein katt (Existential sentences)
there be.PRES dar a cat
'Over there, there is a cat.'

Interestingly, *dar* is only used as an expletive, and cannot be explained as an allophonic variant of *der*. The conclusion therefore must be that Lyngdal South-Norwegian has a lexical expletive.

Helge Lødrup (p.c.) suggests that the vowel in *dar* is a remnant from the Old Norse form *þar*, used only as the referential, demonstrative locative adverb. Why the Lyngdal dialect has preserved this vowel in the expletive use alone, is unclear, but it is the fact that it could that poses a problem for Grimshaw and Samek-Lodovici's model, for want of a non-trivial lexicon.

[6]The phenomenon is as far as we are aware undocumented, and it is unclear how widespread the use of *dar* is. To give us a slight hint to the use and distribution of *dar* we have looked for instances of *dar* on the web. Crucially, instances were found were the same speaker also uses *der* for referential 'there'. The search is not meant as a representative study. We can report a couple of uses that appear to be from the south-west of Norway, up to and including the city of Stavanger. Apart from the spelling *dar*, *dår* and *dårr* – suggesting slightly different pronunciations – have also been found.

4 Solutions

Having reviewed some example cases that are problematic under the current conceptualization of the lexicon in OT syntax, in this section we will propose what we think is the proper place for the lexicon in OT syntax. Before doing so, we will look at an alternative that has been proposed in the literature and argue that it should be rejected.

4.1 A constraint called LEX

Several authors have modeled lexical information using constraints. Given the central role constraints play in linguistic explanation in OT, this approach almost suggests itself. Noyer (1993) proposes an inviolable constraint LEXICALITY, that disallows "signs" that are not composed of "morphemes". Kusters (2003, p69) refines and clarifies this constraint by adding "[LEX] rules out all strings of sound that do not consist of actual lexical material".[7] Finally, "[t]o model accidental lexical gaps" Bresnan (2002) assumes a highly ranked constraint LEX that says that "candidates [...] have pronunciations". Notice that, in these formulations, only Kusters commits himself to having the phonological string available during optimization. There, candidates are built up out of bits of associations of semantico-syntactic information and phonological form – i.e. morphemes. Associations that are not 'conventionalized', i.e. they are not in the language's lexicon, violate LEX. As we have seen before, Bresnan assumes that only the semantico-syntactic side plays a part during optimization. That said, with respect to the constraint, the three proposals are essentially the same, and we shall refer to them as LEX.

The amount of lexical information that LEX supplies is enough to solve some of the problems we mentioned in section 3. Like Bresnan's original application, one could use LEX to block forms that are missing from a paradigm for no apparent systematic (syntactic) reason.[8] If the form is missing for, say, phonological reasons, one may partly model the influence of phonology on syntax in that manner. Similarly one can model other cross-linguistic or diachronic idiosyncrasies, too. For instance – while radically changing the model – one could in principle assume that all languages *can* have lexical expletives, but most happen not to do so. Instead, these languages (mis)use regular lexical items for the job. Of course, in Lyngdal West-Norwegian, the candidate that uses the lexical expletive does not violate LEX.

However, LEX leaves some questions unanswered and introduces some conceptual problems of its own. For instance, real effects of phonology on syntax, where the actual phonological string plays a role, are not necessarily addressable by having LEX. Likewise, the potential decidability problem is not solved by LEX, since it is a solution in CON, and the decidability problems are associated with GEN. The lexical information in the system comes in too late to assure decidability.

[7] Without exploring it any further, Kusters does mention the possibility of having "LEX [as part of] the hardware of the grammar", instead of as a constraint (o.c., p70 fn33).

[8] The constraint LEX is used to achieve the same effect as the constraint **amn't* (Bresnan, 2002). It serves to block a certain candidate, to show that the model predicts the correct *replacements* for this form, without having to venture a guess as to why the form doesn't exist. As such, LEX is not a core part of the analysis.

More serious are the conceptual problems associated with LEX. Firstly, there will be a reduplication of information in the system. Lexical information is already needed for the phonological mapping, irrespective of where this mapping occurs. Now part of this information needs to be present in CON, too.

Secondly LEX makes for an atypical OT constraint. It is assumed never to be violated. It is also unclear what it would mean to violate LEX, because such a candidate contains either gibberish (Kusters model) or something by definition unpronounceable (Bresnan). As a result, LEX cannot be re-ranked. Also, although the abstract definition of the constraint is universal, actual uses have to be 'parameterized' for the lexicon of the language under scrutiny.

Furthermore, under Bresnan's conception, the constraint is used to model unsystematic properties of a language's lexicon, only. So, it should not block everything that is not in the lexicon of the particular language, but just the candidates whose non-optimality cannot be explained by the rest of the grammar. This, again, makes it an abnormal OT constraint. Whether a constraint is violated should depend only on its definition and on the candidate, but not on other candidates or other constraints, let alone on the outcome of an evaluation of the same candidate using the rest of the grammar. Such a constraint greatly increases the complexity of EVAL.

4.2 The lexicon as an argument of GEN

The problems associated with post-syntactic lexical lookup or with a constraint like LEX, suggest that the proper place for the lexicon is actually before CON. However, both the input and GEN are considered to be of a universal character. In order to retain this universality, we propose to model a language particular lexicon as an argument of GEN. That is, syntactic GEN is a universal function from a meaning-representing input *and* a lexicon to a candidate set.

We can adapt Kuhn's (2003) definition of GEN to include this argument. Remember that Kuhn based GEN on an LFG grammar G_{base}, describing universal properties of language. The candidate set is (roughly) the result of generating with G_{base} from an f-structure representing the input. To this conception of GEN, we easily add the lexicon by letting G_{base} take it as an argument.[9] Thus, the candidate set is defined as:

(10) Definition of GEN with lexicon

$$Gen(\Phi_{in},\Lambda) \quad =_{def} \quad \{\langle T,\Phi'\rangle \in G_{base}(\Lambda) \mid \Phi_{in} \sqsubseteq \Phi'\}$$

(where Φ' and Φ_{in} are f-structures, T is a c-structure and Λ is a set of LFG-style lexical entries.)

Now GEN produces candidates that have lexical items on their c-structure terminals. Information about the phonological string is accessible for the constraints in CON. This allows for interaction of phonological and syntactic constraints, facilitating accounts for the interface phenomena we saw in section 3.1. For example, we can define linear

[9]Notice that we are only making a certain relation more explicit, by stating it as an argument. Kuhn seems to implicitly assume the lexical specification to be part of G_{base}. Our presentation only teases apart what in classical LFG are the annotated c-structure rules (i.e.: $\lambda x.G_{base}(x)$) and the lexical entries.

order constraints referring to syllable structure to account for the distribution of monosyllabic questions words in Tromsø Norwegian. An additional advantage of this setup is that it allows for simpler integration of morphology in the system. A phonology-free model of syntax makes impossible any form of interaction with morphology, which is highly string-sensitive. As a result, morphology has to be modeled as a separate module, connected to the rest of the language model in some way. Our model, on the other hand, allows for interaction of phonological, morphological and syntactic constraints.

Furthermore, we now have a locus for storing unsystematic language particular information, whether phonological or morpho-syntactical, and we do not have to apply a constraint ranking to account for the presence or absence of the word *hamburger* in a particular language at a particular time. As long as a language does not have a lexical entry for a particular concept, the one word realization is not in the candidate set, because GEN cannot generate it. Because English does not have a lexical entry for ‘the professor’s wife’ (like Swedish does), it will use the genitive construction to express that meaning.

In our setup, the presence of a lexical item that is uniquely used as an expletive pronoun is not problematic. We simply treat it as an unsystematic language particularity and store it as such in the lexicon. This does not explain why so many languages unfaithfully use personal or demonstrative pronouns for expletives. In other words: we want to keep the explanatory power of the analysis in Samek-Lodovici (1996). It is not impossible to build in the analysis in our model: the Norwegian *dar* may have acquired its use as an expletive in exactly the way proposed, but the referential use may have disappeared or evolved while the lexicalized expletive use remained. Some additional assumptions have to be made, though, to explain the striking infrequency of these visibly lexicalized expletive pronouns.

Finally, the proposed model saves Kuhn’s proof of decidability (Kuhn, 2003) without the need for any further assumptions.

5 RotB Revisited

We have shown that modeling the lexicon as an argument of GEN avoids many of the problems that a strict interpretation of RotB encounters. But at what cost? Do we throw out the most basic principle of the OT framework?

The model described in section 4.2 violates RotB in that it does not restrict all variation to differences in constraint ranking. Instead, we now have two places of analysis: the lexicon and the constraint ranking. But this does not mean that we throw out RotB altogether: the model is compatible with RotB in the sense that it assumes a) an unconstrained, universal set of possible inputs, b) a universal function GEN and c) a universal set of constraints.

5.1 Evaluating models

With two loci for linguistic analyses (the lexicon and the constraint ranking), the question arises which locus to choose. We have seen that analyses that crucially rely on information from the lexicon are necessary for some linguistic phenomena. However, we agree with Smolensky and Legendre (2005) and Bresnan (2002) and most other work in OT syntax that explanations in terms of constraint ranking are to be preferred over lexicalist accounts. We therefore adopt a methodological principle as in Kuhn (2003):[10]

(11) *Methodological principle of OT*
Try to explain as much as possible as an effect of constraint interaction.

Recall that Smolensky and Legendre (2005) also realized that there are language particularities that cannot be explained by the ranking of universal constraints. For these phenomena, they weaken RotB by allowing language particular constraints. With language particular constraints, the ranking of the constraints is no longer the only source of linguistic variation. In order to save this idea as much as possible, they adopt a methodological principle very similar to the one above:

> One might say that the OT principle 'constraints are universal', is a violable meta-constraint on the explanatory value of substantive linguistic theories, the most explanatory theory of some domain being the one that best-satisfies the universal constraint. (Smolensky and Legendre, 2005)

We propose to view the OT principle 'all systematic variation is constraint ranking' as a violable meta-constraint in the same fashion Smolensky and Legendre (2005) propose for the universal constraint principle.

5.2 Kusters' diachronic perspective

A different approach can be found in the work of Kusters (2003), who also assumes that information about the lexicon of the language is available in syntax, albeit in the form of a constraint LEX. Interestingly, he exploits the resulting explanatory overlap to model language change in connection with social change.

Kusters posits that the content of the language particular lexicon is acquired by a new generation of speakers by inducing it from the output of the previous generation. Crucially, this output is not only the result of the previous generation's lexicon but also of their grammar. Consider the case in which a lexical item never surfaces because its use would involve some fatal violation of a markedness constraint. As a result, the item would never be incorporated into the lexicon of a language user from the next generation.

Another interesting case is when some lexical item is overloaded with meaning. To express the meaning $f'(g')$, a speaker may – again because of markedness constraints – be forced to just use the lexical entry for g': "gee", instead of uttering it together with the entry for f': "eff gee". This means that a language learner assigns the meaning $f'(g')$ to "gee". In the same fashion, an item can be stripped of content.

As a side effect, Kusters notes, the inter-generation change of the content of a morpheme mimics the Lexicon Optimization of OT phonology (Prince and Smolensky, 1993, p209). If "gee" alone lexically specifies $f'(g')$, no faithfulness constraints are

[10] Kuhn (2003) is more concerned with restricting the role of GEN than the role of the lexicon. In both cases the aim is to keep the candidate set as large as possible.

violated by using "gee" to express exactly $f'(g')$. This means that the Harmony of the optimal candidate in the the new generation is higher than the Harmony of the previous generation's optimal candidate. It shares this *Harmony maximization* with Lexicon Optimization. However it should not be forgotten that the lexicon does not relate to syntax as it does to phonology. In phonology, the lexicon supplies inputs. Lexicon Optimization in phonology is therefore *input optimization*. In syntax the input is meaning related, and if it has any relation to the lexicon at all, it is indirect.

As it stands, Kusters' model captures instances of lexical items changing content, or items being dropped from the lexicon from one generation to the other, and serves as a theory of grammaticalization in the sense that what used to be the result of optimization becomes entrenched in the lexicon. The addition of new words to a language, be they loan-words or inventions, does not readily follow. Nor is speaker internal language change catered for. Nevertheless the model looks like a good starting point for investigating these topics in OT syntax.

Finally, Kusters' approach directly carries over to the architecture we propose in the previous section. The lexicon is still learned from output forms, but the information enters the system in a different place.

6 Conclusion

Since the beginning of Optimality Theory, there has been a tendency to accentuate the universalist approach to grammar. This has led to the claim that all (systematic) linguistic variation should be explained by the ranking of universal constraints. We argued in this paper that this does not always give the right results in OT syntax. We focused on the role of the lexicon within this universalist approach to grammar and we showed how the lack of a language particular lexicon causes problems for different approaches to OT syntax.

In order to remedy these problems, we proposed to view a language particular lexicon as an argument in GEN, technically only a small formal adjustment to OT. While creating the possibility of solving the aforementioned problems, this keeps GEN universal. As a possible down-side, the new setup has as a consequence that the lexicon and constraint ranking as explanatory devices may have overlapping domains. We considered this situation in the light of Richness of the Base and of modeling language change and argued that this need not be a problem and may even be an asset of the theory.

This paper has only provided a formal sketch of what the framework should look like with a proper lexicon. Of course, many questions remain. For instance, the (extent of the) interaction between phonological and syntactic constraints offers a vast and mainly uncharted terrain of research. Also, although we assume that the lexicon provides information about the availability of terminals and maps from morpho-syntax to phonology, we have not considered what is specified about these items. An obvious question is whether argument structure should be coded in these lexicons.

Another open question is how the various proposals in the literature could be implemented in the proposed setup. Recasting Grimshaw and Samek-Lodovici's work in our framework offers some possible solutions, but also calls for extra assumptions because of the less restricted nature of the setup. Furthermore, as Kusters' model is compatible with ours, it would be interesting to explore the issues brought forward in his work from a more formal perspective.

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References

Anttila, Arto. 1997. Deriving variation from grammar. In F. Hinskens, R. van Hout, and L. Wetzels, editors, *Variation, change and phonological theory*. Benjamins, Amsterdam.

Boersma, Paul and Bruce Hayes. 2001. Empirical tests of the gradual learning algorithm. *Linguistic Inquiry*, 32(1):45–86.

Bresnan, J. 2001. *Lexical Functional Syntax*. Blackwell Publishers.

Bresnan, Joan. 1999. Explaining morphosyntactic competition. In Mark Baltin and Chris Collins, editors, *Handbook of Contemporary Syntactic Theory*. Oxford: Blackwell Publishers, pages 11–44. Also available on the Rutgers Optimality Archive: (ROA-299-0299).

Bresnan, Joan. 2000. Optimal syntax. In Joost Dekkers, Frank van der Leeuw, and Jeroen de Weijer, editors, *Optimality Theory: Phonology, Syntax and Acquisition*. Oxford University Press, Oxford, pages 334–385.

Bresnan, Joan. 2002. The lexicon in optimality theory. In Suzanne Stevenson and Paola Merlo, editors, *The Lexical Basis of Syntactic Processing: Formal,Computational and Experimental Issues*. John Benjamins, pages 39–58.

Bresnan, Joan and Ashwini Deo. 2001. Grammatical constraints on variation: 'be' in the survey of english dialects and (stochastic) optimality theory. MS. Available on `http://www-lfg.stanford.edu/bresnan/`.

Dixon, R.M., 1982. *Where Have All the Adjectives Gone? and other essays in Semantics and Syntax*, chapter Semantic neutralisation for phonological reasons, pages 235–238. Berlin: Mouton Publishers.

Gazdar, Gerald, Ewan Klein, Geoffrey Pullum, and Ivan Sag. 1985. *Generalized Phrase Structure Grammar*. Blackwell.

Grimshaw, Jane. 1997. Projection, heads, and optimality. *Linguistic Inquiry*, 28:373–422.

Grimshaw, Jane and Vieri Samek-Lodovici. 1998. Optimal subjects and subject universals. In Pilar Barbosa et al., editor, *Is the Best Good Enough?* MIT Press, Cambridge, MA, pages 193–219.

Klein, Henny. 1998. *Adverbs of Degree in Dutch and Related Languages*. John Benjamins, Amsterdam.

Kuhn, Jonas. 2003. *Optimality-Theoretic Syntax—A Declarative Approach*. CSLI Publications, Stanford, CA.

Kusters, Wouter. 2003. *Linguistic Complexity; The Influence of Social Change on Verbal Inflection*. Ph.D. thesis, Landelijke Onderzoeksschool Taalkunde, Utrecht. LOT dissertation series 77.

Legendre, Gérealdine, Paul Smolensky, and Colin Wilson. 2001. When is less more. In Pilar Barbosa, Danny Fox, Paul Hagstrom, Martha McGinnis, and David Pesetsky, editors, *Is the Best Good Enough? Optimality and Compitition in SYntax*. MIT Press, pages 249–289.

Mohanan, Tara and K.P. Mohanan. 2003. Universal and language-particular constraints in ot-lfg. In Miriam Butt and Tracy Holloway King, editors, *The Proceedings of the LFG'03 Conference*. CSLI Publications.

Noyer, Rolf. 1993. Optimal words: Towards a declarative theory of word-formation. MS. Rutgers Optimality Workshop-1.

van Oostendorp, Marc. 2000. Back to the base. on the richness of the base hypothesis. MS. Available on `http://www.vanoostendorp.nl/fonologie.php?lan=en`.

Pollard, Carl and Ivan Sag. 1994. *Head-driven Phrase Structure Grammar*. University of Chigago / CSLI.

Prince, Alan and Paul Smolensky. 1993. *Optimality theory: constraint interaction in generative grammar*. Rutgers University Center for Cognitive Science, Piscataway, NY.

Rice, Curt and Peter Svenonius. 1998. Prosodic V2 in Northern Norwegian. MS. University of Tromsø.

Samek-Lodovici, Vieri. 1996. *Constraints on subjects. An Optimality Theoretic analysis*. Ph.D. thesis, Rutgers University, New Brunswick, NJ.

Sells, Peter. 2003. Morphological and constructional expression and recoverability of verbal features. In C. Orhan Orgun and Peter Sells, editors, *Morphology and the Web of Grammar: Essays in Memory of Steven G. Lapointe*. CSLI Publications.

Smolensky, Paul and Géraldine Legendre. 2005. *The Harmonic Mind: From Neural Computation To Optimality-Theoretic Grammar Vol. 1: Cognitive Architecture; vol. 2: Linguistic and Philosophical Implications*. To appear at MIT Press.

Vangsnes, Øystein. 2004. On wh-questions and v2 across norwegian dialects: a survey and some speculations. In *Working Papers in Scandinavian Syntax 73*. Lund University, Institutionen för nordiska språk.

Westergaard, Marit Richardsen. 2003. Word order in wh-questions in a north norwegian dialect: some evidence from an acquisition study. *Nordic Journal of Linguistics*, 23(1):81–109.

Zwicky, Arnold. 1969. Phonological constraints in syntactic descriptions. *Papers in Linguistics*, pages 411–453.

Zwicky, Arnold M. and Geoffrey K. Pullum. 1986. The principle of phonology-free syntax: introductory remarks. In *Working Papers in Linguistics 32*. The Ohio State University, Columbus, OH, pages 63–91.

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THE "LOST" READING OF CONTROL SENTENCES AND PLURAL SEMANTICS IN GLUE

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Abstract

This paper presents a formal semantic analysis of the plural reading of split control sentences in the context of the propositional theory of control in the framework of LFG and Glue. For sentences that involve a collective controlled verb, the proposed analysis provides, for the first time, an adequate semantic derivation that does not require anaphoric resolution of the understood subject.

Two extensions of the existing frameworks are proposed in order to derive the meaning of such sentences. The concept of *multi-functional control* proposes to represent the contribution of multiple grammatical functions to the understood subject of the controlled sentence as a set of f-structures. Such a set can be assigned non-distributive features that describe the understood subject, such as the semantic number. The meaning of multi-functional control sets is derived using *meta meaning constructors* that extend the semantic derivation process by providing the means to derive the meaning of f-structure sets when the number of set elements is a-priori unknown. We also show how resource sensitivity issues can be resolved by employing the multiplicative fragment of the underlying linear logic.

As an additional result, meta-meaning constructors can be used to solve the problem of coordination of more than two conjuncts.

1 Introduction

Split control sentences such as (1) and (2) are sentences in which both the grammatical subject and object jointly contribute to the meaning of the understood subject. Split control sentences may have a single (plural) reading, as in (1) or both singular and plural readings as in (2) (John may or may not accompany Mary upon leaving the restaurant).

(1) *John persuaded Mary to meet in the restaurant*

(2) *John persuaded Mary to leave the restaurant*

Meaning derivation of split control sentences in LFG's Glue interface is challenging in several respects. The first question to consider is anaphoric vs. functional control. While anaphoric control is commonly used in LFG analyses of equi verbs, some phenomena are better described using functional control. For example, the intransitive verb *meet* requires a semantically plural understood subject, as shown in (3), and this restriction is best described using functional control, as shown in section 3.

(3) (a) ** John tried to meet in the afternoon*
(b) *The committee tried to meet in the afternoon*

Asudeh (to appear) also proposes a functional control analysis for some English equi verbs, but points out that a functional control analysis cannot be used to describe split antecedents, since the understood subject can be shared with only one grammatical function of the matrix sentence. In order to overcome this inherent restriction of functional control, we propose to extend the idea of functional control analysis in a way that would account for split control sentences. In this paper we introduce a *multi-functional control* analysis, that uses a set to represent the contributions of the different grammatical functions to the understood subject.

The next step in the meaning derivation is performed at the semantic level. While the meaning derivation in the property approach (Chierchia, 1984; Dowty, 1985) is straightforward, the propositional approach (Pollard and Sag, 1994; Dalrymple, 2001) poses two kinds of challenges. First, the meaning of the understood subject must be computed, while accounting for the possibility of an unlimited number of set elements. Handling sets of unlimited size is problematic in the current Glue analysis and relies on the use of the '!' (of course) operator. We address this challenge by presenting *meta-meaning constructors* that can also be used to derive the meaning of noun phrase coordination. The second challenge is handling resource sensitivity issues, which is addressed by duplicating the required resources in the multiplicative fragment of the linear logic.

The objective of this work is to provide the formal framework that allows the derivation of the plural reading of sentences such as (1). When such a reading constitutes the only possible reading our framework correctly derives its semantics. In other cases[1] both readings are allowed — the plural reading is derived using our framework and other readings can be derived as alternatives.

The rest of the paper is organized as follows: Section 2 presents the basic background and surveys some relevant work. Section 3 discusses the semantic number of noun phrases and its effect on the grammaticality of control sentences. Section 4 briefly presents the c-structure rules that are used in derivation of control sentences. Section 5 presents the multi-functional control approach. Section 6 presents our approach to the meaning derivation of sets. Section 7 provides the meaning derivation of multi-functional control sentences using meta-meaning constructor that were presented in section 6. Section 8 concludes.

[1] In some cases the plural reading is the preferred, but not the only possible reading.

2 Preliminaries and previous work

2.1 Glue

The standard LFG analysis (Kaplan and Bresnan, 1982; Bresnan, 2001; Dalrymple, 2001; Falk, 2001) represents the sentence as a combination of a constituent (c-)structure and a functional (f-)structure. Since LFG is a syntactic theory, neither structure is intended to represent the meaning of the sentence. The Glue language (Dalrymple, 1999, 2001) provides the bridge between the f-structure and the sentence meaning by providing the means for deriving the sentence meaning from the meanings of its constituents, based on their grammatical function in the f-structure.[2]

Before deriving the meaning, the meaning representation language must be chosen. In this work we use model theoretic semantics (Montague, 1970, 1973) in conjunction with the simply typed λ-calculus (Hindley, 1997) as the meaning representation language. The type system is built from two basic types — the t type represents a truth value and the e type represents an entity in the model's domain. Higher types are build upon these two basic types. Other possibilities for meaning representation language exist as well (e.g., intentional logic (Montague, 1973) and DRT (Kamp, 1981)).

Glue makes use of linear logic (Girard, 1987) in the meaning derivation process. Linear logic is a resource-sensitive logic, which makes Glue meaning derivations resource sensitive too. The essence of a linear resource logic is that each premise must be used exactly once in the derivation. That is, premises cannot be freely discarded or duplicated. For example, in propositional logic, $\{a, a \rightarrow b, a \rightarrow c\} \vdash b$. However the linear logic counterpart doesn't have any valid derivation:

$\{a, a \multimap b, a \multimap c\} \nvdash b$	$a \multimap c$ cannot be discarded
$\{a, a \multimap b, b \multimap c\} \vdash c$	all premises are used exactly once
$\{a, a \multimap b, a \multimap b \multimap c\} \nvdash c$	a cannot be used twice

Glue extends the LFG projections infrastructure by presenting the semantic (s-)structure and a mapping function (σ) that maps elements of the f-structure to elements of the s-structure. The σ-projection of an f-structure is denoted by a σ index (e.g., the σ-projection of some f-structure j is j_σ). Apart from representing the semantic data, s-structures also serve as the premises of the Glue linear logic.[3] Each such premise is then paired with a meaning expression in the meaning representation language through the Curry-Howard isomorphism (Curry and Feys, 1958; Howard, 1980) and such a pair is called a *meaning constructor*. Each derivation step in the linear logic is therefore accompanied by the appropriate function application (or abstraction) on the meaning side.[4]

This work uses the multiplicative fragment of linear logic, which includes the linear implication operator '$\multimap$' and the linear conjunction operator '$\otimes$'. The elimination rules of both operators are used in this work, but only the linear implication introduction rule is needed. Another required operator is the universal quantifier '$\forall$' that operates on the linear logic side of the meaning constructor, while leaving the meaning side intact. The '$\forall$' operator allows the substitution of *any* premise for the quantification variable (an example appears in figure 4; see Asudeh (2004) for a discussion of the proof term invariance for this elimination rule). Just as any other premise, once the universal quantification premise is used, it cannot be used again with a different premise substitute. Appendix A lists all linear logic rules that are used in this work.

Linear logic premises (s-structures) in meaning constructors are semantically typed and these types correspond to the types of the λ-expressions on the meaning side according to the rules of the Curry-Howard isomorphism. Therefore, an additional subscript is attached to the σ projection denotation. For example, the f_{σ_t} notation stands for the σ-projection of the f-structure f, that is associated with the semantic type t. In many cases the type index is omitted in favor of brevity.

Consider for example sentence (4) and the corresponding f-structure that appears in figure 1.

(4) *John loves Mary*

$$f\begin{bmatrix}\text{PRED} & \text{`LOVE<SUBJ,OBJ>'} \\ \text{SUBJ} & j\begin{bmatrix}\text{PRED} & \text{`JOHN'}\end{bmatrix} \\ \text{OBJ} & m\begin{bmatrix}\text{PRED} & \text{`MARY'}\end{bmatrix}\end{bmatrix}$$

Figure 1: The f-structure of *John loves Mary*

(5) $\mathsf{love}(\mathsf{john}, \mathsf{mary})$

[2] Glue is not unique to LFG. Asudeh and Crouch (2002b) describe how Glue can be used to provide semantics for HPSG.
[3] Andrews (2003) proposes to eliminate the semantic projection level, and to use the f-structures as linear logic resources.
[4] In that sense the Glue approach is similar to the approach of categorial grammar (Moortgat, 1997).

A possible meaning of (4) is (5). The meaning constructors that appear in (6) (contributed by the lexical entries) are the inputs to the meaning derivation process. The labels on the left are not part of the Glue formalism, they are used to reference the meaning constructors only.

(6) **[John]** $\mathsf{john} : j_{\sigma_e}$
[Mary] $\mathsf{mary} : m_{\sigma_e}$
[loves] $\lambda x.\lambda y.\mathsf{love}(y, x) : m_{\sigma_e} \multimap (j_{\sigma_e} \multimap f_{\sigma_t})$

Figure 2 shows the derivation proof tree of the meaning of (4), that involves two eliminations of the '$\multimap$' operator and two functional applications on the meaning side. The result is a meaning constructor, that describes the meaning of the sentence *John loves Mary*.

$$\dfrac{\mathsf{john} : j_{\sigma_e} \qquad \dfrac{\lambda x.\lambda y.\mathsf{love}(y, x) : m_{\sigma_e} \multimap (j_{\sigma_e} \multimap f_{\sigma_t}) \qquad \mathsf{mary} : m_{\sigma_e}}{\lambda y.\mathsf{love}(y, \mathsf{mary}) : j_{\sigma_e} \multimap f_{\sigma_t}}\multimap_\varepsilon}{\mathsf{love}(\mathsf{john}, \mathsf{mary}) : f_{\sigma_t}}\multimap_\varepsilon$$

Figure 2: The meaning derivation of *John loves Mary*

The meaning constructors appear in an uninstantiated form in the lexicon.[5] The lexical entries of *John*, *Mary* and *loves* look like:

(7) *John* NP $(\uparrow \textsc{pred}) = \text{`JOHN'}$
$\mathsf{john} : \uparrow_\sigma$

Mary NP $(\uparrow \textsc{pred}) = \text{`MARY'}$
$\mathsf{mary} : \uparrow_\sigma$

loves V $(\uparrow \textsc{pred}) = \text{`LOVE<SUBJ,OBJ>'}$
$\lambda x.\lambda y.\mathsf{love}(y, x) : (\uparrow \textsc{obj})_\sigma \multimap ((\uparrow \textsc{subj})_\sigma \multimap \uparrow_\sigma)$

After the f-structure of the sentence is computed, the meaning constructors are instantiated, in a way similar to the instantiation of the functional equations.

Example (8) demonstrates the use of universal quantification in Glue that is provided by the meaning constructor of *everyone* in (9). The f-structure is presented in figure 3 and the meaning derivation is presented in figure 4. It should be noted that the universal quantifier application is usually implicit. However, in figure 4 the substitution of H by f_σ is shown in detail.

(8) *Everyone walked.*

(9) *everyone* N $(\uparrow \textsc{pred}) = \text{`EVERYONE'}$
$\lambda P.\mathsf{every}(x, \mathsf{person}(x), P(x)) : \forall H.[\uparrow_\sigma \multimap H] \multimap H$

$$f\begin{bmatrix} \textsc{pred} & \text{`WALK<SUBJ>'} \\ \textsc{subj} & g\begin{bmatrix}\textsc{pred} & \text{`EVERYONE'}\end{bmatrix} \end{bmatrix}$$

Figure 3: The f-structure of *Everyone walked*

$$\dfrac{\lambda x.\mathsf{walk}(x) : g_{\sigma_e} \multimap f_{\sigma_t} \qquad \dfrac{\lambda P.\mathsf{every}(x, \mathsf{person}(x), P(x)) : \forall H.[g_{\sigma_e} \multimap H] \multimap H}{\lambda P.\mathsf{every}(x, \mathsf{person}(x), P(x)) : [g_{\sigma_e} \multimap f_{\sigma_t}] \multimap f_{\sigma_t}}(H \Rightarrow f_\sigma)}{\mathsf{every}(x, \mathsf{person}(x), \mathsf{walk}(x)) : f_{\sigma_t}}$$

Figure 4: The meaning derivation of *Everyone walked*

[5] Lexical entries are the primary source of meaning constructors, but c-structure rules can contribute meaning constructors as well (Asudeh and Crouch, 2002a).

2.2 Control

Control sentences can be analyzed as having a subject-less sentence as a complement of the main verb. Such a complement is called the *controlled* sentence, and although it does not have an overt syntactical subject, it has an understood subject (the *controllee*), which contributes to the meaning of the controlled sentence just as a regular subject does. Control sentences can be classified according to the grammatical function that controls the understood subject (the *controller*). *Subject control* (10a) and *object control* (10b) describe sentences in which the controller is a subject or an object of the matrix sentence respectively. *Split antecedent control* (10c) describes sentences in which both grammatical functions control the understood subject.

(10) (a) *John promised Mary to become a writer*

(b) *John persuaded Mary to become a writer*

(c) *John persuaded Mary to meet at the local writers' convention*

Another distinction is made between *obligatory* (*unique*) control (all examples in (10)) and *non-obligatory* (*free*) control (11). The difference between the two lies in the fact that in obligatory control the controller is uniquely determined as a grammatical function of the matrix sentence, which is not the case in non-obligatory control.

(11) *Diane begged Daniel to leave early* [6]

The intransitive verb *meet* requires a semantically plural subject, which also restricts the possible understood subject in control sentences. Therefore (12a) is grammatical (the plural reading is possible), while (12b) is not (plural reading is not possible):

(12) (a) *John persuaded Mary to meet in the restaurant.*

(b) ** John tried to meet in the restaurant*

(c) *Mary agreed to meet in the restaurant*

(d) *? Bad weather persuaded Mary to meet in the restaurant*

It appears that some control verbs, such as *agree*, *prefer* and others, allow underspecification of the understood subject. Landau (2000) calls such a form of control a *partial control* (as opposed to *exhaustive control* in (12a)). Partial control is the reason why (12c) is grammatical, although there is no apparent person that Mary will meet with. If selectional restrictions are used, sentence (12d) can be also considered as exhibiting the properties of partial control, although the control verb is not one of the verbs described by Landau. Partial control poses additional challenges to the meaning derivation of control sentences, but providing the appropriate analysis for partial control is outside the scope of this work.

LFG commonly classifies control verbs as *equi* (the controller has a thematic role in the matrix sentence) and *raising* (the controller does not have a thematic role). This distinction and the question of functional vs. anaphoric control analysis are extensively discussed in the LFG literature (Kaplan and Bresnan, 1982; Bresnan, 1982, 2001; Falk, 2001) and recent work (Asudeh, to appear).

The c-structure of control sentences can be rather complex. Our work only focuses on the level of the functional and semantic structures of control sentences and therefore we assume the simplest treatment of control at the c-structure level. In particular, following Falk (2001), this work uses the informal notation of $\overline{\mathrm{VP}}$ to describe the category of the infinitival *to* constructions.

A comprehensive survey of different control types can be found in Jackendoff and Culicover (2003) and Engh and Kristoffersen (1996) list many other resources. Control has received significant attention in other linguistic theories as well (see Chomsky (1981) for treatment in Government and Binding and Sag and Pollard (1991), later revised in Pollard and Sag (1994, Ch.7) for treatment in HPSG).

2.3 The semantics of control

2.3.1 Propositional and property theories of control

Two major theories provide different semantic analyses for control verbs. One approach (Chierchia, 1984; Dowty, 1985) argues that the control verb's complement denotes a property, and therefore is called the *property approach*. According to this approach, the meaning of (13) is (14):

(13) *John tried to yawn*

[6]Example (11) is example (114) from Jackendoff and Culicover (2003).

(14) $\mathsf{try}(\mathsf{john}, \lambda x.\mathsf{yawn}(x))$

This analysis allows correct inference patterns as described, among other sources, in Asudeh (2002). The second approach is the *propositional approach* (Sag and Pollard, 1991; Pollard and Sag, 1994) that argues that the verb's complement is a proposition, and this approach is also adopted by Dalrymple (2001). In the propositional theory of control the meaning of (13) is

(15) $\mathsf{try}(\mathsf{john}, \mathsf{yawn}(\mathsf{john}))$

Our work was performed in the context of the propositional approach to control.

2.3.2 Current Glue analysis of control

Resource management issues arise when a functional control analysis of equi verbs is combined with the propositional theory of control. Both Dalrymple (2001) and Asudeh (to appear) propose (for different languages) a high order meaning constructor to derive the correct semantics. The lexical entry of a control verb *try* looks like:

(16) *try* V (↑ PRED) = 'TRY<SUBJ,XCOMP>'
(↑ XCOMP SUBJ)=(↑ SUBJ)
$\lambda P.\lambda x.\mathsf{try}(x, P(x))$: $((\uparrow \text{XCOMP SUBJ})_\sigma \multimap (\uparrow \text{XCOMP})_\sigma) \multimap (\uparrow \text{SUBJ})_\sigma \multimap \uparrow_\sigma$

This approach provides a flat semantic derivation, in which the control verb is responsible for explicitly substituting the meaning of the understood subject into the semantic predicate.

In section 5 we propose a more structured analysis, in which the understood subject is specified once only at the f-structure level, through f-structure sharing.

2.4 Plural entities

Plural entities are required to describe collective and cumulative quantification (Scha, 1981) and mass terms (Link, 1983). Plural entities are also needed to represent the meaning of simple sentences like (17)

(17) *John and Mary met.*

which cannot be represented by

(18) * $\mathsf{meet}(\mathsf{john}) \wedge \mathsf{meet}(\mathsf{mary})$

Scha (1981) suggests that entities that represent more than one element should be represented as a set of elements. Each element is of semantic type e, and therefore a set of elements would be of type (e, t). Verb predicates can then operate on atomic elements of type e or on sets of atomic elements of type (e, t). While proposing a solution to the problem of collective and cumulative predication, it requires a model in which the semantic type of plural entities is the same as of nouns and intransitive verbs, which in turn must be raised in order to operate on the plural entities.

Link (1983) proposes a semi-lattice structure to represent the elements of the model. In this approach all elements are of type e, but while some elements represent single entities (like the person John), other represent plural entities (like the two persons, John and Mary). The main advantage of this work highlighted by Link is the ability to correctly represent mass terms (e.g., water) and its ability to correctly describe the "part-of" relation (e.g., the diamond is part of the ring). Other approaches exist apart from these two and Schwarzschild (1996); Landman (2004) as well as other sources provide a comprehensive discussion on the various approaches to the representation of plural entities.

Our account is indifferent to the theory of plurality used. Link's notation is used and no distinction between singular and plural entities is made (both are of the same semantic type 'e'). This allows us to keep the usual type system in which entities (whether they are plural or mass entities) are of the same semantic type (e) and nouns and intransitive verbs are of type (e, t). Additionally, in our approach as it is presented in section 3, there is no need for an atom/set distinction, discussed in Winter (2001, Ch. 5.3), because the validation of the semantic number is performed at the f-structure level, and at the semantic level the lattice entities are all of the same kind and may be either plural or singular.

Disregarding the preferred choice of plural entry representation it is convenient to organize plural entities in a semi-lattice. The $\perp$ entity (corresponding to the empty set if sets are used) and all singular entries are the atoms of the semi-lattice. Plural entities are created using the least upper bound operator of the semi-lattice that is represented by the $\oplus$ symbol. For example the plural entity that represents both John and Mary is $\mathsf{john} \oplus \mathsf{mary}$. In section 7 the $\oplus$ operator is used to derive the plural semantics of multi-functional control sentences.

3 The semantic number

In section 1 we have briefly mentioned that the controlled verb may introduce restrictions on the understood subject. One such restriction is the semantic number restriction (compare the two sentences in (3)). These restrictions are unique in the fact that they cross the boundaries of the controlled sentence and influence directly the matrix sentence. In this section we show that functional control provides a correct analysis of the phenomena. In section 5 we present the multi-functional control approach that provides an analysis of split control sentences that also exhibit the semantic number restriction.

3.1 Linguistic data

The semantic number is a distinct property of noun phrases. For example, a semantic number mismatch is responsible for the ungrammaticality of (19b) and (19c):

(19) (a) *The boys gathered in the old building*
(b) * *Bob met in the park*
(c) * *The girl gathered elsewhere*

All four combinations of syntactic and semantic number values are possible. Syntactic number agreement is still required, as shown in (20b):[7]

(20) (a) *The committee gathers this afternoon*
(b) * *The committee gather this afternoon*
(c) * *The eyeglasses are similar*

The subject of (20a) is syntactically singular, and it agrees with the verb, the form of which is 3rd person, singular. However it is also semantically plural, which is exactly what the verb *gathers* requires as a subject. On the other hand (20b) is ungrammatical because although the noun *committee* is semantically plural, it is syntactically singular, and therefore is does not agree with the verb *gather*. To complete the picture, some verb phrases require a semantically singular subject. Consider for example the difference between the next two sentences:

(21) (a) *The boy is a writer*
(b) * *The committee is a writer*

As mentioned above, the semantic number restriction crosses the boundaries of the controlled sentence. Consider for example the differences between (a) and (b) in:

(22) (a) *The boys planned to gather elsewhere*
(b) * *The girl planned to gather elsewhere*

(23) (a) *The committee seems to meet in the conference room*
(b) * *Bob seems to meet in the conference room*

Despite its name, the semantic number is a syntactic property and no knowledge of the actual number of the committee members is needed in order to determine that (20a) is grammatical. Similar syntactic property was also proposed by Wechsler and Zlatic (2003); Heycock and Zamparelli (to appear).

3.2 The "SEMNUM" feature and functional control

It is possible to model the observations of the previous section by introducing a new feature in the f-structure, the SEMNUM feature. This new feature describes the semantic number of nouns and noun phrases and has two possible values — "SG" for semantically singular nouns, and "PL" for semantically plural nouns. For example, the noun *committee* that is considered syntactically singular and semantically plural will have (NUM: SG) and (SEMNUM: PL), while the word *eyeglasses* which is considered syntactically plural and semantically singular will have (NUM: PL) and (SEMNUM: SG). Heycock and Zamparelli (to appear) propose a similar distinction between syntactic ad semantic number for nouns and noun phrases. The paper proposes two boolean properties: LATT that describes semantic and PLUR that denotes syntactic plurality.

Only a few verbs like the intransitive *meet* and *gather* pose semantical number restrictions on their subject. Therefore, only these verbs require the additional functional equation constraining the semantic number of the subject, and the rest of the verbs in the lexicon remain unchanged. Additionally, as it has been noted in the previous section, the SEMNUM feature is not part of the usual agreement restrictions between the subject and the verb in a sentence.

[7] Example (20c) is inspired by Winter 2001, p. 192.

The functional control analysis accounts for the semantic restriction posed on the understood subject by a controlled verb. Functional control ensures that the local restrictions posed by the controlled verb on its understood subject propagate through f-structure sharing to the controlling grammatical function in the matrix sentence. Consider for example the following control sentence:

(24) *The committee plans to gather (in the afternoon)*

The appropriate lexical entries for the controlled infinitive verb *to gather* and the controlling verb *plans* are presented in (25).[8] Figure 5 presents the full f-structure and the s-structure of the sentence.[9]

(25) *to gather*^{it} $\overline{\text{VP}}$ $(\uparrow \text{PRED}) = \text{'GATHER}<\text{SUBJ}>\text{'}$
$(\uparrow \text{SUBJ SEMNUM}) = \text{PL}$

plans V $(\uparrow \text{PRED}) = \text{'PLAN}<\text{XCOMP,SUBJ}>\text{'}$
$(\uparrow \text{SUBJ NUM}) = \text{SG}$
$(\uparrow \text{XCOMP SUBJ}) = (\uparrow \text{SUBJ})$

$$\left[\begin{array}{ll}
\text{PRED} & \text{'PLAN}<\text{XCOMP,SUBJ}>\text{'} \\
\text{SUBJ} & \left[\begin{array}{ll}
\text{SPEC} & \left[\begin{array}{ll}\text{PRED} & \text{'THE'}\end{array}\right] \\
\text{PRED} & \text{'COMMITTEE'} \\
\text{NUM} & \text{SG} \\
\text{SEMNUM} & \text{PL}
\end{array}\right] \\
\text{XCOMP} & \left[\begin{array}{ll}
\text{PRED} & \text{'GATHER}<\text{SUBJ}>\text{'} \\
\text{SUBJ} & \rule{2cm}{0.4pt}
\end{array}\right]
\end{array}\right]
\xrightarrow{\sigma}
\left[\begin{array}{ll}
\text{VAR} & [\;\;] \\
\text{RESTR} & [\;\;]
\end{array}\right]$$

(a) F-structure (b) S-structure

Figure 5: The f-structure and the s-structure of *The committee plans to gather*

Since the semantic number is in fact a syntactic feature, the meaning constructors of the affected nouns and verbs don't have to change. Lexical entries of representative nouns and a verb appear in (26). Notice that the premises on the linear logic side of the meaning constructor involve internal elements of the s-structures, which themselves are σ-projections of the corresponding f-structures. These meaning constructors are described in detail in Dalrymple (2001, p. 251).

(26) *committee* N $(\uparrow \text{PRED}) = \text{'COMMITTEE'}$
$(\uparrow \text{NUM}) = \text{SG}$
$(\uparrow \text{SEMNUM}) = \text{PL}$
$\lambda x.\mathsf{committee}(x) : (\uparrow_\sigma \text{VAR}) \multimap (\uparrow_\sigma \text{RESTR})$

eyeglasses N $(\uparrow \text{PRED}) = \text{'EYEGLASSES'}$
$(\uparrow \text{NUM}) = \text{PL}$
$(\uparrow \text{SEMNUM}) = \text{SG}$
$\lambda x.\mathsf{eyeglasses}(x) : (\uparrow_\sigma \text{VAR}) \multimap (\uparrow_\sigma \text{RESTR})$

met V $(\uparrow \text{PRED}) = \text{'MEET}<\text{SUBJ}>\text{'}$
$(\uparrow \text{SUBJ SEMNUM}) = \text{PL}$
$\lambda x.\mathsf{meet}(x) : (\uparrow \text{SUBJ})_\sigma \multimap \uparrow_\sigma$

meets V $(\uparrow \text{PRED}) = \text{'MEET}<\text{SUBJ}>\text{'}$
$(\uparrow \text{SUBJ NUM}) = \text{SG}$
$(\uparrow \text{SUBJ SEMNUM}) = \text{PL}$
$\lambda x.\mathsf{meet}(x) : (\uparrow \text{SUBJ})_\sigma \multimap \uparrow_\sigma$

[8]See section 4 for the description of the $\overline{\text{VP}}$ notation.
[9]Figure 5 only shows the outline of the s-structure. In-depth discussion can be found in Dalrymple (2001).

The analysis presented in this section has yet to be extended to account for determiner agreement (Dalrymple and King, 2004) and quantification in order to correctly analyze sentences such as *All committees met* and *Every committee met* (Winter, 2001, p. 202, ex. 34).

4 The c-structure rules

This section presents the main c-structure rules that will be used in the rest of this work. First there is the basic sentence rule, the noun phrase creation rule (Dalrymple, 2001, pg. 156) and the noun phrase coordination rule that will be used in section 6.1.

(27)
$$\text{S} \longrightarrow \underset{(\uparrow \text{SUBJ})=\downarrow}{\text{NP}} \quad \underset{\uparrow=\downarrow}{\text{VP}}$$

$$\text{NP} \longrightarrow \underset{(\uparrow \text{SPEC})=\downarrow}{\text{Det}} \quad \underset{\uparrow=\downarrow}{\text{N}}$$

$$\text{NP} \longrightarrow \underset{\downarrow \in \uparrow}{\text{NP}} \quad \underset{\uparrow=\downarrow}{\text{Cnj}} \quad \underset{\downarrow \in \uparrow}{\text{NP}}$$

The last rule that should be considered is the VP rule. Following Falk (2001) we use the informal notation of $\overline{\text{VP}}$ to describe the category of the *to* constructions.[10] The rules that handle the most relevant VP complements are:

(28)
$$\text{VP} \longrightarrow \underset{\uparrow=\downarrow}{\text{V}} \quad \left(\underset{(\uparrow \text{OBJ})=\downarrow}{\text{NP}}\right) \quad \left(\underset{(\uparrow \text{COMP}|\text{XCOMP})=\downarrow}{\overline{\text{VP}}}\right) \quad \underset{\downarrow \in (\uparrow \text{ADJ})}{\text{PP*}}$$

$$\overline{\text{VP}} \longrightarrow \textit{to} \quad \underset{\uparrow=\downarrow}{\text{VP}}$$

5 Multi-functional control

Consider the plural reading of sentence (1), repeated here for convenience

(29) *John persuaded Mary to meet in the restaurant*

In this plural reading that talks about John and Mary meeting together in the restaurant, the understood subject of the controlled sentence is no longer controlled by a single grammatical function of the matrix sentence. Instead, it is controlled jointly by two grammatical functions of the matrix sentence, its subject and its object.

We propose to describe this phenomenon by representing the understood subject of the controlled sentence by an f-structure that represents both contributors. The f-structure representing the understood subject becomes a set, the elements of which are the matrix subject and object that appear inside the understood subject f-structure via the f-structure sharing mechanism (figure 6). This way, the f-structure of the understood subject can have properties of its own, as is the case with coordination. For example, the syntactic and the semantic number of the understood subject may differ from the corresponding number of its constituents.

The f-structure that represents a multi-functional control analysis of (29) is presented in figure 6. In the f-structure the number properties of the understood subject correctly describe the syntactic and the semantic number of the understood subject.

The multi-functional control structure is created by the functional equations in the control verb's lexical entry. The lexical entry is also responsible for assigning the number feature.[11] We propose the following lexical entry for the verb *persuaded*, that is responsible for creating the f-structure in figure 6:

(30) *persuaded* V
$$\begin{array}{l} (\uparrow \text{PRED}) = \text{`PERSUADE}<\text{SUBJ,OBJ,XCOMP}>\text{'} \\ (\uparrow \text{SUBJ}) \in (\uparrow \text{XCOMP SUBJ}) \\ (\uparrow \text{OBJ}) \in (\uparrow \text{XCOMP SUBJ}) \\ (\uparrow \text{XCOMP SUBJ NUM}) = \text{PL} \\ (\uparrow \text{XCOMP SUBJ SEMNUM}) = \text{PL} \end{array}$$

[10] Refer to Falk (in preparation) for a discussion on the categorization of the infinitival *to*.

[11] An approach that would solve the problem of non-distributive features in noun phrase coordination can be applied to compute the number features of the understood subject. To simplify the analysis multi-functional control assigns plural semantic number to the understood subject.

$$f\left[\begin{array}{lll} \text{PRED} & & \text{‘PERSUADED}<\text{SUBJ,OBJ,XCOMP}>\text{’} \\ \text{SUBJ} & j & \left[\begin{array}{ll}\text{PRED} & \text{‘JOHN’}\\ \text{NUM} & \text{SG}\\ \text{SEMNUM} & \text{SG}\end{array}\right] \\ \text{OBJ} & m & \left[\begin{array}{ll}\text{PRED} & \text{‘MARY’}\\ \text{NUM} & \text{SG}\\ \text{SEMNUM} & \text{SG}\end{array}\right] \\ \text{XCOMP} & l & \left[\begin{array}{lll}\text{PRED} & & \text{‘MEET}<\text{SUBJ}>\text{’}\\ \text{SUBJ} & s & \left[\begin{array}{ll}\text{NUM} & \text{PL}\\ \text{SEMNUM} & \text{PL}\\ \{\ ,\ \} & \end{array}\right]\end{array}\right] \end{array}\right]$$

Figure 6: A multi-functional control analysis of *John persuaded Mary to meet*

The proposed lexical entry for the verb *persuaded* does not replace the existing conventional functional analysis that is suitable for sentences that exhibit simple subject or object control, such as (10b), repeated here for convenience as (31):

(31) *John persuaded Mary to become a writer*

The verb *persuaded* has two lexical entries — the multi-functional entry and the conventional entry. These lexical entries share the common properties of the verb and only the functional equations that define the control features differ between the two.[12] When the LFG analysis is performed both lexical entries are considered. If the semantic number restriction permits conventional functional control it will be used (for example, it is possible for (31), but not for (29)). Additionally, a multi-functional control analysis is attempted that succeeds for (29) but fails for (31), because the multi-functional understood subject disagrees in its semantic number with the verb phrase *to become a writer*:

(32) *become a writer* VP $(\uparrow \text{PRED}) = \text{‘BECOME-A-WRITER}<\text{SUBJ}>\text{’}$
$(\uparrow \text{SUBJ SEMNUM}) = \text{SG}$

For sentences such as (2), both analyses will succeed, and the result is two possible f-structures that describe the sentence. As a direction for future research, it should be possible to generalize the multi-functional analysis to correctly analyze conventional functional control sentences as having a single element in the understood subject set, assuming the ability to compute the semantic number of such a set.

6 Plural meaning of sets

In this section we present our approach to meaning derivation of sets. In this paper we are mostly interested with the application to multi-functional control, but the most immediate application is probably to coordination. While our approach is formulated in such a way that it can suit other types of coordination as well, we focus on the issue of noun-phrase coordination, since it is most close to the problem of deriving the meaning of multi-functional control sentences.

6.1 The case of noun-phrase coordination

6.1.1 Current analysis

Consider for example the following sentence that involves noun phrase coordination:

(33) *John, Philip, Mary and Susan walked.*

The corresponding f-structure (based on Dalrymple 2001) is shown in figure 7.

Now that an f-structure has been created, the semantic meaning can be derived using the Glue framework. We would like to build a meaning constructor that consumes all set elements' semantic projections and produces the semantic projection of the subject, with the appropriate meaning achieved through the Curry-Howard isomorphism. However, the number of set

[12]Dalrymple et al. (2004) propose notational mechanism that will allow sharing of the common properties between the two alternative entries.

$$f\left[\begin{array}{ll} \text{PRED} & \text{`WALK}\langle\text{SUBJ}\rangle\text{'} \\ \text{SUBJ} & g\left[\begin{array}{l} \text{CONJ} \quad \text{AND} \\ \left\{\begin{array}{l} j\left[\text{PRED} \quad \text{`JOHN'}\right] \\ p\left[\text{PRED} \quad \text{`PHILIP'}\right] \\ m\left[\text{PRED} \quad \text{`MARY'}\right] \\ s\left[\text{PRED} \quad \text{`SUSAN'}\right] \end{array}\right\} \end{array}\right] \end{array}\right]$$

Figure 7: The f-structure of *John, Philip, Mary and Susan walked*

elements is unknown at the time the lexicon is designed and meaning constructors that appear in the lexicon cannot deal with a variable number of Glue premises.

Some techniques have been proposed to cope with this problem. Dalrymple (2001, Ch. 13) proposes to attach two meaning constructors to the lexical entry of *and*. The first (**[g-and]**) is responsible for picking two arbitrary elements from the set and computing their conjunction. The second meaning constructor (**[g-and2]**) is responsible for consuming the rest of the set elements and producing the final meaning of the subject. This meaning constructor (**[g-and2]**) is defined with the '!' linear logic operator that suspends resource sensitivity limitations of this meaning constructor and allows to use it an unlimited number of times. This is a major drawback of this approach, since it complicates the Glue derivation, while the actual number of uses is known, and it is the number of set elements. Another approach proposed by Asudeh and Crouch (2002a) attempts to solve the problem by presenting meaning constructors in c-structure rules, and allow c-structure operators, such as the Kleene star to duplicate them as well. A drawback of this approach is having (complex) meaning constructors in c-structures, while most meaning constructors are provided by the lexicon.

6.1.2 Our analysis

We propose a different approach that handles both the noun-phrase coordination and multi-functional control (section 5). We take advantage of the fact that the semantic meaning derivation can be done in three consecutive steps. First, the c-structure and the f-structure are created. Next, the semantic projections are computed and meaning constructors are instantiated. As a last step, Glue logic rules are applied to the meaning constructors.

While the first and the last steps are performed in the frameworks external to Glue (LFG itself and linear logic), the second step can be extended to enrich the expressive power of the meaning constructors.

We propose to allow the creation of meaning constructors using constructs similar to templates or macros[13] in programming languages. Such a template, which we call a *meta-meaning constructor* would allow us to create a meaning constructor, based on the knowledge of the whole f-structure, as opposed to specifying the meaning constructors in the lexicon, where the f-structure context information is, of course, not available. Specifically, when the meta-meaning constructor is instantiated, the number of set elements is already known, while information of that kind is usually not available at the time the lexicon is created. After instantiation, the meta-meaning constructor becomes a regular meaning constructor that is used in derivation as usual.

The meta-meaning constructor for noun phrase coordination of some set S is defined as:

$$Coord(S) = \lambda x_1. \ldots \lambda x_n . x_1 \oplus \ldots \oplus x_n : (S \in)_{\sigma_e} \multimap \ldots \multimap (S \in)_{\sigma_e} \multimap S_{\sigma e}$$

The set S is the parameter of the noun phrase coordination meta-meaning constructor. When the meta-meaning constructor appears in the lexical entry of *and*, the mother node meta-variable appears as the parameter. After the f-structure has been instantiated the meta-variable is substituted by the actual f-structure set. The lexical entry of the noun-phrase coordinating *and* is:

(34) *and*$^{\text{NP}}$ Cnj ($\uparrow$ CONJ) = AND
$Coord(\uparrow)$

[13] Asudeh and Crouch (2002a) mentions the possible application of *macros* to provide linguistic generalizations, but no details are provided.

After the f-structure has been created (see figure 7) the actual f-structure set g is substituted as the parameter of the meaning constructor. The result, that reflects the number of g's set elements is

$$Coord(g) = \lambda x_1.\lambda x_2.\lambda x_3.\lambda x_4.x_1 \oplus x_2 \oplus x_3 \oplus x_4 : (S \in)_{\sigma_e} \multimap (S \in)_{\sigma_e} \multimap (S \in)_{\sigma_e} \multimap (S \in)_{\sigma_e} \multimap S_{\ e}$$
$$Coord(g) = \lambda x_1.\lambda x_2.\lambda x_3.\lambda x_4.x_1 \oplus x_2 \oplus x_3 \oplus x_4 : j_e \multimap p_e \multimap m_e \multimap s_e \multimap g_e$$

It should be mentioned that if the set g consisted of only two f-structures, the result would be the same meaning constructor as in the lexical entry of *and*, proposed by (Dalrymple, 2001).

6.1.3 Coordinating quantified nouns phrases

With meta-meaning constructors, quantified noun phrases are analyzed in same way as before. Consider, for example, the following sentence:

(35) *John, Mary, a professor and Susan walked.*

The corresponding f-structure is presented in figure 8:

$$f\begin{bmatrix} \text{PRED} & \text{`WALK<SUBJ>'} \\ \text{SUBJ} & g\begin{bmatrix} \text{CONJ} & \text{AND} \\ \multicolumn{2}{l}{\left\{\begin{array}{l} j\begin{bmatrix}\text{PRED} & \text{`JOHN'}\end{bmatrix} \\ m\begin{bmatrix}\text{PRED} & \text{`MARY'}\end{bmatrix} \\ p\begin{bmatrix}\text{PRED} & \text{`PROFESSOR'} \\ \text{SPEC} & \text{`A'}\end{bmatrix} \\ s\begin{bmatrix}\text{PRED} & \text{`SUSAN'}\end{bmatrix}\end{array}\right\}} \end{bmatrix} \end{bmatrix}$$

Figure 8: The f-structure of *John, Mary, a professor and Susan walked*

In order to instantiate the meaning constructor for *and* the $Coord$ meta-meaning constructor is applied on the f-structure set g. The result is the meaning constructor **[and]** that appears in (36)[14] along with the complete list of all instantiated meaning constructors.

(36)
[John] $\text{john} : j_\sigma$
[Mary] $\text{mary} : m_\sigma$
[a professor] $\lambda Q.\text{a}(x, \text{professor}(x), Q(x)) : \forall H.[p_\sigma \multimap H] \multimap H$
[Susan] $\text{susan} : s_\sigma$
[and] $\lambda x_1.\lambda x_2.\lambda x_3.\lambda x_4.x_1 \oplus x_2 \oplus x_3 \oplus x_4 : m_\sigma \multimap p_\sigma \multimap j_\sigma \multimap s_\sigma \multimap g_\sigma$
[walked] $\lambda x.\text{walked}(x) : g_\sigma \multimap f_\sigma$

Figure 9 shows the complete meaning derivation of (35). Note that if more than one quantified noun phrase occurred in the sentence, the semantic analysis would become naturally ambiguous.

6.2 Set coordination for other phrase types

The approach introduced in section 6.1 can be applied to sentence level (S) coordination with the only differences being the semantic type (which is now t), the coordination operator (propositional $\wedge$) and the f-structure label. Consider sentence (37) with figure 10 showing the appropriate f-structure.

(37) *John smiled, Mary laughed and Susan giggled.*

In order to accommodate additional semantic types and coordination operators, we generalize the coordination meta-meaning constructor. The new constructor is generic with respect to three parameters: the f-structure set being coordinated, the semantic coordination operator and the semantic types of the set elements' semantic projections. The generic set coordination

[14]We do not analyze the internal structure of the quantified noun phrase. A detailed analysis can be found in Dalrymple (2001).

$$
\dfrac{\dfrac{\textbf{[a professor]}}{\lambda Q.\mathsf{a}(x, \mathsf{professor}(x), Q(x)) : \forall H.[p_\sigma \multimap H] \multimap H} \qquad \dfrac{\dfrac{\dfrac{\textbf{[walked]}}{\lambda x.\mathsf{walked}(x) : g_\sigma \multimap f_\sigma} \qquad \dfrac{\dfrac{\textbf{[Susan]}}{\mathsf{susan} : s_\sigma} \qquad \dfrac{\dfrac{\textbf{[John]}}{\mathsf{john} : j_\sigma} \qquad \dfrac{z : [p_\sigma] \qquad \dfrac{\dfrac{\textbf{[Mary]}}{\mathsf{mary} : m_\sigma} \qquad \dfrac{\textbf{[and]}}{\lambda x_1.\lambda x_2.\lambda x_3.\lambda x_4.x_1 \oplus x_2 \oplus x_3 \oplus x_4 : m_\sigma \multimap p_\sigma \multimap j_\sigma \multimap s_\sigma \multimap g_\sigma}}{\lambda x_2.\lambda x_3.\lambda x_4.\mathsf{mary} \oplus x_2 \oplus x_3 \oplus x_4 : p_\sigma \multimap j_\sigma \multimap s_\sigma \multimap g_\sigma}}{\lambda x_3.\lambda x_4.\mathsf{mary} \oplus z \oplus x_3 \oplus x_4 : j_\sigma \multimap s_\sigma \multimap g_\sigma}}{\lambda x_4.\mathsf{mary} \oplus z \oplus \mathsf{john} \oplus x_4 : s_\sigma \multimap g_\sigma}}{\mathsf{mary} \oplus z \oplus \mathsf{john} \oplus \mathsf{susan} : g_\sigma}}{\mathsf{walked}(\mathsf{mary} \oplus z \oplus \mathsf{john} \oplus \mathsf{susan}) : f_\sigma}}{\lambda z.\mathsf{walked}(\mathsf{mary} \oplus z \oplus \mathsf{john} \oplus \mathsf{susan}) : p_\sigma \multimap f_\sigma}\ (I)}{\mathsf{a}(x, \mathsf{professor}(x), \mathsf{walked}(\mathsf{mary} \oplus x \oplus \mathsf{john} \oplus \mathsf{susan})) : f_\sigma}\ (H \Rightarrow f_\sigma, \multimap_{\mathcal{E}})
$$

Figure 9: The semantic derivation of *John, Mary, a professor and Susan walked*

$$
f\left[\begin{array}{ll}
\text{CONJ} & \text{AND} \\
 & \left\{\begin{array}{l}
s\left[\begin{array}{ll}\text{PRED} & \text{‘SMILE<SUBJ>’} \\ \text{SUBJ} & \left[\text{PRED} \quad \text{‘JOHN’}\right]\end{array}\right] \\
l\left[\begin{array}{ll}\text{PRED} & \text{‘LAUGH<SUBJ>’} \\ \text{SUBJ} & \left[\text{PRED} \quad \text{‘MARY’}\right]\end{array}\right] \\
g\left[\begin{array}{ll}\text{PRED} & \text{‘GIGGLE<SUBJ>’} \\ \text{SUBJ} & \left[\text{PRED} \quad \text{‘SUSAN’}\right]\end{array}\right]
\end{array}\right\}
\end{array}\right]
$$

Figure 10: The f-structure of *John smiled, Mary laughed and Susan giggled.*

meta-meaning constructor for some set f, elements of which have semantic projection type τ that uses the ‘$\odot$’ coordination operator is defined as:

$$Coord(f, \odot, \tau) = \lambda x_1. \ldots \lambda x_n.x_1 \odot \ldots \odot x_n : (f\in)_{\sigma_\tau} ⊸ \ldots ⊸ (f\in)_{\sigma_\tau} ⊸ f_{\sigma_\tau}.$$

For sentence (37) the meta-meaning constructor is instantiated with set f, semantic type t and semantic coordination operator $\wedge_t$ and can be now used in the meaning derivation:

$$\lambda x_1.\lambda x_2.\lambda x_3.x_1 \wedge x_2 \wedge x_3 : s_{\sigma_t} ⊸ (l_{\sigma_t} ⊸ (g_{\sigma_t} ⊸ f_{\sigma_t}))$$

While meta-meaning constructors may not be the ultimate answer to the issue of coordination in natural languages, they can help the lexicon designer to better organize the (structured) lexicon, and assist in the meaning derivation of control sentences.

7 The semantics of multi-functional control

7.1 The semantics of the understood subject

In order to derive the meaning of the understood subject of the controlled sentence in (29) (the f-structure appears in figure 6) we use the $Coord$ meta-meaning constructor introduced in section 6.2. In order to use the meta-meaning constructor we add the following element to the multi-functional lexical entry of *persuade* in (30):

(38) $Coord((\uparrow \text{XCOMP SUBJ}), \oplus_e, e)$

After instantiation (recall that j and m are elements of s), it becomes:

(39) **[coord]** $\lambda x_1.\lambda x_2.x_1 \oplus x_2 : j_\sigma ⊸ (m_\sigma ⊸ s_\sigma)$

When the coordination meaning constructor is combined with the meaning constructors of *John* and *Mary*

(40) **[John]** john : j_σ
[Mary] mary : m_σ

the meaning of the understood subject can be derived, as shown in figure 11.

$$
\dfrac{\dfrac{\textbf{[Mary]}}{\text{mary} : m_\sigma} \qquad \dfrac{\dfrac{\textbf{[John]}}{\text{john} : j_\sigma} \qquad \dfrac{\textbf{[coord]}}{\lambda x_1.\lambda x_2.x_1 \oplus x_2 : j_\sigma ⊸ (m_\sigma ⊸ s_\sigma)}}{\lambda x_2.\text{john} \oplus x_2 : m_\sigma ⊸ s_\sigma}}{\text{john} \oplus \text{mary} : s_\sigma}
$$

Figure 11: The derivation of the understood subject meaning

The meaning derivation of the understood subject is only the first step in the meaning derivation process. In the next steps the meaning of the understood subject is used to derive the meaning of the controlled sentence, which in turn is used to derive the meaning of the whole sentence. The complete derivation appears in figure 15.

7.2 Multi-functional control and resource sensitivity

7.2.1 Control sentences and resource deficit

The meaning derivation of the understood subject, presented in the previous section, has consumed the resources that represented the meanings of the controllers *John* and *Mary*. Since a resource that was consumed cannot be used again for the derivation of the meaning of the whole sentence, the derivation of the whole sentence will fail. Such a situation is called a *resource deficit*.

Two approaches have been proposed to deal with such a resource scarcity. The first is the "paths as resources" approach (Kehler et al., 1999). In this approach it is possible for a verb to consume a path that leads to the semantic projection, and not the projection itself. This way, shared resources can be consumed the number of times they are shared in the f-structure, and solve the resource deficit problem. However this approach appears to fail when it comes to some control verbs. For example, the f-structure (Dalrymple, 2001; Asudeh, to appear) for a sentence like

(41) *David seems to leave*

shares the subject of the main sentence with the subject of the controlled sentence. However, the semantic projection of the shared subject is consumed only once, by the controlled verb. If the "paths as resources" approach would be applied here, there would be an unused resource which would cause the whole derivation to fail.

When it comes to equi, similar problem exists in property theory of control.[15] The subject of the main sentence is shared with the subject of the controlled sentence, and according to this theory two resources are introduced. Yet, the semantic subject of the controlled sentence is never consumed in the property theory, which again, leaves an unused resource.

The second approach, proposed by Asudeh (2002, to appear) is to "get in charge" of the problem, by using high order types. This approach claims that if a control verb is responsible for establishing the sharing via its functional equations, it should be responsible for dealing with it in its meaning constructor. That is, the control verb's meaning constructor expects to receive all its grammatical functions that contribute to its meaning. The meaning side of the meaning constructor will take care of substituting the right meaning into the understood subject's position. According to this approach, the meaning constructor of the multi-functional version of *persuaded*, would look like

$$\lambda x.\lambda.y.\lambda P.\mathsf{persuade}(x, y, P(x \oplus y)) : ((\uparrow \text{XCOMP SUBJ})_\sigma \multimap (\uparrow \text{XCOMP})_\sigma) \multimap ((\uparrow \text{SUBJ})_\sigma \multimap ((\uparrow \text{OBJ})_\sigma \multimap \ \uparrow_\sigma))$$

The disadvantage of this approach is that it proposes a flat analysis of the sentence that ignores the complex f-structure almost completely. For example, a meaning constructor, the right side of which corresponds to the understood subject $(\uparrow \text{XCOMP SUBJ})_\sigma$ does not occur in the derivation.

7.2.2 Resource management

In order to handle these resource sensitivity issues we step outside the implicational fragment of the linear logic. In this section we propose the means to produce additional copies of Glue premises in a controlled manner. The resource management rules which are based on the rules in Asudeh (2004), use the linear conjunction '$\otimes$' operator, with the corresponding use of the '$\times$' operator on the meaning side. For example, the following meaning constructor, when added to the lexical entry of *persuaded* will create another copy of the matrix subject:

(42) $\lambda a.a \times a : (\uparrow \text{SUBJ})_\sigma \multimap ((\uparrow \text{SUBJ})_\sigma \otimes (\uparrow \text{SUBJ})_\sigma)$

This way, the matrix subject can contribute to the meaning of the understood subject of the controlled sentence and still be used as the subject of the matrix verb. The instantiated version of this meaning constructor for sentence (29), based on the f-structure in figure 6, is presented below along with the meaning constructor of the subject. Figure 12 presents the derivation of the duplicated subject meaning.

(43) **[John]** $\mathsf{john} : j_\sigma$
[subjdup] $\lambda a.a \times a : j_\sigma \multimap (j_\sigma \otimes j_\sigma)$

$$\dfrac{\dfrac{\textbf{[john]}}{\mathsf{john} : j_\sigma} \qquad \dfrac{\textbf{[subjdup]}}{\lambda a.a \times a : j_\sigma \multimap (j_\sigma \otimes j_\sigma)}}{\mathsf{john} \times \mathsf{john} : j_\sigma \otimes j_\sigma}$$

Figure 12: The duplication of the matrix subject meaning constructor

The newly created meaning constructor cannot be simply split into two meaning constructors. The conjunction elimination rule (Asudeh, 2004) shown in figure 13 must be used.[16] The result can be β-reduced using the rule in (44).

[15]We mention it here although the work focuses on the propositional theory of control.
[16]All linear logic rules used in this work appear in Appendix A.

$$\dfrac{\begin{matrix} & [x:A]^1\ [y:B]^2 \\ \vdots & \vdots \\ a:A\otimes B & f:C \end{matrix}}{\text{let } a \text{ be } x\times y \text{ in } f:C}\ \otimes_{\varepsilon,1,2}$$

Figure 13: The linear conjunction elimination rule

(44) let $a \times b$ be $x \times y$ in $f \quad \Rightarrow_\beta \quad f[a/x, b/y]$

In the resource management approach we use the fact that systematic mismatches between representation levels are possible in Glue. Hence, resource duplication is induced by the f-structure sharing rules, but is not mandatory. This allows a fine grained control over resource duplication, as opposed to the "paths as resources" approach of Kehler et al. (1999) discussed earlier.

In order to derive the meaning of (29), both f-structure sharings must be realized with resource duplication constructors. Therefore another meaning constructor, similar to (42) that duplicates the object's meaning is required in the lexical entry of *persuaded*. The full derivation of a multi-functional control sentence is presented in the next section.

7.3 Complete derivation

In this section we present the complete meaning derivation of the sentence *John persuaded Mary to meet (in the restaurant)*. For this sentence, the plural reading (i.e., both John and Mary will be meeting) is the only possible reading. The derivation here is presented from the basic lexical entries, up to the full propositional meaning derivation.

7.3.1 The lexical entries

These are the lexical entries that belong to the above sentence:

John	NP	$(\uparrow \textsc{pred}) = \text{`}\textsc{john}\text{'}$ $(\uparrow \textsc{num}) = \textsc{sg}$ $(\uparrow \textsc{semnum}) = \textsc{sg}$ $\mathsf{john} : \uparrow_\sigma$
Mary	NP	$(\uparrow \textsc{pred}) = \text{`}\textsc{mary}\text{'}$ $(\uparrow \textsc{num}) = \textsc{sg}$ $(\uparrow \textsc{semnum}) = \textsc{sg}$ $\mathsf{mary} : \uparrow_\sigma$
meet^{it}	V	$(\uparrow \textsc{pred}) = \text{`}\textsc{meet}<\textsc{subj}>\text{'}$ $(\uparrow \textsc{subj semnum}) = \textsc{pl}$ $\lambda x.\mathsf{meet}(x) : (\uparrow \textsc{subj})_\sigma \multimap \uparrow_\sigma$
persuade	V	$(\uparrow \textsc{pred}) = \text{`}\textsc{persuade}<\textsc{xcomp,subj,obj}>\text{'}$ $\left.\begin{array}{l}(\uparrow \textsc{xcomp subj semnum}) = \textsc{pl}\\ (\uparrow \textsc{xcomp subj num}) = \textsc{pl}\\ (\uparrow \textsc{subj}) \in (\uparrow \textsc{xcomp subj})\\ (\uparrow \textsc{obj}) \in (\uparrow \textsc{xcomp subj})\end{array}\right\}$ *set creating constraints* $\left.\begin{array}{l}\lambda a.a \times a : (\uparrow \textsc{subj})_\sigma \multimap ((\uparrow \textsc{subj})_\sigma \otimes (\uparrow \textsc{subj})_\sigma)\\ \lambda a.a \times a : (\uparrow \textsc{obj})_\sigma \multimap ((\uparrow \textsc{obj})_\sigma \otimes (\uparrow \textsc{obj})_\sigma)\end{array}\right\}$ *resource management* $Coord((\uparrow \textsc{xcomp subj}), \oplus, e)$ $\lambda P.\lambda y.\lambda x.\mathsf{persuade}(x, y, P) : (\uparrow \textsc{xcomp})_\sigma \multimap [(\uparrow \textsc{obj})_\sigma \multimap [(\uparrow \textsc{subj})_\sigma \multimap \uparrow_\sigma]]$

Recall that the $Coord$ meaning meta-constructor is defined by:

$$Coord(f, \odot, \tau) = \lambda x_1 \ldots \lambda x_n . x_1 \odot \ldots \odot x_n : \underbrace{(f\in)_{\sigma_\tau} \multimap \ldots \multimap (f\in)_{\sigma_\tau}}_{|f|\ \textit{times}} \multimap f_{\sigma_\tau}$$

7.3.2 The c/f-structure correspondence

As the first step of the derivation the c-structure tree is built using the rules described in section 4 and the ϕ-projection is computed to create the f-structure. Figure 14 shows both structures and the ϕ-projection function.

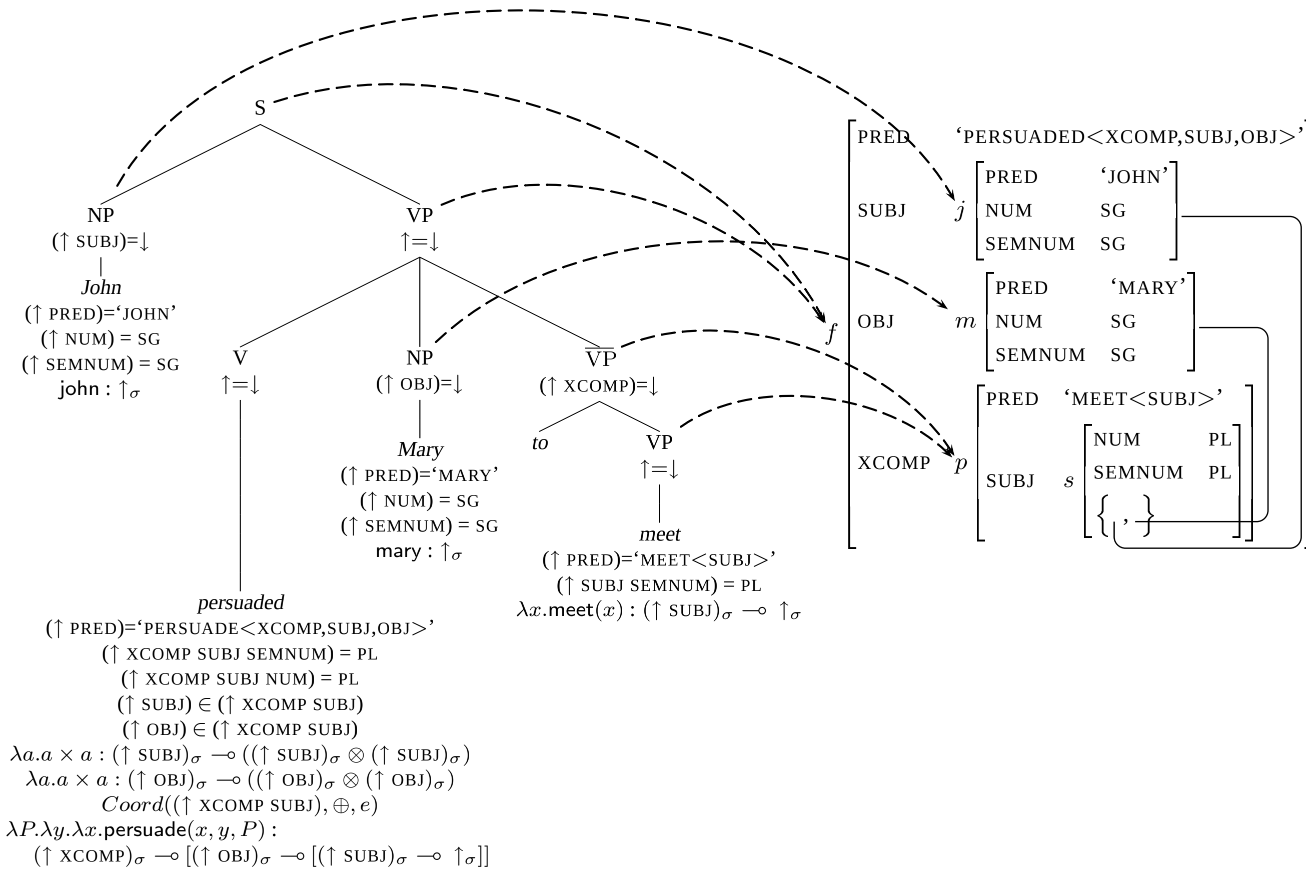

Figure 14: The c/f-structures of *John persuaded Mary to meet*

7.3.3 Instantiating the meaning constructors

After the f-structure has been created, meaning constructors are instantiated. The meaning constructors introduced by *John*, *Mary* and *meet* are instantiated in the same way they were instantiated in regular functional control, because they indeed didn't change:

(45) **[john]** $\textsf{john} : j_\sigma$
[mary] $\textsf{mary} : m_\sigma$
[meet] $\lambda x.\textsf{meet}(x) : s_\sigma \multimap p_\sigma$

The control verb *persuade* introduces several meaning constructors. First, the uninstantiated resource management meaning constructors in (46) are instantiated to become the meaning constructors in (47)

(46) $\lambda a.a \times a : (\uparrow \textsc{subj})_\sigma \multimap ((\uparrow \textsc{subj})_\sigma \otimes (\uparrow \textsc{subj})_\sigma)$
$\lambda a.a \times a : (\uparrow \textsc{obj})_\sigma \multimap ((\uparrow \textsc{obj})_\sigma \otimes (\uparrow \textsc{obj})_\sigma)$

(47) **[subjdup]** $\lambda a.a \times a : j_\sigma \multimap (j_\sigma \otimes j_\sigma)$
[objdup] $\lambda a.a \times a : m_\sigma \multimap (m_\sigma \otimes m_\sigma)$

Next, the internal coordination meaning constructor is instantiated. After substituting the actual parameters into the $Coord$ meta-meaning constructor and picking the set elements for the corresponding positions, it becomes:

(48) **[coord]** $\lambda x_1.\lambda x_2.x_1 \oplus x_2 : j_\sigma \multimap (m_\sigma \multimap s_\sigma)$

Last but not least is the meaning constructor that generates the meaning of the whole sentence. It is instantiated as usual, and the result is

(49) **[persuade]** $\lambda P.\lambda y.\lambda x.\mathsf{persuade}(x, y, P) : p_\sigma \multimap (m_\sigma \multimap (j_\sigma \multimap f_\sigma))$

To summarize this step, all 7 instantiated meaning constructors are listed again for reference:

(50)	**[john]**	$\mathsf{john} : j_\sigma$
	[mary]	$\mathsf{mary} : m_\sigma$
	[meet]	$\lambda x.\mathsf{meet}(x) : s_\sigma \multimap p_\sigma$
	[subjdup]	$\lambda a.a \times a : j_\sigma \multimap (j_\sigma \otimes j_\sigma)$
	[objdup]	$\lambda a.a \times a : m_\sigma \multimap (m_\sigma \otimes m_\sigma)$
	[coord]	$\lambda x_1.\lambda x_2.x_1 \oplus x_2 : j_\sigma \multimap (m_\sigma \multimap s_\sigma)$
	[persuade]	$\lambda P.\lambda y.\lambda x.\mathsf{persuade}(x, y, P) : p_\sigma \multimap (m_\sigma \multimap (j_\sigma \multimap f_\sigma))$

7.4 Glue derivation

After all meaning constructors have been instantiated, Glue logic rules are applied to derive the meaning of the sentence. Due to lack of space, the derivation is presented in parts that are eventually combined into the complete linear logic proof. Following that, the full derivation tree is presented in a smaller font size in figure 16.

$$\dfrac{\dfrac{[B : m_\sigma]^2 \quad \dfrac{[A : j_\sigma]^1 \quad \dfrac{\textbf{[coord]}}{\lambda x_1.\lambda x_2.x_1 \oplus x_2 : j_\sigma \multimap (m_\sigma \multimap s_\sigma)}}{\lambda x_2.A \oplus x_2 : m_\sigma \multimap s_\sigma}}{A \oplus B : s_\sigma} \quad \dfrac{\textbf{[meet]}}{\lambda x.\mathsf{meet}(x) : s_\sigma \multimap p_\sigma}}{\mathsf{meet}(A \oplus B) : p_\sigma}$$

$$\dfrac{[C : j_\sigma]^3 \quad \dfrac{[D : m_\sigma]^4 \quad \dfrac{\mathsf{meet}(A \oplus B) : p_\sigma \quad \dfrac{\textbf{[persuade]}}{\lambda P.\lambda y.\lambda x.\mathsf{persuade}(x, y, P) : p_\sigma \multimap (m_\sigma \multimap (j_\sigma \multimap f_\sigma))}}{\lambda y.\lambda x.\mathsf{persuade}(x, y, \mathsf{meet}(A \oplus B)) : m_\sigma \multimap (j_\sigma \multimap f_\sigma)}}{\lambda x.\mathsf{persuade}(x, D, \mathsf{meet}(A \oplus B)) : j_\sigma \multimap f_\sigma}}{\mathsf{persuade}(C, D, \mathsf{meet}(A \oplus B)) : f_\sigma}$$

$$\dfrac{\dfrac{\dfrac{\dfrac{\textbf{[john]}}{\mathsf{john} : j_\sigma} \quad \dfrac{\textbf{[subjdup]}}{\lambda a.a \times a : j_\sigma \multimap (j_\sigma \otimes j_\sigma)}}{\mathsf{john} \times \mathsf{john} : j_\sigma \otimes j_\sigma} \quad \dfrac{\dfrac{\mathsf{persuade}(C, D, \mathsf{meet}(A \oplus B)) : f_\sigma \quad \dfrac{\dfrac{\textbf{[mary]}}{\mathsf{mary} : m_\sigma} \quad \dfrac{\textbf{[objdup]}}{\lambda a.a \times a : m_\sigma \multimap (m_\sigma \otimes m_\sigma)}}{\mathsf{mary} \times \mathsf{mary} : m_\sigma \otimes m_\sigma}}{\mathsf{let\ mary} \times \mathsf{mary\ be}\ B \times D\ \mathsf{in\ persuade}(C, D, \mathsf{meet}(A \oplus B))} \otimes_{\varepsilon,2,4}}{\mathsf{persuade}(C, \mathsf{mary}, \mathsf{meet}(A \oplus \mathsf{mary})) : f_\sigma} \Rightarrow_\beta}{\mathsf{let\ john} \times \mathsf{john\ be}\ A \times C\ \mathsf{in\ persuade}(C, \mathsf{mary}, \mathsf{meet}(A \oplus \mathsf{mary}))} \otimes_{\varepsilon,1,3}}{\mathsf{persuade}(\mathsf{john}, \mathsf{mary}, \mathsf{meet}(\mathsf{john} \oplus \mathsf{mary})) : f_\sigma} \Rightarrow_\beta$$

Figure 15: Glue derivation of *John persuaded Mary to meet*

8 Conclusion

In this paper we have presented the multi-functional control analysis of split control sentences such as *John persuaded Mary to meet in the restaurant.* The multi-functional control analysis represents the understood subject of the controlled sentence at the f-structure level as a set, that consists of the grammatical functions that contribute to the meaning of the understood subject. In order to derive the meaning of the understood subject, meaning meta-constructors, that allow the template-like specification of meaning constructors, were presented. We have also presented how meaning meta-constructors can be used in the analysis of noun-phrase and sentence level coordination.

While both extensions to the LFG Glue formalism were presented in order to solve the problem of the lost plural reading, we believe that these extensions can be applicable to the semantic derivation of other constructs as well.

$$
\dfrac{\dfrac{\dfrac{\textbf{[john]}}{\mathsf{john} : j_\sigma} \quad \dfrac{\textbf{[subjdup]}}{\lambda a.a \times a : j_\sigma \multimap (j_\sigma \otimes j_\sigma)}}{\mathsf{john} \times \mathsf{john} : j_\sigma \otimes j_\sigma} \quad \dfrac{\dfrac{\dfrac{\dfrac{\textbf{[mary]}}{\mathsf{mary} : m_\sigma} \quad \dfrac{\textbf{[objdup]}}{\lambda a.a \times a : m_\sigma \multimap (m_\sigma \otimes m_\sigma)}}{\mathsf{mary} \times \mathsf{mary} : m_\sigma \otimes m_\sigma} \quad \dfrac{[C : j_\sigma]^3 \quad \dfrac{[D : m_\sigma]^4 \quad \dfrac{\dfrac{\dfrac{[B : m_\sigma]^2 \quad \dfrac{[A : j_\sigma]^1 \quad \dfrac{\textbf{[coord]}}{\lambda x_1.\lambda x_2.x_1 \oplus x_2 : j_\sigma \multimap (m_\sigma \multimap s_\sigma)}}{\lambda x_2.A \oplus x_2 : m_\sigma \multimap s_\sigma}}{A \oplus B : s_\sigma} \quad \dfrac{\textbf{[meet]}}{\lambda x.\mathsf{meet}(x) : s_\sigma \multimap p_\sigma}}{\mathsf{meet}(A \oplus B) : p_\sigma} \quad \dfrac{\textbf{[persuade]}}{\lambda P.\lambda y.\lambda x.\mathsf{persuade}(x, y, P) : p_\sigma \multimap (m_\sigma \multimap (j_\sigma \multimap f_\sigma))}}{\lambda y.\lambda x.\mathsf{persuade}(x, y, \mathsf{meet}(A \oplus B)) : m_\sigma \multimap (j_\sigma \multimap f_\sigma)}}{\lambda x.\mathsf{persuade}(x, D, \mathsf{meet}(A \oplus B)) : j_\sigma \multimap f_\sigma}}{\mathsf{persuade}(C, D, \mathsf{meet}(A \oplus B)) : f_\sigma}}{\mathsf{let}\ \mathsf{mary} \times \mathsf{mary}\ \mathsf{be}\ B \times D\ \mathsf{in}\ \mathsf{persuade}(C, D, \mathsf{meet}(A \oplus B))}\ \otimes_{\varepsilon,2,4}}{\mathsf{persuade}(C, \mathsf{mary}, \mathsf{meet}(A \oplus \mathsf{mary})) : f_\sigma}\ \Rightarrow_\beta}{\dfrac{\mathsf{let}\ \mathsf{john} \times \mathsf{john}\ \mathsf{be}\ A \times C\ \mathsf{in}\ \mathsf{persuade}(C, \mathsf{mary}, \mathsf{meet}(A \oplus \mathsf{mary}))}{\mathsf{persuade}(\mathsf{john}, \mathsf{mary}, \mathsf{meet}(\mathsf{john} \oplus \mathsf{mary})) : f_\sigma}\ \Rightarrow_\beta}\ \otimes_{\varepsilon,1,3}
$$

Figure 16: Compact Glue derivation of *John persuaded Mary to meet*

A Glue logic rules

Glue logic rules used in this work were adopted from Asudeh (2004).

- Implication — Elimination

$$\dfrac{\begin{array}{c}\vdots\\ a : A\end{array} \qquad \begin{array}{c}\vdots\\ f : A \multimap B\end{array}}{f(a) : B} \multimap_{\mathcal{E}}$$

  Introduction

$$\dfrac{\begin{array}{c}[x : A]^1\\ \vdots\\ f : B\end{array}}{\lambda x.f : A \multimap B} \multimap_{\mathcal{I},1}$$

- Conjunction — Elimination

$$\dfrac{\begin{array}{c}\vdots\\ a : A \otimes B\end{array} \qquad \begin{array}{c}[x : A]^1 \; [y : B]^2\\ \vdots\\ f : C\end{array}}{\text{let } a \text{ be } x \times y \text{ in } f : C} \otimes_{\mathcal{E},1,2}$$

- Universal — Elimination

$$\dfrac{\begin{array}{c}\vdots\\ x : \forall H.A\end{array}}{x : A[G/H]} \forall_{\mathcal{E}}$$

References

Avery Andrews. Glue logic vs. spreading architecture in LFG. In Christo Moskovsky, editor, *Proceedings of the 2003 Conference of the Australian Linguistics Society*, 2003.

Ash Asudeh. A resource-sensitive semantics for equi and raising. In David Beaver, Stefan Kaufmann, Brady Clark, and Luis Casillas, editors, *The construction of meaning*. CSLI Publications, Stanford, CA, 2002.

Ash Asudeh. *Resumption as resource management*. PhD thesis, Stanford University, 2004.

Ash Asudeh. Control and semantic resource sensitivity. *Journal of Linguistics*, to appear.

Ash Asudeh and Richard Crouch. Coordination and parallelism in glue semantics. In Miriam Butt and Tracy Holloway King, editors, *Proceedings of the LFG02 Conference*. CSLI Publications, 2002a.

Ash Asudeh and Richard Crouch. Glue semantics for HPSG. In F. van Eynde, L. Hellan, and D. Beermann, editors, *Proceedings of the 8th. International HPSG Conference*, Stanford, CA, 2002b. CSLI Publications.

Joan Bresnan. Control and complementation. In Joan Bresnan, editor, *The Mental Representation of Grammatical Relations*, pages 282–390. MIT Press, Cambridge, MA, 1982.

Joan Bresnan. *Lexical-Functional Syntax*. Blackwell Publishing, Oxford, 2001.

Gennaro Chierchia. Anaphoric properties of infinitives and gerunds. In Mark Cobler, Susannah MacKaye, and Michael Wescoat, editors, *Proceedings of the Third West Coast Conference on Formal Linguistics*, pages 28–39. Stanford Linguistics Association, Stanford, CA, 1984.

Noam Chomsky. *Lectures on government and binding*. Foris, Dordrecht, 1981.

Haskell Brookes Curry and Robert Feys. *Combinatory Logic, Volume I*. Studies in Logic and the Foundations of Mathematics. North-Holland, Amsterdam, 1958. Second printing 1968.

Mary Dalrymple, editor. *Semantics and Syntax in Lexical Functional Grammar: The Resource Logic Approach*. The MIT Press, Cambridge, MA, 1999.

Mary Dalrymple. *Syntax and Semantics*, volume 31 of *Lexical Functional Grammar*. Academic Press, 2001.

Mary Dalrymple, Ron Kaplan, and Tracy Holloway King. Lexical structures as generalizations over descriptions. In Miriam Butt and Tracy Holloway King, editors, *Proceedings of the LFG2004 Conference*. CSLI Publications, 2004.

Mary Dalrymple and Tracy Holloway King. Determiner agreement and noun conjunction. *Journal of Linguistics*, 2004.

David Dowty. On recent analyses of the semantics of control. *Linguistics and Philosophy*, 1985.

Jan Engh and Kristian Emil Kristoffersen. The bibliography of control. *Norskrift*, 1996. URL `http://folk.uio.no/janengh/KONTROLL/`. Updated version exists online.

Yehuda N. Falk. *Lexical-Functional Grammar*. Number 126 in CSLI Lecture Notes. CSLI Publications, Stanford, CA, 2001.

Yehuda N. Falk. Infinitival *to*. URL `http://pluto.mscc.huji.ac.il/~msyfalk/Infinitival.pdf`. in preparation.

Jean-Yves Girard. Linear logic. *Theoretical Computer Science*, 50:1–102, 1987.

Caroline Heycock and Roberto Zamparelli. Friends and colleagues: Plurality, coordination, and the structure of DP. *Natural Language Semantics*, to appear.

J. Roger Hindley. *Basic simple type theory*. Cambridge University Press, 1997.

W. A. Howard. The formulae-as-types notion of construction. In J. P. Seldin and J. R. Hindley, editors, *To H. B. Curry: Essays on Combinatory Logic, Lambda Calculus and Formalism*, pages 479–490. Academic Press, New York, N.Y., 1980.

Ray Jackendoff and Peter W. Culicover. The semantic basis of control in english. *Language*, 79(3):517–556, 2003.

Hans Kamp. A theory of truth and semantic representation. In J. Groenendijk, T. Janssen, and M. Stokhof, editors, *Formal Methods in the Study of Language*, pages 277–321. Mathematical Centre Tracts, Amsterdam, 1981.

Ronald M. Kaplan and Joan Bresnan. Lexical-functional grammar: A formal system for grammatical representation. In Joan. Bresnan, editor, *The Mental Representation of Grammatical Relations*, pages 173–281. MIT Press, Cambridge, MA, 1982.

Andrew Kehler, Mary Dalrymple, John Lamping, and Saraswat Vijay. Resource sharing in glue language semantics. In Mary Dalrymple, editor, *Semantics and Syntax in Lexical Functional Grammar*, pages 191–208. MIT Press, 1999.

Idan Landau. *Elements of Control: Structure and Meaning in Infinitival Constructions*. Studies in Natural Language & Linguistic Theory. Kluwer, Dordrecht, 2000.

Fred Landman. *Indefinites and the Type of Sets*. Explorations in Semantics. Blackwell Publishing, 2004.

Godehard Link. The logical analysis of plurals and mass terms: a lattice theoretical approach. In R. Bauerle, C. Schwarze, and A. von Stechow, editors, *Meaning, Use and Interpretation of Language*. De Gruyter, Berlin, 1983.

Richard Montague. English as a formal language. In Bruno Visentini et al., editors, *Linguaggi nella Societa e nella Tecnica*. Edizioni di Comunita, Milan, 1970.

Richard Montague. The Proper Treatment of Quantification in Ordinary English. In Jaakko Hintikka, Julian Moravcsik, and Patrick Suppes, editors, *Approaches to Natural Language*, pages 221–242. Reidel, Dordrecht, 1973.

Michael Moortgat. Categorial type logics. In Johan van Benthem and Alice ter Meulen, editors, *Handbook of Logic and Language*, pages 93–177. Elsevier, Amsterdam, 1997.

Carl Pollard and Ivan Sag. *Head-Driven Phrase Structure Grammar*. University of Chicago Press, 1994.

Ivan Sag and Carl Pollard. An integrated theory of complement control. *Language*, 67(1):63–113, 1991.

Remko J.H. Scha. Distributive, collective and cumulative quantification. In J. Groenendijk, M. Stokhof, and T. M. V. Janssen, editors, *Formal Methods in the Study of Language*. Mathematisch Centrum, Amsterdam, 1981.

Roger Schwarzschild. *Pluralities*, volume 61 of *Studies in Linguistics and Philosophy*. Kluwer, Dordrecht, 1996.

Stephen Wechsler and Larisa Zlatic. *The Many Faces of Agreement*. CSLI Publications, 2003.

Yoad Winter. *Flexibility Principles in Boolean Semantics*, volume 37 of *Current studies in linguistics*. MIT Press, 2001.

EVALUATION OF AN AUTOMATIC F-STRUCTURE ANNOTATION ALGORITHM AGAINST THE PARC 700 DEPENDENCY BANK

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— Abstract —

An automatic method for annotating the Penn-II Treebank (Marcus et al., 1994) with high-level Lexical Functional Grammar (Kaplan and Bresnan, 1982; Bresnan, 2001; Dalrymple, 2001) f-structure representations is described in (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004). The annotation algorithm and the automatically-generated f-structures are the basis for the automatic acquisition of wide-coverage and robust probabilistic approximations of LFG grammars (Cahill et al., 2002; Cahill et al., 2004a) and for the induction of LFG semantic forms (O'Donovan et al., 2004). The quality of the annotation algorithm and the f-structures it generates is, therefore, extremely important. To date, annotation quality has been measured in terms of precision and recall against the DCU 105. The annotation algorithm currently achieves an f-score of 96.57% for complete f-structures and 94.3% for preds-only f-structures. There are a number of problems with evaluating against a gold standard of this size, most notably that of overfitting. There is a risk of assuming that the gold standard is a complete and balanced representation of the linguistic phenomena in a language and basing design decisions on this. It is, therefore, preferable to evaluate against a more extensive, external standard. Although the DCU 105 is publicly available,[1] a larger well-established external standard can provide a more widely-recognised benchmark against which the quality of the f-structure annotation algorithm can be evaluated. For these reasons, we present an evaluation of the f-structure annotation algorithm of (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004) against the PARC 700 Dependency Bank (King et al., 2003). Evaluation against an external gold standard is a non-trivial task as linguistic analyses may differ systematically between the gold standard and the output to be evaluated as regards feature geometry and nomenclature. We present conversion software to automatically account for many (but not all) of the systematic differences. Currently, we achieve an f-score of 87.31% for the f-structures generated from the original Penn-II trees and an f-score of 81.79% for f-structures from parse trees produced by Charniak's (2000) parser in our pipeline parsing architecture against the PARC 700.

1 Introduction

An automatic method for annotating the Penn-II Treebank (Marcus et al., 1994) with high-level Lexical Functional Grammar (Kaplan and Bresnan, 1982; Bresnan, 2001; Dalrymple, 2001) f-structure representations is described in (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004). Annotation coverage is near complete with 99.83% of the 48K Penn-II sentences receiving a single, connected and covering f-structure. The annotation algorithm and the automatically-generated f-structures

[1]Available on `http://www.computing.dcu.ie/research/nclt/gold105.txt`.

are the basis for the automatic acquisition of wide-coverage and robust probabilistic approximations of LFG grammars (Cahill et al., 2002; Cahill et al., 2004a) and for the induction of LFG lexical resources (O'Donovan et al., 2004). The quality of the annotation algorithm and the f-structures it generates is, therefore, extremely important. To date, annotation quality has been measured in terms of precision and recall against the DCU 105, a set of manually constructed, gold-standard f-structures for 105 randomly selected sentences from Section 23 of the WSJ section of Penn-II. The annotation algorithm currently achieves an f-score of 96.57% for complete f-structures and 94.3% for preds-only f-structures using the evaluation methodology and software presented in (Crouch et al., 2002) and (Riezler et al., 2002).

There are a number of problems with evaluating against a gold standard of this size, most notably that of overfitting. There is a risk of assuming that the gold standard is a complete and balanced representation of the linguistic phenomena in a language and basing design decisions on this. It is, therefore, preferable to evaluate against an independently constructed, more extensive, external standard. A larger well-established external standard can provide a more widely-recognised benchmark against which the quality of the f-structure annotation algorithm can be evaluated. For these reasons, we present an evaluation of the f-structure annotation algorithm of (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004) against the PARC 700 Dependency Bank (King et al., 2003). The PARC 700 comprises 700 randomly selected sentences from Section 23 of the WSJ section of Penn-II which were parsed by a hand-coded, deep LFG, converted to dependency format (triples) and manually corrected and extended. We use the annotation algorithm of (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004) to generate f-structures for those 700 Penn-II trees and also a subset of 560 following the experimental setup of (Kaplan et al., 2004).

Evaluation against an external standard is a non-trivial and time-consuming task, in this case due primarily to systematic differences in linguistic analysis, feature geometry and nomenclature. In order to carry out the evaluation we developed conversion software to automatically handle some, but not all, of the systematic differences (Figure 1). Before annotating Penn-II trees we deal with named entity recognition. The PARC 700 analyses certain names (e.g. 'Merrill Lynch') as complex predicates while the annotation algorithm analyses the same string fully parsed as a head ('Lynch') modified by an adjunct ('Merrill'). Our pre-processing module identifies and tags named entities in the Penn-II trees. The trees are then annotated by the f-structure annotation algorithm (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004) and passed through three post-processing modules.

A significant number of feature names differ between the PARC 700 dependencies and the automatically-generated f-structures. The first post-processing module (Feature Geometry and Renaming) implements a mapping to establish common feature names, while also resolving some systematic structural differences between the gold standard analyses, including the analysis of oblique agents and quoted speech. A number of features in the PARC 700 are not computed by the automatic f-structure annotation algorithm, while some

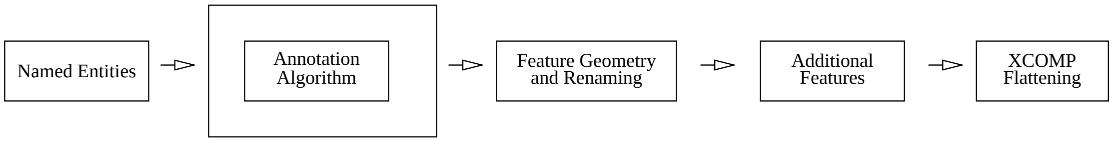

Figure 1: Conversion Software

common features have differing value ranges. The second post-processing module (Additional Features) systematically annotates the trees with as many of the missing features and values as possible.

One key difference in the f-structures automatically-generated by the annotation algorithm and those in the PARC 700 is the representation of tense and aspect information. While our annotation algorithm uses a system of cascading XCOMPs to encode this information at f-structure level, the same details are represented in the PARC 700 dependencies using a flat analysis with tense and aspect features. To cope with this, we automatically flatten the f-structures generated by the annotation algorithm (XCOMP Flattening).

Section 2 of this paper provides a brief overview of the automatic f-structure annotation algorithm. The components of the conversion software used to systematically convert the automatically-generated f-structures for evaluation against the PARC 700 are described in detail in Section 3. Section 4 outlines and analyses the results of the evaluation process. Conclusions and possibilities for future work follow in Section 5.

2 Automatic F-Structure Annotation Algorithm

This section provides a brief overview of the automatic f-structure annotation algorithm of (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004). The generic algorithm is modular, as outlined in Figure 2, and is language and treebank-independent. The modules of the annotation algorithm must be manually seeded with linguistic information for the specific language/treebank pair, in this case the Penn-II treebank for English.

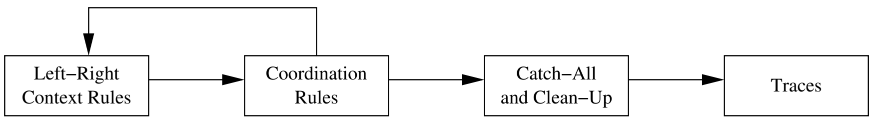

Figure 2: Annotation Algorithm modules

The first module, Left-Right Context Rules, head-lexicalises the treebank using a modified version of Magerman's scheme (Magerman, 1994). This process creates a bi-partition of each local subtree, with nodes lying in either the left or right context of the head. An annotation matrix is manually constructed for each parent category in the treebank. For each parent category the task of matrix construction is greatly minimised by manually analysing only the most frequent CFG rule types that give at least 85% coverage of rule tokens for that parent category in the treebank. For example, only the most frequent 102 NP rule types were analysed to produce the NP annotation matrix which generalises to provide default annotations for all 6595 NP rule types in the treebank. Default annotations are read from these matrices by the annotation algorithm to annotate nodes in the left and right context of each subtree.

The annotation of co-ordinate structures is handled by a separate module in the annotation algorithm, because the relatively flat analysis of co-ordination in Penn-II would complicate the Left-Right Context Rules, making them harder to maintain and extend. Once the elements of the co-ordination set have been identified, the Left-Right Context Rules module may be re-used to provide default annotations for any remaining unannotated nodes in a co-ordinate construction.

The Catch-All and Clean-Up module provides default annotations for remaining unannotated nodes that are labelled with Penn functional tags, e.g. -SBJ. A small amount of over generation is accepted within the first two annotation algorithm modules to allow a concise statement of linguistic generalisations. Some annotations are overwritten to counter this problem and to systematically correct other potential feature clashes.

The first three modules of the annotation algorithm produce proto-f-structures which do not account for non-local dependencies. To create "proper" f-structures, the Traces module uses the wide range of trace information encoded in Penn-II to capture dependencies introduced by topicalisation, passivisation, relative clauses and questions. Figure 3 illustrates a Penn-II style tree and corresponding proto- and proper f-structures for the sentence "U.N. signs treaty, the headline said." The Trace module translates the Penn trace and co-indexation information to capture the long-distance dependency in terms of a corresponding re-entrancy in the proper f-structure which is absent from the proto-f-structure.

The annotation algorithm achieves excellent coverage for the WSJ section of Penn-II with 99.83% of the 48K sentences receiving a single connected and covering f-structure. Figure 4 provides a quantitative evaluation of the f-structures produced by the annotation algorithm. Feature clashes in the annotation of 85 trees result in no f-structure being produced for those sentences. Nodes left unannotated by the annotation algorithm in two trees caused two separate f-structure fragments for both sentences.

While achieving such wide coverage is important, the annotation quality must be of a high standard, particularly as the annotation algorithm plays a vital role in the generation of wide-coverage, probabilistic LFG parsing technology (Cahill et al., 2002; Cahill et al., 2004a) and lexical resources (O'Donovan et al., 2004). To date, annotation quality has been measured in terms of precision, recall and f-score against the DCU 105, a set of manually constructed, gold-standard f-structures for 105 randomly selected sentences from Section 23 of the WSJ part of Penn-II.

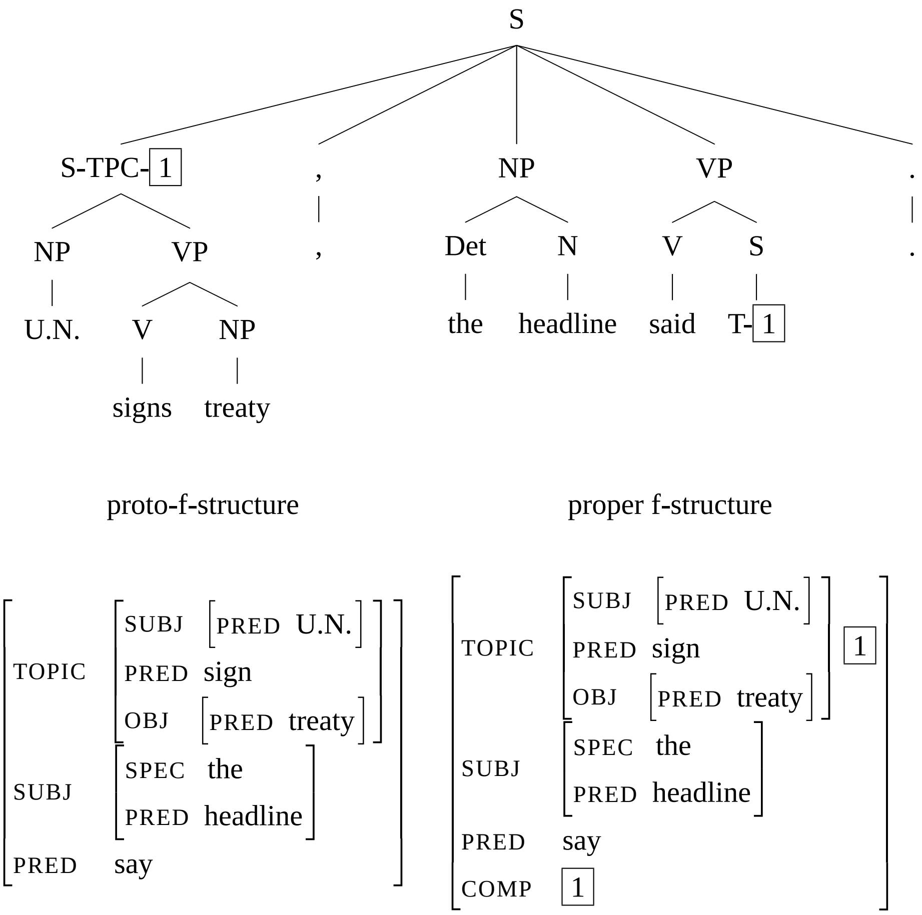

Figure 3: Penn-II style tree with LDD trace and corresponding re-entrancy in proper f-structure

Using the evaluation methodology and software presented in (Crouch et al., 2002) and (Riezler et al., 2002) the annotation algorithm currently achieves an f-score of 96.57% for complete f-structures and 94.3% for preds-only f-structures (Figure 5).[2]

As previously indicated, there are a number of problems with evaluating against a gold standard of this size. There is a risk of assuming that the gold standard is a complete and balanced representation of the linguistic phenomena in a language and basing design decisions on this. It is, therefore, preferable to evaluate against an independently constructed, more extensive, external standard which can provide a more widely-recognised benchmark for the evaluation of annotation quality.

The PARC 700 Dependency Bank (King et al., 2003) was chosen for this purpose. In an initial experiment the 700 Penn-II trees represented in the PARC 700 were annotated by the automatic f-structure

[2]Preds-only f-structures consider only paths in f-structures ending in a PRED feature-value pair

# f-structures	# sentences	Treebank Percentage
0	85	0.176
1	48337	99.820
2	2	0.004

Figure 4: Quantitative Evaluation

annotation algorithm. As expected, the results were poor because the DCU 105 and the automatically-generated f-structures differ substantially in linguistic analysis, feature geometry and nomenclature from the PARC 700 dependencies. An f-score of 49% was achieved which compares very poorly with the results achieved against the DCU 105, as illustrated in Figure 5.

	DCU 105		**PARC 700**
	All grammatical functions	*Preds only*	*Feature set of (Kaplan et al., 2004)*
Precision	96.58	94.53	46.32
Recall	96.55	94.07	51.99
F-Score	96.56	94.30	49.00

Figure 5: Initial qualitative evaluation against PARC 700

In order to achieve a fair evaluation, conversion software was developed to overcome some, but not all, of the systematic differences between the DCU 105 and PARC 700 representations. This software is presented in detail in Section 3.

3 Conversion Software

3.1 Introduction

The previous section provided an overview of the annotation algorithm used to generate f-structures for the WSJ section of Penn-II. An evaluation of the annotation quality against the DCU 105 was presented and the need for evaluation against a more extensive, external standard was motivated.

The chosen external standard, the PARC 700 Dependency Bank (King et al., 2003) comprises 700 randomly selected sentences from Section 23 of the WSJ section of Penn-II. The sentences were parsed by a hand-coded, deep LFG, converted to dependency format (triples) and manually corrected and extended.

This section presents the conversion software developed to overcome some of the systematic differences in linguistic analysis, feature geometry and nomenclature between the automatically-generated f-structures

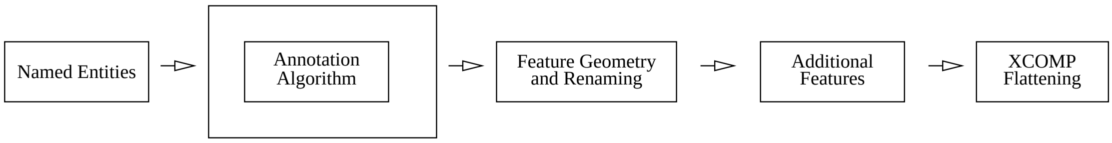

Figure 6: Conversion Software

and the PARC 700 dependency structures. An overview of the conversion software is provided in Figure 6. Penn-II trees are passed through a pre-processing module, Named Entities, before being automatically annotated by the f-structure annotation algorithm, as outlined in Section 2. The annotated trees are then modified by three post-processing modules, Feature Geometry and Renaming, Additional Features and XCOMP Flattening. All four modules of the conversion software are described in the following sections.

3.2 Named Entities

The first module of the conversion software handles differences in the analysis of named entities. The PARC 700 treats certain names (e.g. 'Merrill Lynch') as complex predicates while the annotation algorithm analyses the same string fully parsed as a head ('Lynch') modified by an adjunct ('Merrill'). Our Named Entities pre-processing module identifies and tags named entities in the Penn-II trees, allowing the annotation algorithm to produce the complex predicate analysis expected by the PARC 700 gold standard dependencies.

The identification of named entities is carried out using a list of all the named entities in the PARC 700. The string represented by each subtree is checked against this list. Identified named entities are tagged using a new category NE. A new node, labelled NE, is inserted in the tree above the part of speech tags representing the named entity. This node indicates that the words represented by its daughter nodes should be combined to form a complex predicate at f-structure level.

There are three cases for the automatic insertion of an NE node, the simplest of which occurs when an entire subtree represents a named entity. An NE node is inserted above all part of speech tags in the subtree. Figure 7 illustrates the insertion of an NE node into the subtree representing the named entity "Merrill Lynch".[3] The f-structures automatically-generated by the annotation algorithm for both the original and the pre-processed trees are provided. The NE node allows the correct complex PRED value ("merrill lynch") to be created to match with the version in the corresponding PARC 700 dependency.

A more complex case for the automatic insertion of an NE node occurs when a partial subtree represents a named entity. In such cases, a node labelled NE is inserted above the part of speech tags representing the named entity only. For example, the named entity "White House" is contained in the Penn-II subtree

[3]The conversion software converts the lemmas of the automatically-generated f-structures and the PARC 700 dependencies into lowercase for evaluation purposes.

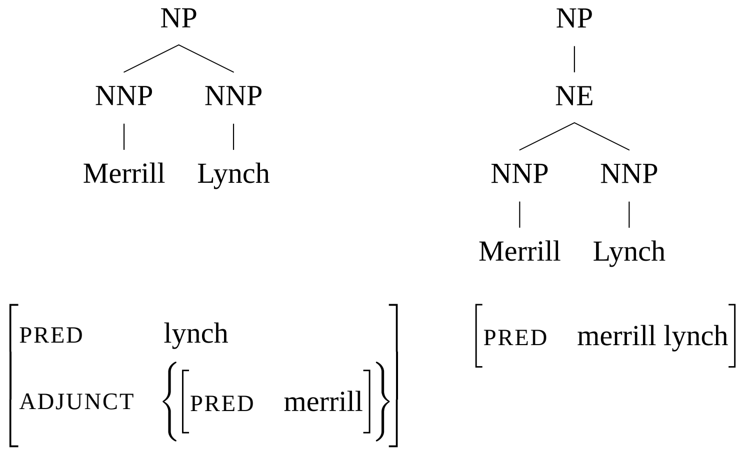

Figure 7: Simple case of named entity node insertion for the phrase

representing the string “The official White House reaction”. The modified subtree in Figure 8 shows the NE node inserted above the four part of speech nodes representing the named entity. The inserted node and the remaining part of speech nodes are now siblings.

The original annotation algorithm did not provide an annotation for the inserted NE node as no left-right context matrix contained entries for NE tags. Therefore, new left-right context entries were created for the new tag. This task was trivial, because the behaviour of named entities is similar to other nominal phrases for which left-right context entries already existed. The new entries were adapted from these existing nominal entries and allowed the inserted NE node in Figure 8 to be annotated as an adjunct.

The final and most complex case of automatic node insertion occurs when a named entity is represented by multiple subtrees. In such subtrees, the parent node is identified and all subordinate nodes, excluding part of speech nodes, are deleted, thus flattening the subtree. An NE node is then inserted as a daughter of the parent node, with the part of speech nodes representing the named entity as its daughters. The original and modified tree is illustrated in Figure 9.

3.3 Feature Geometry and Renaming

Feature Geometry and Renaming is the first post-processing module of the conversion software and is applied to trees that have first been treated for named entities and then automatically annotated by the f-structure annotation algorithm.

A significant number of feature names differ between the PARC 700 dependencies and the automatically-generated f-structures. The Feature Geometry and Renaming module implements a mapping to establish common feature names. Table 1 provides the details of this mapping. The feature names used in the

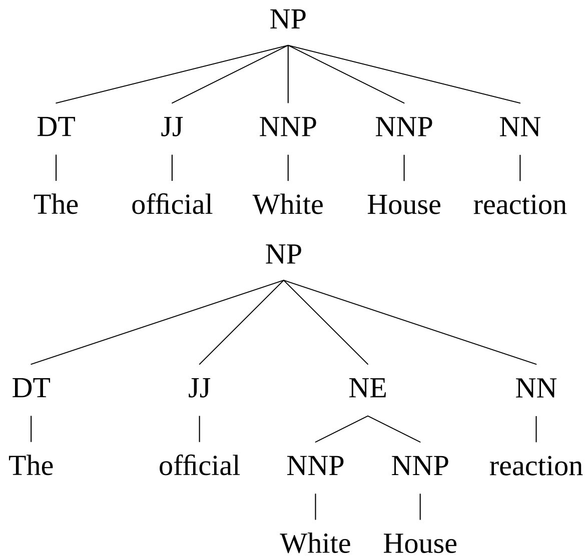

Figure 8: Named entity forming part of a local subtree

automatically-generated f-structures for determiners, particles, co-ordinated elements and interrogatives are mapped to match those present in the PARC 700. The automatic f-structure annotation algorithm does not distinguish between modifiers and other adjuncts, so the PARC 700 MOD feature is mapped to ADJUNCT. Similarly, the PARC 700 features AQUANT and NUMBER are mapped to QUANT, while OBL_COMPAR becomes OBL.

The conversion software encodes feature geometry mappings to resolve some systematic structural differences between the analyses of the DCU 105 and PARC 700 gold standards. The treatment of oblique agents in the DCU 105 and the f-structures automatically-generated by the annotation algorithm is illustrated in Figure 10(a). In order to match the PARC 700 structure Figure 10(b), the PRED value of the oblique agent must be moved and the OBJ feature removed. This is achieved by mapping the annotation of the noun phrase from “up-obj=down” to “up=down”. The feature PFORM is mapped to PCASE; a mapping which only occurs in the context of oblique agents.

The feature geometry mapping for oblique agents systematically overcomes the structural difference in analysis between the gold standards. Structural differences in the analysis of quoted speech and the distribution of shared subjects and objects into co-ordinate structures are also resolved using feature geometry mappings.

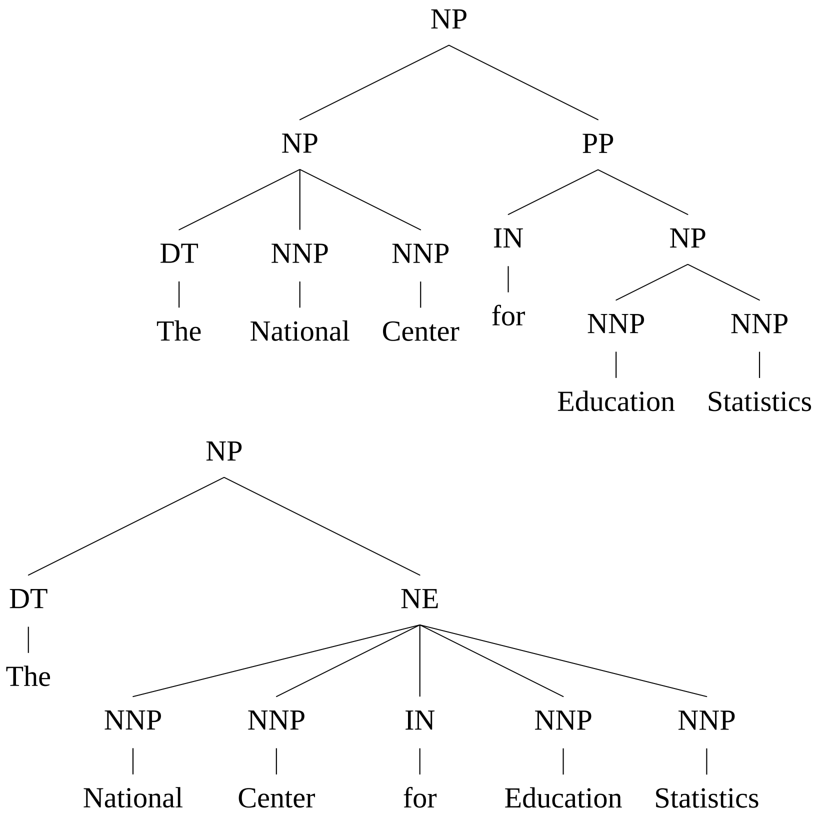

Figure 9: Named entity represented by several subtrees

3.4 Additional Features

The second post-processing module, Additional Features, annotates the trees with PARC 700 features which are not computed by the f-structure annotation algorithm. Furthermore, some features are common to both representations but with differing value ranges. This module also annotates the trees with the missing values.

The first feature to be added is NUMBER_TYPE which has the values “cardinal” and “ordinal”. This module annotates all nodes labelled CD (cardinal number) with the PARC 700 NUMBER_TYPE feature. String analysis is used to identify ordinal numbers which are given the value “ordinal” for this new feature. All other CD nodes are given the value “cardinal” by default. The PARC 700 feature PRECOORD_FORM, with values such as “both” and “either”, is also computed by the Additional Features module. Subtrees containing multiple CC nodes are identified, and the feature is added if the leftmost node is a CC.

The automatically-generated f-structures do not contain the feature STMT_TYPE (statement type), one of the most frequent features in the PARC 700. The value “header” is computed for this feature if the root node of the tree is a noun phrase. STMT_TYPE is added to all S nodes with the value “declarative”.

The feature ADEGREE has two possible values in the automatically-generated f-structures, “compara-

DCU 105	PARC 700	Common feature name
DET	DET_FORM	DET_FORM
PART	PRT_FORM	PRT_FORM
COORD	CONJ	CONJ
FOCUS	FOCUS_INT	FOCUS_INT
ADJUNCT	MOD	ADJUNCT
OBL	OBL_COMPAR	OBL
QUANT	AQUANT	QUANT
QUANT	NUMBER	QUANT

Table 1: Feature Mapping table

$$\begin{bmatrix} \textsc{pred} & \text{purchase} \\ \textsc{obl\_ag} & \begin{bmatrix} \textsc{pform} & \text{by} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{government} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(a) Automatically-generated f-structure

$$\begin{bmatrix} \textsc{pred} & \text{purchase} \\ \textsc{obl\_ag} & \begin{bmatrix} \textsc{pcase} & \text{by} \\ \textsc{pred} & \text{government} \end{bmatrix} \end{bmatrix}$$

(b) PARC 700 representation

Figure 10: Feature geometry mapping for oblique agents

tive" and "superlative", which are provided by the lexical macros for comparative adverbs (RBR), comparative adjectives (JJR), superlative adverbs (RBS) and superlative adjectives (JJS). Every adjective in the PARC 700 has an ADEGREE feature, which may be "comparative", "superlative" or "positive", which acts as a default value. Simply annotating all adjectives (JJ) with the ADEGREE value "positive" will provide many of the missing annotations. However, in the cases where a comparative or superlative adverb modifies an adjective, the adverb's ADEGREE feature must be moved to overwrite the adjective's new "positive" ADEGREE annotation.

Figure 11 provides four f-structure fragments for the phrase "most troublesome" to illustrate this mapping. An f-structure representation of the PARC 700 dependency and the automatically-generated f-structure for this phrase are provided in the first row. The ADEGREE features are attached at different levels. The "first pass" f-structure is created when the module annotates all adjectives with the value "positive" for the ADEGREE feature. For this particular phrase, adding this feature-value pair actually increases the divergence between the automatically-generated f-structure and the PARC 700 version. Overwriting the adjective's ADEGREE feature with that of the adverb corrects this problem. The PRED value for the adverb "most" does not occur in the PARC 700 dependency, but is still present in the automatically-generated f-structure.

$$\left[\begin{array}{ll} \text{PRED} & \text{troublesome} \\ \text{ADEGREE} & \text{superlative} \end{array}\right]$$

PARC 700 representation

$$\left[\begin{array}{ll} \text{PRED} & \text{troublesome} \\ \text{ADJUNCT} & \left\{\left[\begin{array}{ll} \text{PRED} & \text{most} \\ \text{ADEGREE} & \text{superlative} \end{array}\right]\right\} \end{array}\right]$$

Automatically-generated f-structure

$$\left[\begin{array}{ll} \text{PRED} & \text{troublesome} \\ \text{ADEGREE} & \text{positive} \\ \text{ADJUNCT} & \left\{\left[\begin{array}{ll} \text{PRED} & \text{most} \\ \text{ADEGREE} & \text{superlative} \end{array}\right]\right\} \end{array}\right]$$

First pass

$$\left[\begin{array}{ll} \text{PRED} & \text{troublesome} \\ \text{ADEGREE} & \text{superlative} \\ \text{ADJUNCT} & \left\{\left[\begin{array}{ll} \text{PRED} & \text{most} \end{array}\right]\right\} \end{array}\right]$$

Final version

Figure 11: Adegree complications

3.5 XCOMP Flattening

The most noticeable difference between automatically-generated f-structures and PARC 700 dependencies is the representation of tense and aspect information. While our annotation algorithm uses a system of cascading XCOMPs to encode this information, as shown in Figure 12 for the sentence “Unlike 1987, interest rates have been falling this year”, the PARC 700 uses a flat analysis with tense and aspect features. This final post-processing module, XCOMP Flattening, implements a systematic mapping to overcome this difference.

The first step carried out by the “XCOMP flattening” module is the identification of the correct PRED and TENSE values to maintain. The correct PRED value is that of the main verb found at the “deepest” level of the cascade of XCOMPs. The TENSE value at the “outer” level is also maintained. All other PRED and TENSE values are deleted.

Secondly, the PARC 700 aspect features, PROGressive and PERFective, are computed. Progressive aspect is represented in the automatically-generated f-structures by the PARTICIPLE feature occurring with the value “pres”. If this feature-value pair is found at any XCOMP level, it is replaced by the PARC 700 feature PROG with value “+”. The PERF feature is added with value “+” if the PRED value “have” is found at any XCOMP level before the “deepest” level.

The final step in this module achieves the task of flattening the XCOMP cascade, while grouping and maintaining the adjuncts from each level. The XCOMP annotation is removed from all nodes, except modals, and is replaced with the “up=down” annotation. Removing all XCOMP annotations in this manner “flattens” the f-structure. The process of unification invoked by the constraint solver groups together all the adjuncts

$$\left[\begin{array}{ll}
\text{ADJUNCT} & \left\{\left[\begin{array}{ll}\text{PFORM} & \text{unlike}\\ \text{OBJ} & \left[\text{PRED}\ 1987\right]\end{array}\right]\right\}\\
\text{SUBJ} & \left[\begin{array}{ll}\text{ADJUNCT} & \left\{\left[\text{PRED}\quad \text{interest}\right]\right\}\\ \text{PRED} & \text{rate}\end{array}\right]\boxed{1}\\
\text{PRED} & \text{have}\\
\text{TENSE} & \text{pres}\\
\text{XCOMP} & \left[\begin{array}{ll}\text{SUBJ} & \boxed{1}\\ \text{PRED} & \text{be}\\ \text{TENSE} & \text{past}\\ \text{XCOMP} & \left[\begin{array}{ll}\text{SUBJ} & \boxed{1}\\ \text{PRED} & \text{fall}\\ \text{PARTICIPLE} & \text{pres}\\ \text{ADJUNCT} & \left\{\left[\begin{array}{ll}\text{SPEC} & \left[\text{DET}\ \left[\text{PRED}\quad \text{this}\right]\right]\\ \text{PRED} & \text{year}\end{array}\right]\right\}\end{array}\right]\end{array}\right]
\end{array}\right]$$

Figure 12: Cascading XCOMP example

in one set. Similarly, the information that has been maintained and added at various levels in the XCOMP cascade, e.g. PRED values and aspect features, are retained through unification. The entire process of XCOMP flattening is achieved through a process of systematically rewriting annotations on the trees and without moving any annotations.

Figure 13 provides the "flattened" f-structure produced by the conversion software for the sentence of Figure 12: "Unlike 1987, interest rates have been falling this year". The adjuncts "unlike 1987" and "this year" are both contained in a single adjunct set at sentence level in the flattened version. The "deepest" PRED value in the cascade of XCOMPs has been maintained. The "outer" TENSE is maintained, while PROG and PERF features have been added. All other feature-value pairs have been removed.

3.6 Conclusions

Section 2 provided a brief overview of the automatic f-structure annotation algorithm of (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004). This section has described the four modules of the conversion software developed to systematically map the automatically-generated f-structures for evaluation against the PARC 700. This software was applied to the 700 sentences that comprise the PARC 700. Using the evaluation methodology and software presented in (Crouch et al., 2002) and (Riezler et al.,

$$\begin{bmatrix} \text{ADJUNCT} & \left\{ \begin{matrix} \begin{bmatrix} \text{PFORM} & \text{unlike} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & 1987 \end{bmatrix} \end{bmatrix} \\ \begin{bmatrix} \text{SPEC} & \begin{bmatrix} \text{DET} & \begin{bmatrix} \text{PRED} & \text{this} \end{bmatrix} \end{bmatrix} \\ \text{PRED} & \text{year} \end{bmatrix} \end{matrix} \right\} \\ \text{SUBJ} & \begin{bmatrix} \text{ADJUNCT} & \left\{ \begin{bmatrix} \text{PRED} & \text{interest} \end{bmatrix} \right\} \\ \text{PRED} & \text{rate} \end{bmatrix} \\ \text{PRED} & \text{fall} \\ \text{TENSE} & \text{pres} \\ \text{STMT\_TYPE} & \text{declarative} \\ \text{PERF} & + \\ \text{PROG} & + \end{bmatrix}$$

Figure 13: Flattened version of Figure 12

2002), the converted f-structures were evaluated against the PARC 700 dependencies. Section 4 provides an analysis of the results of this evaluation.

4 Evaluation

4.1 Introduction

Section 2 provided an overview of the automatic f-structure annotation algorithm of (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004). Section 3 described conversion software which allows the annotation algorithm to be evaluated against the PARC 700. This section provides the results of the evaluation process. The results are analysed in comparison with the results achieved against the DCU 105 gold standard. The conversion software was also used to evaluate the output generated by our CFG parsing technology based on the f-structure annotation algorithm against the PARC 700. The results of this evaluation are also provided.

4.2 Qualitative Evaluation

The 700 sentences comprising the PARC 700 were split into a development set of 140 sentences and a test set of 560 for the experiments described in (Kaplan et al., 2004). The same sets were used for the processes of developing and testing the conversion software. The 560 sentences of the test set were annotated by the automatic annotation algorithm and converted using the software outlined in the previous section. The resulting f-structures were evaluated against the PARC 700 using the evaluation methodology and software presented in (Crouch et al., 2002) and (Riezler et al., 2002). The converted f-structures for the 560 sentence test set achieved an f-score of 87.31% against the PARC 700 dependencies. The f-score for all 700 sentences of the PARC 700 was 87.36%.

	PARC 700: 560 sentence test set	**DCU 105**	
	Feature set of (Kaplan et al., 2004)	*All grammatical functions*	*Preds only*
Precision	88.57	96.52	94.45
Recall	86.10	96.63	94.16
F-Score	87.31	96.57	94.30

Table 2: Evaluation Results against PARC 700 and DCU 105

Table 2 illustrates the results in terms of precision, recall and f-score[4]. The results achieved by the annotation algorithm against the DCU 105 for all grammatical functions and for preds-only are also provided. An analysis of the different results achieved against both gold standards follows.

4.3 Analysis of Results

There is a wide gap between the results achieved by the annotation algorithm when evaluated against the DCU 105 and, using the conversion software, against the PARC 700. There are a number of reasons for the poorer results against the PARC 700, most of which are related to differences between the representations used in the automatically-generated f-structures and the PARC 700 which could not be captured using the systematic mappings of the conversion software. Some of these differences will now be analysed, the first of which is the treatment of hyphenated words.

[4]Precision, Recall and F-Score were calculated according to the following equations:

$$Precision = \frac{\#\ of\ correct\ feature-value\ pairs\ in\ the\ automatically\ generated\ f-structure}{\#\ of\ feature-value\ pairs\ in\ the\ automatically\ generated\ f-structure}$$

$$Recall = \frac{\#\ of\ correct\ feature-value\ pairs\ in\ automatically\ generated\ f-structure}{\#\ of\ feature-value\ pairs\ in\ the\ gold\ standard\ f-structure}$$

$$F-Score = \frac{2\ X\ Precision\ X\ Recall}{Precision + Recall}$$

4.3.1 Hyphenated Words

In the PARC 700 dependencies, hyphenated words are often, but not always, split into separate lemmas, each with their own feature-value pairs. Hyphenated words remain as a single unit in the f-structures automatically-generated by the annotation algorithm. The conversion software does not attempt to split these words and crucially, hyphenated words also remain intact in the DCU 105. Therefore, the converted f-structures are penalised in the evaluation against the PARC 700 for every hyphenated word that is split.

adjunct(property, investment-grade)	adjunct(property, investment)
	adjunct(property, grade)
Automatically-generated triple	PARC 700 triples

Figure 14: Hyphenation problems

Figure 14 illustrates the PARC 700 triples and those produced by the annotation algorithm for the phrase "investment-grade property". The annotation algorithm produces one triple which does not occur in the gold standard, which in turn contains two triples that are not produced by the annotation algorithm. Thus, the annotation algorithm is penalised despite correctly producing the adjunct relationship.

Not all hyphenated words are split in this manner in the PARC 700 dependencies. Given the resources available to us, i.e. Penn tags, there is no systematic pattern which can be used to predict the PARC 700 treatment of hyphenation, so no attempt is made within the conversion software to solve this problem.

4.3.2 Penn-II POS Tagging

The annotation algorithm annotates Penn-II part of speech tags using a set of lexical macros. Singular nouns (NN) are annotated with a NUM feature with value "sg", while nodes labelled NNS receive NUM value "pl". Section 3 explained how all adjectives (JJ) receive an ADEGREE feature in the Additional Features module of the conversion software. Adjuncts in the converted f-structures may have an ADEGREE or NUM feature, the choice of which is determined entirely by the Penn-II POS tags.

The analysis of adjuncts as nominal or adjectival in the PARC 700 dependencies cannot be accurately predicted from the Penn-II POS tags. In the majority of cases the Penn-II tagging and PARC 700 analyses match, but there is a significant amount of divergence and in every such case, the converted f-structures are penalised. As with the treatment of hyphenated words, no attempt is made to solve this problem in the conversion software, as there is no systematic way of doing so using the available resources, i.e. Penn-II POS tags.

As outlined above, the annotation algorithm provides NUM annotations through the lexical macros for each Penn-II POS tag. However, named entities in the PARC 700 dependencies also receive a NUM value which cannot be predicted from POS tags or other indicators. The conversion software provides a default "sg" NUM value for all named entities, although this is not always correct.

4.3.3 Computational Error Margins

As outlined in Section 3, the conversion software consists of five modules, one of which is the annotation algorithm itself. It is inevitable that each additional computation module adds its own margin of error: these are cases where a conversion mapping is carried out inappropriately. The four additional modules required for evaluation against the PARC 700 gold standard must produce a higher computational error margin than the simpler process of evaluating against the DCU 105.

4.3.4 Characteristics of both Gold Standards

The origin of both gold standards must also impact on the results achieved by the automatically-generated f-structures. The DCU 105 was designed for the purpose of evaluating f-structures produced by the annotation algorithm and the derived parsing technology. The PARC 700, in turn, is based on the f-structures for the 700 sentences provided by the hand-crafted broad-coverage LFG grammar of English using the XLE system (Maxwell III and Kaplan, 1993). As a result, in each case there is some systematic bias towards a particular style of analysis. The most obvious example of this bias is the lemmas used. As the lemmas which are used in both the DCU 105 and the automatically-generated f-structures are derived from a common source, there is a 100% match. While efforts were made to align the lemmas of the automatically-generated f-structures with those used in the PARC 700, there are some inconsistencies which could not be systematically resolved. This inconsistency results in an additional margin of error when evaluating against the PARC 700.

The DCU 105 is a relatively small gold standard. There are a number of problems with evaluating against a gold standard of this size, most notably that of overfitting. There is a risk of assuming that the gold standard is a complete and balanced representation of the linguistic phenomena in a language and then basing design decisions on this assumption. The possibility that the annotation algorithm overfits the DCU 105 may be a contributory factor to the gap between the evaluation results.

4.4 Evaluation of Parsing Technology

The conversion software described in Section 3 can also be used to evaluate the performance of the parsing technology of (Cahill et al., 2002; Cahill et al., 2004a). Two parsing architectures are presented in detail: an integrated model and a pipeline model. The best PCFG induced using the integrated model achieved an f-score of 80.33% against the 560 sentence test subset of the PARC 700. The pipeline model, using the output of Charniak's parser (Charkiak, 2000), achieved an f-score of 81.79% against the same test set. This result is an improvement of 2.19% on the previous best published results against this test set in (Kaplan et al., 2004).

5 Conclusions

This paper has presented an evaluation of the automatic f-structure annotation algorithm of (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004) against the PARC 700 Dependency Bank (King et al., 2003). A brief outline of the annotation algorithm was provided in Section 2 and the need for an evaluation against a larger well-established external standard was motivated. The differences in linguistic analysis, feature geometry and nomenclature between the automatically-generated f-structures and the dependency structures of the chosen gold standard, the PARC 700, necessitated the development of an automatic conversion process. The conversion software developed for the purpose of overcoming systematic differences between the representations was presented in Section 3. The results of the evaluation process were provided and analysed in Section 4. Differences in linguistic analysis, which could not be resolved by the systematic mappings of the conversion software, were illustrated as these problems contribute to the difference in results achieved by the annotation algorithm against the PARC 700 and DCU 105. Currently we achieve an f-score of 96.57% for full f-structures and 94.3% for preds-only f-structures against the DCU 105. Using our conversion software we achieve an f-score of 87.31% against the PARC 700 for the feature set of (Kaplan et al., 2004). Evaluation against an external gold standard is non-trivial and we expect improvements in the conversion software to yield corresponding improvements in the results.

The conversion software presented in this paper also allows the parsing technology of (Cahill et al., 2002; Cahill et al., 2004a) to be evaluated against the PARC 700. Currently we achieve an f-score of 81.79% using the output of Charniak's (2000) parser in our pipeline architecture, an improvement of 2.19% over the previous best result of (Kaplan et al., 2004). This is a significant development as it provides a more widely-recognised benchmark for the parser quality and allows more direct comparisons to be made with the published results of others.

While the conversion software was established for evaluation purposes, it can also be used to produce a version of the Penn-II treebank annotated with f-structure information in the style of those generated by the hand-crafted grammars developed in the ParGram project (Butt et al., 2002) underlying the PARC 700 dependencies. Scaling up the Named Entities module for the identification of all named entities in the treebank is a task for further work. The evaluation of the automatically-generated f-structures against the larger PARC 700 provides many opportunities for the future improvement of the automatically-generated grammatical and lexical resources presented in (Cahill et al., 2002; Cahill et al., 2004a; Cahill et al., 2004b; O'Donovan et al., 2004).

References

Bresnan, J. 2001. *Lexical Functional Syntax*. Blackwell, Oxford.

Butt, M., H. Dyvik, T. King, H. Masuichi, and C. Rohrer. 2002. The Parallel Grammar Project. In *Proceedings of COLING-2002 Workshop on Grammar Engineering and Evaluation*, pages 1–7, Taipei, Taiwan. printed.

Cahill, A., M. Burke, R. O'Donovan, J. van Genabith, and A. Way. 2004a. Long-Distance Dependency Resolution in Automatically Acquired Wide-Coverage PCFG-Based LFG Approximations. In *Proceedings of 42nd Conference of the Association for Computational Linguistics*, pages 319–326, Barcelona, Spain. printed.

Cahill, A., M. McCarthy, M. Burke, R. O'Donovan, J. van Genabith, and A. Way. 2004b. Evaluating Automatic F-Structure Annotation for the Penn-II Treebank. In *Journal of Research on Language and Computation*. Kluwer Academic Publishers.

Cahill, A., M. McCarthy, J. van Genabith, and A. Way. 2002. Parsing with PCFGs and Automatic F-Structure Annotation. In M. Butt and T. Holloway-King, editors, *Proceedings of the Seventh International Conference on Lexical-Functional Grammar*, pages 76–95, Athens, Greece. CSLI Publications, Stanford, CA. [in press]. printed.

Charkiak, E. 2000. A Maximum-Entropy-Inspired Parser. In *Proceedings of the First Annual Meeting of the North American Chapter of the Association of Computational Linguistics*, pages 132–139, Seattle, WA. printed.

Crouch, R., R. Kaplan, T. King, and S. Riezler. 2002. A Comparison of Evaluation Metrics for a Broad Coverage Parser. In *Beyond PARSEVAL Workshop at 3rd Int. Conference on Language Resources and Evaluation*, pages 67–74, Las Palmas, Canary Islands, Spain.

Dalrymple, M. 2001. *Lexical-Functional Grammar*. San Diego, CA.; London: Academic Press.

Kaplan, R. and J. Bresnan, 1982. *The Mental Representation of Grammatical Relations*, chapter Lexical-Functional Grammar: A Formal System for Grammatical Representation, pages 173–281. MIT Press, Cambridge, MA.

Kaplan, R., S. Riezler, T. King, J. Maxwell, A. Vasserman, and R. Crouch. 2004. Speed and Accuracy in Shallow and Deep Stochastic Parsing. In *Proceedings of the Human Language Technology Conference and the 4th Annual Meeting of the North American Chapter of the Association for Computational Linguistics*, pages 97–104, Boston, MA. printed.

King, T. H., R. Crouch, S. Riezler, M. Dalrymple, and R. M. Kaplan. 2003. The PARC 700 Dependency Bank. In *Proceedings of the 4th International Workshop on Linguistically Interpreted Corpora at the 10th Conference of the European Chapter of the Association for Computational Linguistics*, pages 1–8, Budapest, Hungary. printed.

Magerman, D. 1994. *Natural Language Parsing as Statistical Pattern Recognition*. Ph.D. Thesis, Department of Computer Science, Stanford University, CA. printed.

Marcus, M., G. Kim, M. A. Marcinkiewicz, R. MacIntyre, M. Ferguson, K. Katz, and B. Schasberger. 1994. The Penn Treebank: Annotating Predicate Argument Structure. In *Proceedings of ARPA Human Language Technology Workshop*, pages 114–119, Plainsboro, NJ. printed.

Maxwell III, J. and R. Kaplan. 1993. The Interface between Phrasal and Structural Constraints. *Computational Linguistics*, 19(4):571–589. printed.

O'Donovan, R., M. Burke, A. Cahill, J. van Genabith, and A. Way. 2004. Large-Scale Induction and Evaluation of Lexical Resources from the Penn-II Treebank. In *Proceedings of 42nd Conference of the Association for Computational Linguistics*, pages 367–374, Barcelona, Spain.

Riezler, S., R. Kaplan, T. King, M. Johnson, R. Crouch, and J. Maxwell III. 2002. Parsing the Wall Street Journal using a Lexical-Functional Grammar and Discriminative Estimation Techniques. In *Proceedings of 40th Conference of the Association for Computational Linguistics*, pages 271–278, Philadelphia, PA. printed.

VERBAL SEMANTICS VIA PETRI NETS

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Abstract

This paper introduces Petri Nets (Peterson 1981) into the vexed question of lexical semantic representation. We argue that Petri Nets can offer new insights into the organization of lexical meaning. Petri Nets can furthermore be translated directly into linear logic, thus ensuring compatibility with the glue logic semantic construction already defined within LFG (Dalrymple 1999). The potential usefulness of Petri Nets is demonstrated with respect to light verbs in Urdu.

1 Introduction

The study of complex predicates, both of the V-V and the N-V type, has been conducted quite intensely within Lexical-Functional Grammar (LFG) and related approaches (e.g., Alsina 1996, Alsina, Bresnan and Sells 1997, Butt 1995, Mohanan 1994). The major syntactic properties of complex predicates have been explored within, by now, well established analyses in terms of a(rgument)-structure fusion or merging. Complex predicates have been recognized to be complex in the sense that the two components of a complex predicate each contribute information about the a-structure properties of the construction. The main part of the predication is contributed by the noun or main/full verb. The second component of the complex predicate has generally been termed a *light verb* because its contributions tend to be semantically "lighter" than that of the main predicate. Some examples are shown in (1).

(1) a. ram=ne kɑhani=ko **yad** **k-i**
Ram.M.Sg=Erg story.F.Sg=Acc memory.F do-Perf.F.Sg
'Ram remembered the story.'

b. nadya=ne xɑt **lɪk^{h}** **li-ya**
Nadya.F=Erg letter.M.Nom write take-Perf.M.Sg
'Nadya wrote a letter (completely).'

The light verb is generally finite and carries tense/aspect marking. Its contribution to the a-structure is so subtle that some researchers have been tempted to analyze it as being empty (e.g., Grimshaw and Mester 1988), though one can show that the light verb does indeed contribute at least one argument to the predication (usually the highest one) (e.g., Butt 1995, Ritter and Rosen 1993).

Since both the main verb/noun and the light verb contribute information to the a-structure, the predication is complex. Unlike in equi/raising or control constructions (see Bresnan 1982 for an overview), this complex predication corresponds to a simplex predication at f-structure. That is, although the a-structure is complex and potentially embedded, the f-structure is exactly that of a monoclausal predication (see Alsina 1996, Butt 1995, Mohanan 1994).

Although the syntactically relevant predicational aspects of constructions as in (1) have been investigated in some detail (see also Alsina 1996, Butt 1995, Kaplan and Wedekind 1993, Butt 1994, Butt, King and Maxwell 2003 on architectural issues within LFG), the precise semantic contribution of the light verb to the joint predication remains elusive. One classic difficulty with complex predication involving light verbs is that the meaning does not necessarily represent the sum of its parts. While light verbs are always form-identical to a main verb in the language, they do not predicate like the main verb version. This is especially true for V-V constructions as in (1b), where the light verb version of 'take' does not mean 'take', but rather seems to indicate some kind of completion. Additionally, it can be contrasted with the light verb 'give', as in (2), whereby 'give' indicates benefaction (for somebody else) and 'take' implies that the action was self-serving.

(2) a. nadya=ne g^{h}ɑr **bɑna li-ya**
Nadya.F=Erg house.M.Nom make take-Perf.M.Sg
'Nadya built a house (completely, for herself).'

b. nadya=ne gʰɑr **bɑna di-ya**
Nadya.F=Erg house.M.Nom make give-Perf.M.Sg
'Nadya built a house (completely, for somebody else).'

However, this contrast between 'take' and 'give' does not always hold. Consider, for example, the sentences in (3). In neither of these examples can the light verb 'give' be interpreted as adding a benefactive meaning to the complex predication. Rather, as discussed in Butt and Geuder (2001), the main contribution of 'give' in (3b) is one of forcefulness, whereby in (3a), the use of 'give' implies responsibility for the loss on the part of the agent.

(3) a. kısi=ne baṭua **kʰo di-ya**
someone=Erg wallet.M.Sg.Nom lose give-Perf.M.Sg
'Somebody lost their wallet.' (from Hook 1974)

b. nadya=ne dʊʃmɑn=ko pani=mẽ **ḍub-a di-ya**
Nadya.F=Erg enemy=Acc water=in drown-Caus give-Perf.M.Sg
'Nadya drowned the enemy in the water (forcefully).'

Indeed, the range of usage documented for Urdu/Hindi[1] light verbs in V-V complex predicates (see Hook 1974 for a comprehensive discussion, for example) shows that the meanings contributed by the light verbs are manifold, varied, and contextually dependent. A popular analysis of light verbs has been that they represent a "semantically bleached" form of the main verb. However, it is not clear exactly what is being bleached into what and how the contextual dependence can be accounted for. Another popular analysis has been that the light verbs represent stages on the way to a grammaticalization of aspect (Hook 1991, 2001). While this would account for the completive/telic readings which are definitely part of the examples in (2) and (3), this analysis does not extend to the other subtle dimensions of meaning such as control, suddenness forcefulness, or benefaction.

This paper builds on the insights arrived at by Butt and Geuder (2001) and Butt and Ramchand (2003) as to the semantic composition of V-V complex predicates, but attempts to take things a step further towards a concrete formal understanding of the range and type of semantic predication that a light verb can have in interaction with a main verb. To this end, we introduce Petri Nets (Peterson 1981) into the vexed question of lexical semantic representation. In particular, we assume that the form-identical light verbs and main verbs must be derived from one and the same underlying, underspecified lexical entry. This underspecified lexical entry becomes specified as either a main verb or a light verb predication, depending on the surrounding syntactic context. The process of the semantic specification towards either a light or a main verb meaning is modeled in terms of a Petri Net, thus allowing one to concretely identify the semantic dimensions that are involved.

In what follows, we first lay out the reasons for assuming a semantically underspecified lexical representation for main verbs and their form-identical light verbs (section 2). We then briefly discuss Petri Nets and how they can be put to use in modeling linguistic processes (section 3). In section 4 we provide sample analyses involving the verb 'give' and try to account for the varied dimensions in meaning exemplified by (2) and (3). Finally, section 5 concludes the paper.

2 Light Verbs and Semantic Underspecification

This section briefly discusses why an analysis in terms of lexical underspecification should be adopted with respect to light verbs and their form-identical main verbs.

[1]The South Asian languages Urdu and Hindi are closely related. Differences are found mainly in the domain of the vocabulary. Both languages are among the 18 official languages of India and are spoken primarily in the north of India. Urdu is the national language of Pakistan.

2.1 Historical Interconnectedness

The primary reason for assuming underspecification has to do with the diachronic behavior of light verbs. Given the "semantic bleaching" or aspectual grammaticalization analyses alluded to above, one would expect that light verbs behave much like auxiliaries in terms of diachronic development. That is, given a verb like 'go', one expects a stage in which there is a 'go' which is used in a more temporal, rather than a concrete spatial sense. A current example of this in English is the "going to" future, as in *Peter is going to go home.* Over time, one expects that this 'go' will be reanalyzed as an auxiliary with future import and given more time, this auxiliary night then be further reanalyzed as tense inflection.

Indeed, this is exactly what can be found with the verb 'go' and the development of future morphology in Urdu. The table in (4) shows the paradigm for the Urdu/Hindi future.

(4) **Urdu Future Paradigm** (for mar- 'hit')

	Singular M/F	Plural M/F	Respect (ap) M/F	Familiar (tʊm) M/F
1st	mar-ũ-g-a/i	mar-ẽ-g-e/i		
2nd	mar-e-g-a/i		mar-ẽ-g-e/i	mar-o-g-e/i
3rd	mar-e-g-a/i	mar-ẽ-g-e/i		

The consensus in the literature is that the future *-g-* morpheme is derived from a Sanskrit participle of the verb *gā* 'go' (Kellog 1893:231, Beg 1988:191, McGregor 1968). The gender and number agreement morphology (*a/i/e*) exhibited by the future is regular synchronically in that exactly this agreement morphology is also found on the perfect, imperfect and progressive forms, all descended from participles. The appearance of this morphology follows unproblematically if the *-g-* is indeed associated with an old participle of 'go'. The person/number inflection of the future paradigm in (4) is identical to the inflections found in conjunction with the present tense paradigm of *ho* 'be'. There is some indication that these forms are indeed related, so that one can speculate that the modern Urdu future consists of a verb stem, some present tense inflections or a trapped present tense auxiliary, the remnants of the participle 'go', and the gender/number agreement inflections that belong with participles.

Up until a hundred years ago, the main verb+person/number (former present tense) morphology could be separated from the *g*+number/gender morphology (some speakers can still do this). This indicates that the change from periphrastic auxiliary to future inflection with respect to 'go' took place relatively recently and that the change from a main verb to a tense inflection took place quite rapidly. Now, if light verbs were to be derived from main verbs in a similar manner, one would expect to see similar patterns of historical change. However, a thorough scrutiny of the available diachronic data fails to turn up any such patterns (Butt and Lahiri 2004).[2] Instead, at every stage in the language where a light verb use can be identified (this is not always easy), the light verb is form-identical to a main verb in the language. This includes taking exactly the same inflections and participating in exactly the same paradigms as the main verb version. An example of a documented use of the light verb version of 'give' in Middle Indo-Aryan is shown in (5).

(5) a. . . . assamapadaṃ ānetvā aggiṃ **katvā** **adāsi**
hermitage.Acc lead.Gd fire.Acc.Sg make.Gd Aug.give.Impf.3.Sg
'. . . brought her to his hermitage and made a fire for her' (Pāli)
['having brought (her) to the hermitage, made a fire (for her)']
Jatāka Tales I.296.10, Sri Lanka (Hendriksen 1944:134)

[2] Hook 1991, 2001 documents an increase in the use of light verbs in South Asian languages, as well as a more definitive shift towards encoding aspectual differences, but nothing along the lines that has been established as typical of auxiliary formation.

b. daruni āharitvā aggiṁ **katvā** **dassati**
sticks bring.Gd fire.Acc.Sg make.Gd give.Fut.3.Sg
'Bringing wood he'll make a fire (benefactive use).' (Pāli)
(Trenckner 1879:77, cited by Hook 1993:97)

There is thus no documented development of the light verb *away* from the main verb version. Rather, the main and the light versions of a verb seem to be tied to one another in an intimate manner. This diachronic observation holds not just for Indo-Aryan languages like Urdu, but is one that has been documented across several language families (Germanic, Indo-Aryan, Dravidian; see Butt and Lahiri 2004 for a detailed discussion). Further evidence for the intimate connection between main and light verb versions is the observation that when a verb ceases to exist in a language, then both the main and the light verb usage disappear simultaneously (if both exist). For example, when the English *nimen* 'take' dropped out of the language, both main and light verb uses were taken over simultaneously by *taken* (Iglesias-Rábade 2001).

The available diachronic evidence thus shows that one never finds a light verb on its own: there is always a form-identical main verb in use as well. This situation stands in stark contrast to that of auxiliaries, which tend to develop away from the original main verb form until they are almost unrecognizable (e.g., the English preterite *-d* from *do* or the Urdu future *-g-* described above). This suggests a fundamental interconnectedness between the main and the light use of a verb. One could attempt to analyze the light verb as being derivative of the main verb, but then one would have to stipulate that the light verb must remain connected to the main verb in some way. Given what is known about historical change in general, this type of stipulation seems to be artificial and unexplanatory, to say the least.

On the other hand, if one assumed that both the main and the light uses of a verb are derived from one and the same underlying lexical entry, then the facts follow. If there is only one underlying lexical entry from which both are derived, then the main and light verb use should be form-identical. Furthermore, if the lexical entry is deleted from the grammar of the language, then both the main and the light verb use will cease to exist at the same time. Historical changes that apply to change the surface form of the verb (changes in morphology, form, etc.) will apply to both the light and the main verb uses, since there is just one underlying lexical entry, which these processes can access.

If one grants that an approach in terms of a single underlying lexical entry is on the right track, then the next question which arises is one of representation. Given that (at least) two uses must be derived from one lexical entry, one possible route to take would be to fully specify all the possibilities in the form of disjunctions. These disjunctive possibilities would then be simply associated with one and the same lemma (*de* 'give', for example). This type of "full listing" could lay no claims in terms of elegance of explanation or generalizability; however, if it did justice to the facts, one might be tempted to choose this approach.

The next section discusses a further set of observations that would seem to legislate against a "full listing" type of approach. Instead, a representation in terms of lexical underspecification emerges as potentially more feasible.

2.2 Defeasible Information

Recall that the use of a light verb like 'give' always entails that the action is completed. Furthermore, the light verb 'give' can potentially contribute the semantic dimensions of benefaction, control, or forcefulness to a given predication. Butt and Ramchand (2003) analyze the contribution of completion/telicity in terms of the internal lexical semantic structure of the predication. A given event is taken to have exactly three salient components: a cause/intiation, a process, and a result. These three semantic components tend to be grammatically encoded in languages via morphological or syntactic devices. Light verbs are seen as a syntactic device which interact with the event semantics of the main verb to produce a more complete event description. The more subtle semantic dimensions like benefaction or forcefulness are not dealt with under this approach, but are assumed to have a status that is akin to adverbial event modification, as proposed by Butt and Geuder (2001). That is, when the verb ‘give’ acts as a light verb, the joint event predication is one in which the agent had control over the event and the event is telic, happened in a forceful manner and had some benefit for a participant distinct from the agent of the event.

In something like (3), for example, repeated in (6), the lexical semantic contribution of the light verb to the predication results in a reading that the agent has control and that the event is telic and happened in a forceful manner. However, there is no sense of benefaction.

(6) nadya=ne dʊʃmɑn=ko pani=mẽ **ḍub-a** **di-ya**
Nadya.F=Erg enemy=Acc water=in drown-Caus give-Perf.M.Sg
‘Nadya drowned the enemy in the water (forcefully).’

Now, if one were to take the disjunctive, full listing approach discussed above, then one would also have to anticipate all the situations in which the semantic dimensions of benefaction or forcefulness could or could not apply. Since this depends on contextual as well as lexical semantic factors, listing all the potential contexts which would license (or suppress) these additional event modifications is not a feasible solution.

Another question to consider with respect to a possible common underlying lexical representation for both main and light verb uses is whether one could derive event modificatory semantics such as benefaction or forcefulness from an abstract predicational force associated with the verb ‘give’. That is, is there something about the predicational force of ‘give’ that would lead us to predict that it might be associated with benefaction and forcefulness, as opposed to a verb like ‘take’, for example (cf. the contrast in (2))? The answer that Butt and Geuder (2001) give to this is a “yes”. Under their analysis, the meaning dimensions of the light verb ‘give’ are taken to be loosely based on the predicational force of an abstract action ‘give’.

In conclusion, the diachronic and synchronic facts with respect to light verbs in Urdu lead us to the following realizations:

1. Both light and main verb uses must be derived from the same underlying lexical entry.

2. The event modificatory semantics contributed by the light verb are not random, but are to be associated with an abstract representation of the verb in question.

3. Not all of the meaning dimensions of a light verb must always apply to a given event modification.

Given these observations and realizations, what could such a single underlying, underspecified entry look like? Standard approaches to lexical representation in terms of lexical decomposition, inheritance hierarchies, cognitive semantics, or Davidsonian event semantics all seem to lack the repertoire necessary for a solution to this problem. Or to put it another way, there seems to be no room for the kind of phenomenon described here in the approaches to lexical semantics that have dominated the last few decades: it is very difficult to apply known techniques to the problem at hand, or even to come up with imaginative new ways within the existing approaches.

We do not think it is a coincidence that no detailed lexical semantics approaches exist that could capture the semantic contributions of light verbs, even though these semantic contributions have been observed for quite some time and have been well documented across several language families. At most, the semantics of light verbs is approached within an argument structure or grammaticalization approach (see discussion above), but this tends to be able to account only for a subset of the observed meaning dimensions.

Given that the existing approaches seem to be acting as limiters, rather than as enablers, we decided to explore alternative possibilities for the representation of lexical entries. With *Petri Nets*

(Peterson 1981), we found a model that seemed promising in terms of providing new insights with respect to the representation of lexical semantics. In particular, since the type of Petri Nets used here can be translated into the version of linear logic used for the glue semantic component of LFG (Dalrymple 1999), we anticipate that we would be able to translate the results we arrived at through an exploration of Petri Nets directly into consequences for the representation of the necessary semantic dimensions within glue semantics.

3 Petri Nets

In his dissertation, Carl Adam Petri (1962) introduced a kind of directed graph that opened up new ways of thinking about design issues in communication and computer systems. These so-called *Petri Nets* were accepted by researchers within such diverse fields as biology, astronomy, nuclear physics and sociology as a promising way of solving problematic modeling issues. The Petri Net community today is very active and organized (see, e.g. http://www.daimi.au.dk/˜petrinet/).

Petri Nets are used primarily to model the interactions between different components of systems, whereby each of the components is autonomous and functions independently from the others. This means that even while interacting with one another, each one of the components may execute different tasks at the same time. That is, Petri Nets deal with interacting concurrent components. Since the first presentation of Petri Net theory, a number of extensions for differing applications and purposes have been developed over the years. Even though many of the beneficial aspects of Petri Nets are irrelevant in terms of linguistic theorizing, we would argue that there are some extremely elegant properties of Petri Nets that can be used for a representation language for lexical semantics. In this section, we introduce the ordinary or black-white Petri Nets (based on the version first described by Petri 1962), whose architecture would seem to suffice for the linguistic modeling of lexical semantics.

A Petri Net is represented in the form of directed graphs and serves the purpose of maintaining simplicity and clarity in our analyses. Before looking at specific examples containing Petri Nets as means of representations (section 4), it is essential to present a brief overview of the formal properties of these graphs so that the importance and novelty of the current approach to lexical semantic representation becomes clear. One central characteristic of Petri Nets is that they constitute bipartite graphs. This means that the graphs are determined through the use of two distinct types of nodes: places and transitions. In addition to these two types of nodes and the arcs which assure the directivity of the graph, a fourth object is introduced in order to describe the dynamics of a Petri Net. This object is the token, expressed by a solid dot $\bullet$, which resides inside the circles representing the places. In the framework we work in, namely, the ordinary Petri Nets, the tokens represent abstract information and are not distinguishable from one another. The property of Petri Nets of having two types of nodes defines the way the so-called 'token game' is conducted inside a Petri Net. The token game consists of a transfer of 'tokens' (represented as the black dots) through the graph, whereby the 'event', as the 'complete' execution (including the last possible transition) of a Petri Net can be intuitively called, can be described in different stages according to the positioning of the tokens. Below, the conception of a token game is explained, along with the procedural nature of Petri Nets.

A Petri Net structure, D, is a quadruple, D=(P,T,I,O), where P=p_1, p_2,…,p_n is a finite set of places, $n \geq 0$. T=t_1, t_2,…,t_m is a finite set of transitions, $m \geq 0$. The set of places and transitions are always disjoint, $P \cap T = \emptyset$; this represents formally that we are dealing with different syntactic types in the network. The mapping from the places to transitions and from transitions to places is undertaken by input (I: T $\rightarrow$P ∞) and output functions (I: T $\rightarrow$P ∞). These functions map transitions to bags of places. A graphical representation of Petri Nets as in Figures 1 and 2 illustrates their potential usefulness more clearly. A Petri Net graph consists of places as circles, transitions as bars, and arcs, which realize the input and output functions of the transitions and are always directed. Finally, the tokens are considered to be abstract entities and express the procedural nature of Petri Nets by carrying the relevant information and marking the network in the different stages of its execution.

It should be clear by now that a Petri Net is not just a diagram describing the relationships among the objects represented by the nodes. One could adopt other techniques to do this in a very convenient and simple way. An essential feature of Petri Nets is that they can be executed. Following the terminology adopted in Petri Net theory, the steps below express the algorithm for the execution of a Petri Net.

1. An initial marking is defined (by a marking μ we mean an assignment of tokens to the places of a Petri Net).
2. The set of eligible transitions is activated (eligible transitions are the ones whose input functions contain at least one token in their domains).
3. One of the eligible transitions fires and transfers the tokens to the places that belong to the range of its output functions.
4. Step 2 is returned to until all the eligible transitions have fired or else until the final marking state has been reached.

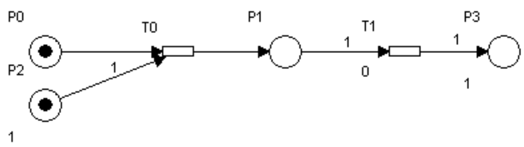

Figure 1: An Initial Marking

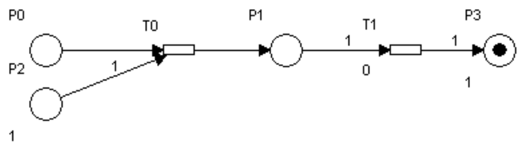

Figure 2: The Final Marking

Before we move on to an illustration of the more complex Petri Nets we explore for the representation of lexical semantics, some explanations of the basic notions just introduced are in order. The Figures in 1 and 2 represent a simple Petri Net in its initial and final marking stages. In what follows, we briefly go through how this Petri Net was executed.

The input function I(p,t) is defined as a mapping $P \times T \rightarrow \{0,1\}$ corresponding to the set of directed arcs from places to transitions and the output functions O(t,p) as a mapping $T \times P \rightarrow \{0,1\}$ corresponding to the set of directed arcs from transitions to places (0 and 1 represent the fact that the function is either realized or not). The structure of the Petri Net in Figure 1, i.e., the quadruple D that defines it, is represented as in (7).

(7) P: $\{p_0, p_1, p_2, p_3\}$
T: $\{t_0, t_1\}$
$I(p_0, t_0) = 1$, $I(p_2, t_0) = 1$, $I(p_1, t_0) = 0$, $I(p_3, t_1) = 0$
$I(p_0, t_1) = 0$, $I(p_2, t_1) = 0$, $I(p_1, t_1) = 1$, $I(p_3, t_1) = 0$
$O(t_0, p_0) = 0$, $O(t_1, p_0) = 0$
$O(t_0, p_2) = 0$, $O(t_1, p_2) = 0$
$O(t_0, p_1) = 1$, $O(t_1, p_1) = 0$
$O(t_0, p_3) = 0$, $O(t_1, p_3) = 1$

The formal representation of the structure of the Petri Net determines which arcs can be activated in the graph. This is based on the knowledge of which connections are allowed, given the structure in (7). A marked Petri Net MΠ is one where we additionally define a marking μ on it. This is a function that maps the members of the set of places p to the nonnegative integers n that represent the number of tokens. In other words, we assign a number of tokens to the places that carry the abstract information. The firing of a transition is achieved in two steps: first of all, the places that lead to the transition (these are all the places that result in a 1 in the input function of the transition) should be marked with at least one token. When this condition is met, the transition is enabled. The enabled transition then consumes the tokens of the 'input' places and, according to the 'power' of the arc, distributes tokens to each one of the appropriate 'output' places. Figure 1 illustrates the initial marking of the Petri Net, in which the places p_0 and p_2 include one token each. During the complete execution of the marked Petri Net, two firings are realized. The first firing is allowed by the enabled transition t_0. Both places p_0 and p_2 need to be marked with at least one token, otherwise the transition is not enabled. If only p_0 or p_2 had a token, then the necessary preconditions for the transition t_0 to be enabled would not have been met and the transition would not fire. Given that in Figure 1 the transition t_0 is properly enabled, it can fire. This results in position p_1 being marked with a token. The second possible firing in the net can now take place since the marking of p_1 enables the transition t_1. Figure 2 illustrates the final marking of the Petri Net, where there is no other possible enabling of a transition.

Now, how does this abstract modeling relate to lexical semantics? The procedural nature of Petri Nets and their usefulness for our purpose of semantic composition can be made clear by thinking of the token game as the consumption of available resources, whereby each new state of a Petri Net represents a step in the process of semantic composition. Sublexical and lexical semantic effects can be represented in terms of abstract tokens in certain initial positions. The interaction of these pieces of (sub)lexical semantic information with one another and with clausal morphosyntactic information as well as contextual information can then be modeled and reliably computed via a Petri Net. That is, the Petri Nets allow a detailed modeling of the subtleties and intricacies of semantic composition that are involved with respect to lexical semantics in general and light verbs in particular. The differing semantic interactions between the bits of semantic knowledge implied by a lexical item can be computed by just enabling one and the same Petri Net (which is meant to represent the lexical semantics of the verb) in different initial markings. These different initial markings correspond to differences in the morphosyntax or in the context.

This lexical semantic perspective on the procedural functioning of Petri Nets has potentially significant import for a treatment of lexical and clausal semantics because it works with fundamentally similar assumptions as *glue semantics*, one type of semantic analysis proposed within LFG. Within glue semantics, semantic composition is driven by the idea that linguistic resources are consumed until a final predication is reached in which all the arguments of the predicates are instantiated (Dalrymple 1999). Glue semantics relies on linear logic and, indeed, linear logic has also been suggested by Engberg and Winskel (1994) as a possible translation of Petri Nets.[3] Under their interpretation of Petri Nets, the multiplicative conjunction $\otimes$ takes as its arguments the places carrying at least one token. Multiplicative conjunction enables a transition in the following way: a given transition is only enabled through the 'conjunction' of the places connected to a transition. If the conjunction holds, the transition can fire. This firing or, better, 'consumption' of tokens is in turn realized by the combination of the multiplicative conjunction and the linear implication $\multimap$. The role of the linear implication is to activate the transitions' function of realizing tokens in the output places. The idea of consuming the appropriate places closed under the multiple conjunction $\otimes$ captures the expressibility of Petri Nets in a simple way.

The marked Petri Net illustrated in Figure 1 can thus be represented by the linear logic formula in (8). Given the interpretation of the multiplicative conjunction as defined above, this formula

[3] Engberg and Winskel (1994) even proposed a small ($\otimes$,$\multimap$) fragment of intuitionistic linear logic.

states that the places p_0 and p_2 enable the firing of a transition that provides us with p_1, which in its turn is consumed and results in p_3.

(8) $((p_0 \otimes p_2) \multimap p_1) \multimap p_3$

This connection of linear logic to Petri Nets concludes the discussion of the basics of Petri Nets. The next section moves on to an illustration of concrete examples with respect to the light verb *de* 'give'. In particular, we use places to represent bundles of semantic properties. Differences in the initial marking of the Petri Net capture the different ways the light verb can modify the event of the main predication and successfully express its subtle semantic contribution to the complex predicate.

4 Sample Analysis

Recall from section 2 that the data with respect to light verbs and their form-identical full verb counterparts points to a very intimate connection between the two. We propose to model this interconnectedness by assuming a single underspecified lexical entry from which both the main and the light verb readings can be derived. The question posed in section 2 was: how can this single underspecified entry be represented? The answer proposed in this section is that a representation in terms of Petri Nets can serve to clarify our ideas on the necessary representational components and their interactions with one another and with clausal and discoursal information.

Most of the familiar approaches to lexical semantics involve some kind of lexical decomposition (e.g., Dowty 1979, Jackendoff 1990, Hale and Keyser 2002). However, lexical decomposition is not at all helpful when trying to come to grips with contextually dependent meaning dimensions like benefaction or forcefulness. Cognitve Semantics (e.g., Newman 1996) appears to be more promising in this regard (see the discussion in Butt and Geuder 2001), but is ultimately not suitable for computational purposes. As a first approximation towards finding the right kind of underspecified lexical entry, we therefore decided to work with Dowty's (1991) Proto-Role entailments.

Dowty (1991) formulated a number of entailments which follow from the lexical semantics of a verb that could help with the identification of an argument as either a Proto-Agent, a Proto-Patient, or neither. As a reminder to the reader, Dowty's entailments are reproduced in (9).

(9) **Dowty's Proto-Role Entailments**

Proto-Agent

a. volitional involvement in the event or state
(Ex.: Kim in *Kim is ignoring Sandy.*)

b. sentience (and/or perception)
(Ex.: Kim in *Kim sees/fears Sandy.*)

c. causing an event or change of state in another participant
(Ex.: loneliness in *Loneliness causes unhappiness.*)

d. movement (relative to the position of another participant)
(Ex.: tumbleweed in *The tumbleweed passed the rock.*)

e. (exists independently of the event named by the verb)
(Ex.: Kim in *Kim needs a new car.*)

Proto-Patient

a. undergoes change of state
(Ex.: cake in *Kim baked a cake.*, error in *Kim erased the error.*)

b. incremental theme
(Ex.: apple in *Kim ate the apple.*)

c. causally affected by another participant
(Ex.: Sandy in *Kim kicked Sandy.*)

d. stationary relative to movement of another participant
(Ex.: rock in *The tumbleweed passed the rock.*)

e. (does not exist independently of the event, or not at all)
(Ex.: house in *Kim built a house.*)

Although some of Dowty's definitions/assumptions are problematic and more could be said on this matter, our interest for the moment is not in trying to go beyond Dowty's insights, but to investigate whether this way of looking at lexical semantics can help with modeling the semantic effects of light verbs.

Given the conclusion that a main verb and its corresponding light verb should be derived from the same underlying entry, one desideratum is that the underlying entry allow for the kind of flexibility in which either a full argument structure is instantiated (main verb reading), or where only some event modificatory meaning dimensions such as benefaction, control, or completion are instantiated (light verb reading). We think that this can be achieved by assuming that the lexical entry by itself only provides a bundling of properties which are typical for the kind of event that is described. That is, the lexical semantic representation primarily consists of an unordered collection of semantic properties that are akin to Dowty's Proto-Role entailments. This bundle of properties is only structured into the familiar lexically decomposed structures (e.g., an LCS) in interaction with syntactic properties that require a main verb predication.[4] When there is no call for a main verb predication, i.e., when the syntactic environment does not allow for one, the bundle of semantic properties is realized in terms of an event modificatory semantics. That is, the meaning dimensions are applied to modify the event semantics of the main verb in the clause.

The screen shots of working Petri Nets in Figures 3 to 6 illustrate this basic idea with respect to the light verb *de* 'give'.[5] As shown in Figures 3 and 5, the lexical entry for 'give' initially only consists of semantic properties such as "volitional involvement", "causation" (both derived from Dowty's Proto-Agent entailments), "change of state" (derived from Dowty's Proto-Patient entailments) and a general "change of location" (goal) component.

The fundamental property of Petri Nets that we make use of is that certain transitions can only be enabled if all of the places leading to that transition are 'armed'. That is, the armed places represent the necessary preconditions for a certain transition to fire. In terms of linear logic, these preconditions can be interpreted as the *resources* from which semantic conclusions are drawn. The idea in Figures 3–6 is that the underlying lexical semantics of the verb are invariant. The unordered bundle of lexical semantic properties is realized as tokens in the places p_0, p_1, p_{17} and p_2. Figures 3 and 5 differ in the additional kinds of resources. In Figure 3, for example, the initial markings indicate that the verb *de* 'give' is the sole verb in a clause with three NPs (p_{11}, p_{12} and p_{13}). In such a configuration, an execution of the Petri Net results in the final marking shown in Figure 4.

[4]Note that this idea shares many features with newer work by Marantz 1997 and Borer 2003 by which the syntactic type (and predicational power) of a lexical item is only determined once it has been inserted into syntax.

[5]The Petri Nets were modeled with the help of *PetrA* (http://computacion.cs.cinvestav.mx/~ameneses/PetraPag/petra.html), one of the few Petri Net implementations that are compatible with a Macintosh operating system.

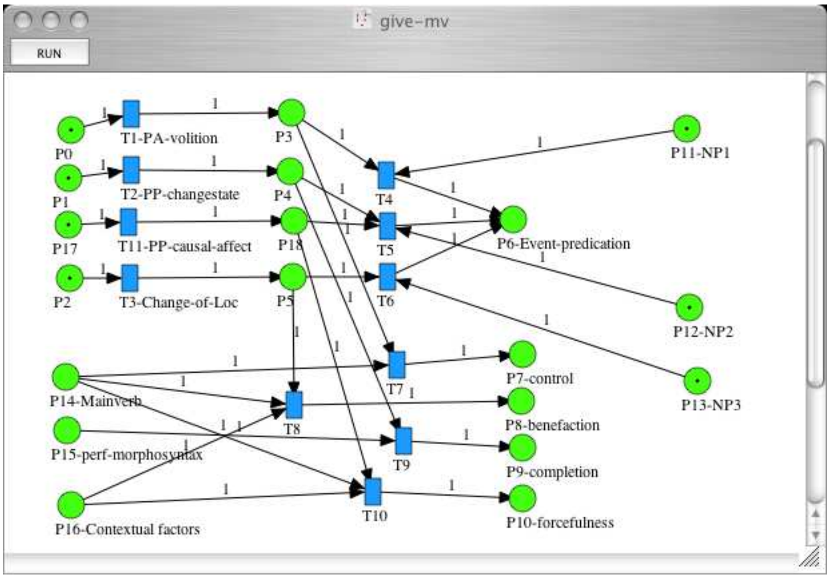

Figure 3: Underspecified entry for ‘give’, in main verb context (Initial)

In Figure 4, the transitions t_1, t_2, t_{11} and t_3 were all enabled and therefore all fired and distributed tokens to p_3, p_4, p_{18}, p_5. These places, in turn, in conjunction ($\otimes$) with the places p_{11}, p_{12} and p_{13} served to enable the transitions in t_4, t_5 and t_6, which then fired and led to a marking of the net in which p_6 is marked. The final marking of the Petri Net, where p_6 is the only place marked, is interpreted as the predication of the event semantics of a main verb with three arguments. These three arguments have the Proto-Role properties of volition (Proto-Agent), change-of-state (Proto-Patient), causal affectedness (Proto-Patient) and change of location (neither Proto-Agent or Proto-Patient, but a third argument).

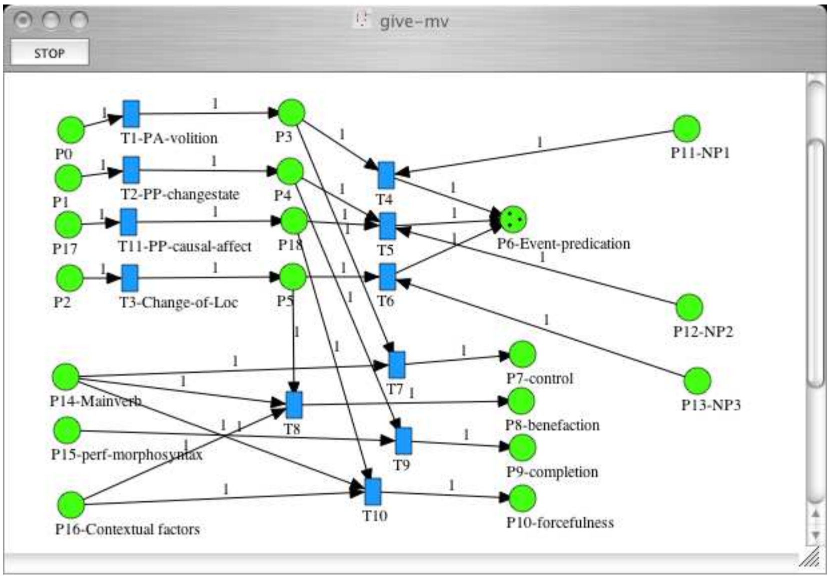

Figure 4: Interpretation for ‘give’, in main verb context (Final)

Contrast this with the initial markings that lead to a light verb interpretation. This is shown in Figure 5, where the places p_0, p_1, p_{17} and p_2 contain tokens representing the lexical semantics of *de* ‘give’, just as in Figure 3. The difference lies in contextual activation. The initial marking in Figure 5 indicates that there already is a main verb in the clause, it takes into account perfective morphology on the main verb (this is how the telic reading is actually licensed, see Butt and Ramchand 2003),[6] and it allows for contextual factors that would license the semantic dimensions of benefaction or forcefulness, for example.

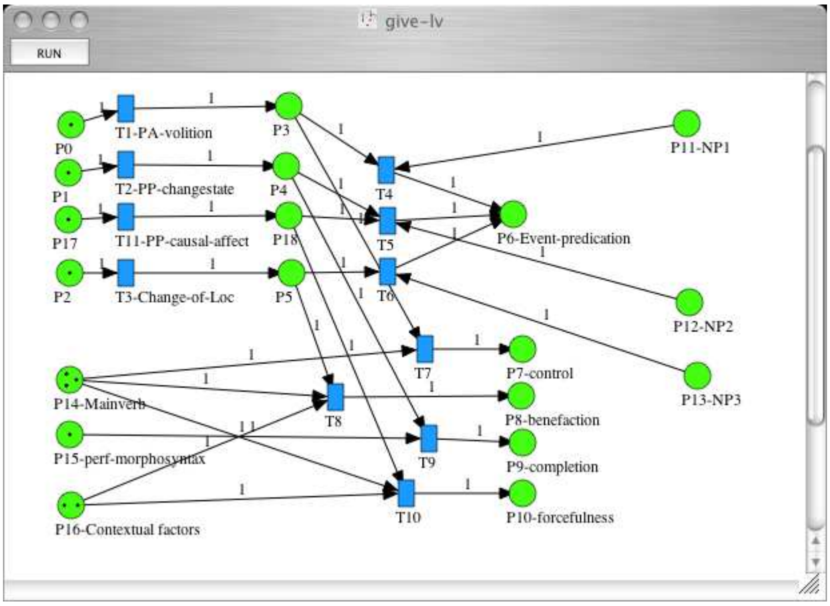

Figure 5: Underspecified entry for 'give', in light verb context (Initial)

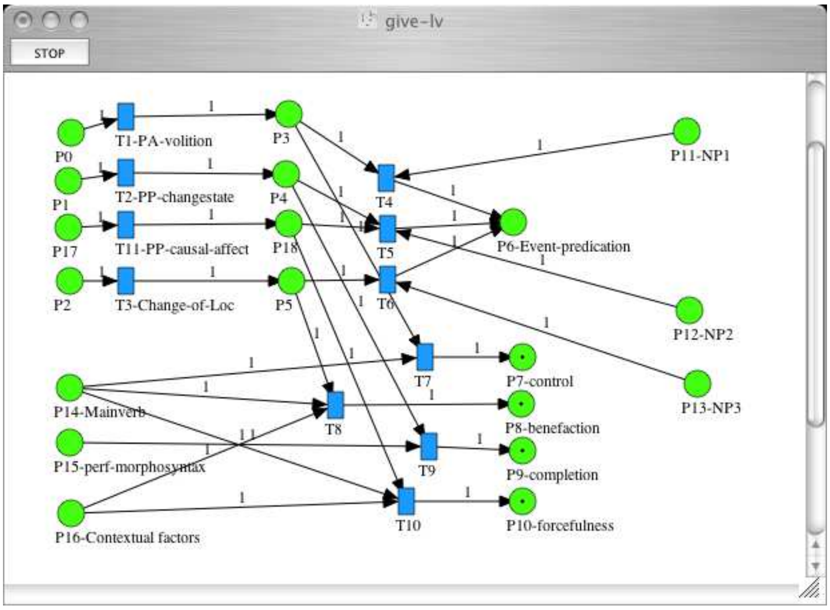

Figure 6: Interpretation of 'give', in light verb context (Final)

In Figure 5, the transitions t_1, t_2, t_{11} and t_3 were enabled and therefore fired. However, given that the positions p_{11}, p_{12} and p_{13} do not contain tokens in the initial marking in Figure 5, the transitions leading to a full event predication were not enabled and could not fire. Instead, the transitions t_7, t_8, t_9 and t_{10} were enabled and fired, resulting in the marking illustrated in Figure 6.

[6] Note that the "perfective" morphology this is taking into account was lost recently in Urdu/Hindi. Bengali, in contrast, still has an overt *-e* marking on the main verb. Discussing this issue in detail would take us too far afield, but see Butt and Ramchand 2003 for a detailed discussion.

Figure 6 thus shows a situation in which all of the meaning dimensions of *de* 'give' have been activated: control (p_7), benefaction (p_8), completion (p_9) and forcefulness (p_{10}). The predication of these meaning dimensions is not random, but must be seen as deriving or being licensed by the collection of initial lexical semantic properties. So, for example, the completion dimension that is the hallmark of transitive light verbs in Urdu can be derived from the change of state (Proto-Patient) property, control is licensed by volition (Proto-Agent), forcefulness by causal affectedness, and benefaction by the change of location.

Thus, the precise interpretation of the initial bundle of lexical semantic properties depends on the clausal and discoursal context. If 'give' were the sole verbal predicate in a clause, as in Figure 3, then the activated bundle of features could be realized as thematic roles if and only if the clausal (or discoursal in case of pro-drop) context licensed the arguments. In this case, the NP states contain tokens and the appropriate transitions (agent, patient, goal) are able to fire, leading to an event predication. On the other hand, if the 'give' is found in conjunction with another verbal predicate, it can be interpreted only as predicating a collection of semantic properties that must be applied to the main event predication of another verb. We assume with Butt and Geuder (2001) that these meaning components are analogous to adverbial modification.

A very nice feature of the Petri Net approach sketched here is that it fulfills exactly the requirements identified in section 2: 1) main and light verb readings should be derived from the same underlying lexical entry (indeed, *the same underlying lexical semantics*); 2) not all of the meaning dimensions supported by a light verb should necessarily always be enabled.

The first point has been illustrated with respect to the abstract situations represented by Figures 3–6. The second point can be illustrated with respect to the example shown in (10). This is a sentence uttered by a man in a context where the woman he has been promised to by his parents (arranged marriage) releases him from his obligation. As she explains that she realizes he does not love her (while she will always love him), he is moved almost to tears and he begs her to stop talking because otherwise he will have to cry.

(10) mɛ̃ ro d-ũ-g-a
I.Nom cry give-1.Sg-Fut-M.Sg
'I will cry.' (from the movie *Kabhi Khushi Kabhi Gham*)

In this situation, the light verb *de* 'give' carries no sense of benefaction or forcefulness. Rather, the use of 'give' overrides the default assumption that crying is more of an involuntary, rather than a controlled action (our hero is manfully controlling his crying, but might still decide to do it anyway). Again, this can be modelled via Petri Nets as shown in Figures 7–8. An execution of the net results in Figure 8. Here again the transitions t_1, t_2, t_{11} and t_3 were all enabled and therefore fired. However, of the transitions t_7, t_8, t_9 and t_{10}, only t_7 and t_9 were enabled and could fire. The tokens in positions p_{18} and p_5 are "stuck" and can be viewed as resources that were made available by the underlying lexical semantics of the verb, but which could not be consumed.[7]

Since these resources could not be consumed, no predication in terms of the semantic dimensions of benefaction and forcefulness is possible. Instead, the semantic import of the light verb in this situation is limited to contributing the information that the crying event was a controlled one and

[7]Note that this does not quite fit with the conception of glue semantics as articulated in Dalrymple 1999, whereby all resources must be consumed as part of arriving at a well formed semantic representation. Under our proposal, Petri Nets could be viewed as a procedural model of meaning whereby bits of semantic knowledge are consumed depending on the context. That is, we assume different stages in the procedural model. In an initial stage all the bits of semantic knowledge that are available are dealt with in some form or another and are "readied" for further possible semantic composition through the activation of p_3, p_4, p_{18} and p_5. In the next stage, only those bits of information which are suitable for consumption actually enter the semantic composition, resulting only in the marking of p_7 and p_9 in Figure 8. A more precise articulation of the relationship between the Petri Net model and glue semantics in this case, however, must be left to further work.

that it would have been completed, had our hero really commenced crying (recall that the utterance is in the future tense).

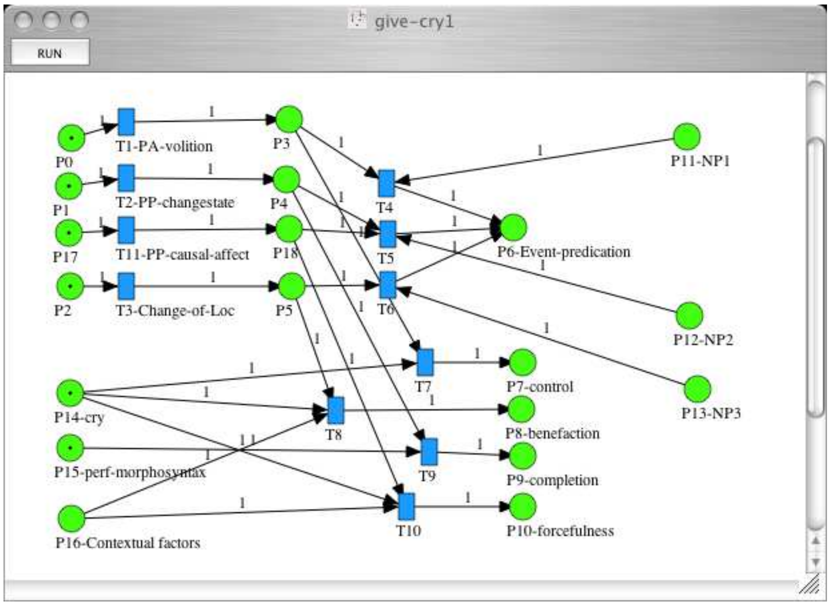

Figure 7: Underspecified entry for ‘give’, in light verb context with ‘cry’ (Initial)

In Figure 7, the initial marking for the underlying lexical semantics of ‘give’ is again the same. And, again, it is the contextually supplied initial information that differs. So, in its initial state, the Petri Net representing the analysis of (10) is marked with the information that there is a main verb ‘cry’. Since ‘cry’ only has one argument which could perform a volitional action, it is associated with transition t_7.

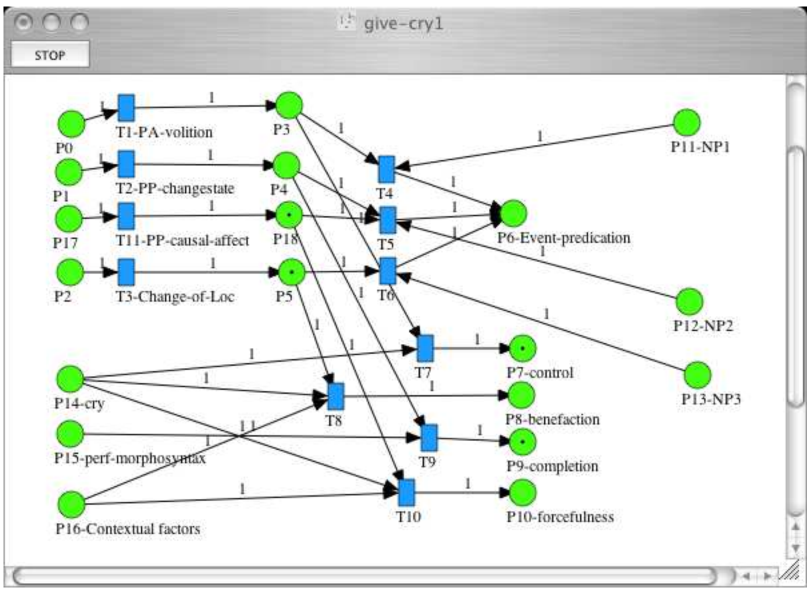

Figure 8: Underspecified entry for ‘give’, in light verb context with ‘cry’ (Final)

This concludes the presentation of sample lexical semantic analyses in terms of Petri Nets. There are several other problems to tackle, such as noun-verb constructions (e.g., *give a wash*) and why not all verbs allow light verb meanings. However, our initial explorations have shown that the Petri Net model can deal with some difficult problems with respect to the semantics of complex predicates quite nicely. Petri Nets would thus seem to provide a promising model of lexical semantic representation, particularly in interaction with context related factors.

5 Conclusions

In conclusion, Petri Nets not only provide an intuitive model for the encoding of lexically underspecified information, they also allow for the necessary flexibility in semantic interpretation. As was shown above, the meaning dimensions of benefaction and forcefulness with respect to the light verb use of *de* 'give' in Urdu are highly context dependent. The relevant transition will only be activated if a corresponding token has been found in the discourse context (encoded as *contextual factor* in the Petri Nets).[8] When the "right" context for benefaction and/or forcefulness is not available, then these meaning dimensions cannot be computed. That is, they are resources made available by the lexical semantics of 'give' that are not always necessarily consumed as part of the computation. The resource sensitivity inherent to Petri Nets is highly reminiscent of glue semantics within LFG (Dalrymple 1999). And indeed, the version of Petri Nets we have explored in this paper has been shown to be equivalent to the version of linear logic assumed within glue semantics. As such, the insights gained from modeling lexical semantics within Petri Nets should be directly translatable into LFG's glue semantics. This remains to be done in future work.

References

Alsina, Alex. 1996. *The Role of Argument Structure in Grammar*. Stanford, California: CSLI Publications.

Alsina, Alex, Joan Bresnan, and Peter Sells (ed.). 1997. *Complex Predicates*. Stanford, California: CSLI Publications.

Beg, Mirza Khalil A. 1988. *Urdu Grammar: History and Structure*. New Delhi: Bahri Publications.

Borer, Hagit. 2003. *Structuring Sense: An Exo-Skeletal Trilogy*. Oxford: Oxford University Press. In Press.

Bresnan, Joan. 1982. Control and Complementation. In *The Mental Representation of Grammatical Relations*, ed. Joan Bresnan. 282–390. Cambridge, Massachusetts: The MIT Press.

Butt, Miriam. 1994. Machine Translation and Complex Predicates. In *Proceedings of KONVENS 94*, 62–71.

Butt, Miriam. 1995. *The Structure of Complex Predicates in Urdu*. Stanford, California: CSLI Publications.

Butt, Miriam. 1998. Constraining Argument Merger Through Aspect. In *Complex Predicates in Nonderivational Syntax*, ed. A. Kathol E. Hinrichs and T. Nakazawa. 73–113. New York, New York: Academic Press.

Butt, Miriam, and Wilhelm Geuder. 2001. On the (Semi)Lexical Status of Light Verbs. In *Semi-lexical Categories: On the content of function words and the function of content words*, ed. Norbert Corver and Henk van Riemsdijk. 323–370. Berlin: Mouton de Gruyter.

[8]Note that in languages like Korean, benefaction is always entailed by the light verb 'give', regardless of context. In these languages, no contextual enabling would be required in order for the benefaction meaning component to flow into the semantic interpretation of the clause.

Butt, Miriam, Tracy Holloway King, and John Maxwell III. 2003. Complex Predicates via Restriction. In *On-line Proceedings of the LFG03 Conference*. CSLI Publications. University at Albany, State University of New York.

Butt, Miriam, and Aditi Lahiri. 2004. Verbal Passepartouts. Unpublished Ms.

Butt, Miriam, and Gillian Ramchand. 2003. Complex Aspectual Structure in Hindi/Urdu. In *The Syntax of Aspect*, ed. Nomi Ertishik-Shir and Tova Rappaport. Oxford: Oxford University Press. To appear.

Dalrymple, Mary (ed.). 1999. *Semantics and Syntax in Lexical Functional Grammar*. Cambridge, Massachussetts: The MIT Press.

Dowty, David. 1979. *Word Meaning and Montague Grammar*. Dordrecht: Reidel.

Dowty, David. 1991. Thematic proto-roles and argument selection. *Language* 67(3):547–619.

Engberg, Uffe, and Glynn Winskel. 1990. Petri Nets as Models of Linear Logic. In *CAAP '90, 15th Colloquium on Trees in Algebra and Programming*. Copenhagen, Denmark.

Grimshaw, Jane, and Armin Mester. 1988. Light Verbs and Θ-Marking. *Linguistic Inquiry* 19(2):205–232.

Hale, Kenneth, and Samuel Jay Keyser. 2002. *Prolegomenon to a Theory of Argument Structure*. Cambridge, Massachusetts: The MIT Press.

Hendriksen, Hans. 1944. *Syntax of the Infinite Verb Forms of Pali*. Copenhagen: Einar Munksgaard.

Hook, Peter Edwin. 1974. *The Compound Verb in Hindi*. Center for South and Southeast Asian Studies: The University of Michigan.

Hook, Peter Edwin. 1991. The Emergence of Perfective Aspect in Indo-Aryan Languages. In *Approaches to Grammaticalization*, ed. Elizabeth Traugott and B. Heine. 59–89. Amsterdam: Benjamins.

Hook, Peter Edwin. 1993. Aspectogenesis and the Compound Verb in Indo-Aryan. In *Complex Predicates in South Asian Languages*, ed. Manindra Verma. 97–113. Delhi: Manohar Publishers & Distributors.

Hook, Peter Edwin. 2001. Where do Compound Verbs Come From? (And Where are They Going?). In *The Yearbook of South Asian Languages and Linguistics*, ed. Peri Bhaskararao and K.V. Subbarao. 101–130. New Delhi: Sage Publications.

Iglesias-Rábade, Luis. 2001. Composite Predicates in Middle English with the verbs *nimen* and *taken*. *Studia Neophilologica* 73:143–163.

Jackendoff, Ray. 1990. *Semantic Structures*. Cambridge, Massachusetts: The MIT Press.

Kaplan, Ronald, and Jürgen Wedekind. 1993. Restriction and Correspondence-based Translation. In *Proceedings of the Sixth European Conference of the Association for Computational Linguistics*, 193–202.

Kellogg, S. H. 1893. *Grammar of the Hindi Language*. Delhi: Munshiram Manoharlal Publishers Pvt. Ltd. Second Edition, reprinted 1990.

Marantz, Alec. 1997. No escape from syntax: Don't try morphological analysis in the privacy of your own lexicon. In *UPenn Working Papers in Linguistics*, ed. L. Siegel and A. Dimitriadis. 201–225. University of Pennsylvania.

McGregor, R.S. 1968. *The Language of Indrajit of Orchā*. Cambridge: Cambridge University Press.

Mohanan, Tara. 1994. *Argument Structure in Hindi*. Stanford, California: CSLI Publications.

Newman, John. 1996. *Give: A Cognitive Linguistic Study*. Berlin: Mouton de Gruyter.

Peterson, John L. 1981. *Petri Net Theory and the Modeling of Systems*. London: Prentice Hall.

Petri, Carl Adam. 1962. *Kommunikation mit Automaten*. Bonn: Institut für Instrumentelle Mathematik.

Ritter, Elizabeth, and Sara Thomas Rosen. 1993. Deriving Causation. *Natural Language and Linguistic Theory* 11:519–555.

Trenckner, V. 1879. *Pali Miscellany*. London: Williams & Norgate.

WHAT MORPHOLOGY CAN TELL US ABOUT GRAMMAR

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Abstract

Most evolved characteristics of organisms show aspects of poor design due to historical accident. It would be surprising if language were different. I argue that the existence of morphology, distinct from syntax, is one example of poor design. Yet there are things that morphology is good at which help to account for otherwise mysterious and apparently functionless morphological phenomena. I give four examples, involving data from Afrikaans, Russian, Polish and Italian. Syntacticians need to bear in mind that aspects of syntax may be poorly designed also. I suggest that grammatical functions such as 'subject' and 'object' may fall into this category.

I am not a practitioner of Lexical-Functional Grammar, so it may seem surprising that I should contribute to the proceedings of a LFG conference. However, I was available locally at the Christchurch venue of the 2004 conference, so having me as one of the invited speakers may have been attractive as a way of keeping down costs! More seriously, I have things to say about the design of language that do impinge on LFG's central concern with grammatical functions.

Is language well designed? More specifically, is grammar well designed? A wide range of contrasting answers have been offered recently to this question, either explicitly or implicitly (e.g. Pinker & Bloom 1990; Uriagereka 1998; Jenkins 1999; Carstairs-McCarthy 1999; Bickerton & Calvin 2000, especially Bickerton's 'linguistic appendix'; Chomsky 2001; Hauser, Chomsky & Fitch 2002; Givón 2002; Jackendoff 2002; Christiansen & Kirby 2003). Assessing these answers depends in large part on how we answer a prior question: What does it mean for any characteristic of any organism or species to be well designed?

This question has given rise to considerable debate and controversy in evolutionary biology. At risk of seeming presumptuous, I will offer a succinct answer. Rather than ask about good design, we should ask about design that it is good enough for the species to survive. Each characteristic of every species living at any moment in history must be designed well enough for the species to have avoided becoming extinct through predation and competition for resources. But design that is good enough for survival is not necessarily the best design imaginable. Douglas Adams in *The Hitchhiker's Guide to the Galaxy* invites us to imagine that our world was in part the outcome of a design competition, in which Slarty Bartfast won a prize for contributing Norway. However, nature is replete with designs that would win no such prizes. Here are examples of organs that are designed poorly for the functions that they fulfil but are still good enough to enable many species endowed with them to survive:

the vertebrate eye
the mammalian sperm ducts
the alimentary and respiratory canals of land vertebrates

In the eyes of vertebrates (by contrast with cephalopods, such as octopuses) the nerves are attached to the light-sensitive cells of the retina not at the back of the eyeball but inside it, between those cells and the lens, thus reducing the amount of light that can reach the retina. The mammalian sperm ducts, which lead from the testes to the penis, are much longer than they need to be, because they loop over the ureters which connect the kidneys with the bladder. Finally, because the nose is above the mouth rather than below it, the respiratory and alimentary canals are forced to cross, thus creating a risk of choking. As the evolutionary biologist George C. Williams puts it (1992: 7): 'Many features of living organisms are functionally arbitrary or even maladaptive.' For these design faults to be remedied, a reduction in fitness (perhaps drastic) during the short and medium term would be necessary; and there is no way in which natural selection can 'plan ahead' so as bring this about. These less-than-perfect characteristics arise because natural selection has no say over the genetic raw materials available for it to work on; it has to make do with what is supplied by historical accident. If circumstances change so that a once adequate design is no longer good enough, the species in question simply becomes extinct.

We do not know for certain what the genetic raw materials were on which natural selection operated so as to yield language. But, whatever they were, it would be surprising if they did not leave residues in the form of less-than-perfect design features. Identifying such features is curiously difficult for us linguists, however, because there is no linguist who is not a native speaker of some human language. We are presented in nature with a variety of different ways in which eyes can be structured. On the other hand, we are not presented in the real world with radical alternatives (Martian or Venusian, perhaps) to the kind of organization and structure that our own grammars exhibit. One way of overcoming this lack is to consider what grammar would need to look like if we, as designers of it, were to stand a chance of winning a prize in Douglas Adams's competition. What are some of the design desiderata for a potentially prize-winning Universal Grammar? I can think of at least three:

(i) a consistent way of coding thematic roles (Agent, Theme, Goal, etc.)
(ii) a consistent way of packaging information (given versus new, topic versus comment, focus, etc.)
(iii) a single pattern of grammatical organization (not two or more)

Are these desiderata satisfied? Short answers are as follows:

(i') No, there is no consistent way of coding thematic roles, although grammatical functions (subject, object, etc.) contribute.
(ii') No, there is no consistent way of packaging information, although linear order plays a large part, and grammatical functions (subject, object, etc.) contribute.
(iii') No, because morphology and syntax are distinct patterns of organization.

The appearance in both (i') and (ii') of grammatical functions, as a sort of make-do device with at least two distinct applications, should intrigue proponents of any syntactic theory in which grammatical functions play a central role, such as Lexical-Functional Grammar. However, as befits a morphologist, I will concentrate in this paper on (iii').

Does morphology have a clearcut function, so as to be plausibly an adaptation created through natural selection? Alternatively, is it what Williams would call a functionally arbitrary or maladaptive characteristic of language, an accidental byproduct of prehistoric circumstance? It is difficult to say 'yes' to the former question. Morphology does two things: it is used in the formation of some lexical items (through derivation and compounding), and in the encoding of some grammatical properties. But it is not essential for either purpose. In most if not all languages, many complex lexical items have an internal structure that is syntactic rather than morphological. These are called clichés if their meaning is compositional and idioms if their meaning is not compositional. Also, in some languages such as Vietnamese, as is well known, there is no or almost no morphological coding of grammatical information. If morphology did not exist, it would not be missed. There is no respect in which language would be less expressive without it. In a morphology-less world, no linguists would puzzle over why there existed only one pattern of grammatical organization (namely syntax), not two. So why does it exist? Presumably for reasons independent of what it is currently used for. I have suggested such reasons elsewhere (Carstairs-McCarthy 2005): morphophonological alternation, and the paradigmatic relations between alternants, are what got morphology started. But, putting the question of origin aside for the moment, we can profitably ask a question about its contemporary characteristics: given that (as I have said) morphology is not needed to serve either grammatical or lexical functions, is there anything that it is particularly good at, whether functional or not? The answer that I will suggest is that it is good at synonymy avoidance, and hence consistent with 'fast mapping' or quick learning. However, among the ways in which synonymy is avoided are some that have nothing at all to do with syntax or semantics in the normal sense. I will presently mention four diverse morphological phenomena that illustrate this. First, though, I will say a little more about synonymy avoidance in general.

Eve Clark, discussing the acquisition of vocabulary in childhood, puts forward a Principle of Contrast (Clark 1992:64): 'Speakers take every difference in form to mark a difference in meaning.' This principle, or something like it, shows up in the strong tendency of young children to assume that any new word that they encounter means something new, and is not a mere synonym of some word that they know already. What is remarkable is that this expectation of semantic novelty is apparently shared with chimpanzees (David Premack in Piattelli-Palmarini 1980:229; Savage-Rumbaugh 1986) and even with German shepherd dogs (Kaminski et al. 2004; Bloom 2004). As Premack puts it, talking about experiments on chimpanzee cognition using plastic tokens as 'words': 'Even the stupidest animal rapidly constructs the sentence, 'Give X [the animal's name] this new piece of plastic'. In other words, the animal requests the unnamed item with the so far unused piece of plastic. Thus the chimpanzees recognize that the potential word, which has not yet been so employed, is the appropriate thing to use in requesting the desired item, which is however not yet named.' So a synonymy-avoiding propensity is not peculiar to humans.

My first example of a synonymy avoidance strategy in morphology involves *-e* (schwa) versus zero on attributive adjectives in Dutch and Afrikaans. In Dutch, an adjective carries *-e* if it is (i) plural (*grote huizen* 'big houses') or (ii) common gender (*een grote stad* 'a big town') or (iii) in a definite context (*het grote huis* 'the big house'). That is, zero appears only with a noun which is singular, neuter and indefinite, e.g. *een groot huis* 'a big house'). In Afrikaans, gender is lost, so one is naturally inclined to expect that this schwa, if it remains, should become more straightforwardly a marker of either definiteness alone or plurality alone, or perhaps of the distinction between attributive and predicative functions. But instead its distribution changes its character completely (Lass 1990; Bouman & Pienaar 1944; Donaldson 1993). An adjective in Afrikaans carries *-e* if it is:

(i) syntagmatically complex: *ge-heim-e* ‘secret’, *be-lang-rik-e* ‘important’, *open-bar-e* ‘public’;
(ii) paradigmatically complex, i.e. with more than one alternant: *vas* ~ *vast-e* ‘fast’, *sag* ~ *sagt-e* ‘soft’, *droog* ~ *dro-ë* ‘dry’, *dood* ~ *dooi-e* ‘dead’, *hard* [hart] ~ *hard-e* ‘hard’, *doof* ~ *dow-e* ‘deaf’, *nuut* ~ *nuw-e* ‘new;
(iii) semantically ‘complex’, i.e. used metaphorically or affectively: *’n enkel man* ‘a solitary man’ versus *’n enkel-e man* ‘a single (unmarried) man’; *’n bitter smaak* ‘a bitter taste’ versus *’n bitter-e teleurstelling* ‘a bitter disappointment’; *jou arm-e ding!* ‘you poor thing!’.

What has happened is that the schwa has entirely lost its role as an exponent of morphosyntax. Instead, it encodes information about the adjective on which it appears. This information has no function, either in communication or in the mental representation of experience; nevertheless, it suffices to ensure that a bare adjective form and any corresponding schwa-suffixed form are not entirely interchangeable.

My second example involves *-e* and *-u* as prepositional (or locative) case endings in Russian and Polish. Originally the *-u* belonged to the stem as a thematic vowel, but in both languages the original ‘o-stems’ and ‘u-stems’ have merged, leaving *-e* and *-u* as potentially synonymous affixes, in violation of the Principle of Contrast. Both languages solve the problem, but in completely different ways. The solution in Russian is, with certain nouns only, to use *-u* in specifically locational contexts, such as with the preposition *v* ‘in’ reserving *-e* for other prepositional-case contexts, such as with the preposition *o* ‘concerning’. These nouns include *sad* ‘garden’ and *les* ‘forest’, but not *dom* ‘house’. We thus find an inflectional contrast between *v sad-ú* ‘in the garden’ and *o sád-e* ‘concerning the garden’, and likewise between *v les-ú* and *o lés-e*, but no such contrast between *v dóme* ‘in the house’ and *o dóme* ‘concerning the house’. Thus, for a minority of nouns, contrast is maintained by the invention of a new case. In Polish, on the other hand, the distribution of the two suffixes follows the principle that *-e* is used if the noun has a special so-called ‘palatal’ stem alternant in the locative case, and *-u* if it hasn’t (Cameron-Faulkner and Carstairs-McCarthy 2000; Baudouin de Courtenay 1972 [1927]). Examples are:

sy[n] ‘son’: only one stem alternant [sɨn]: locative *sy*[n]*-u*

Nixo[n] ‘Nixon’: normal stem altenant [nikson], special alternant [niksoɲ]: locative *Nixo*[ɲ]*-e*

Carte[r] ‘Carter’: normal stem altenant [karter], special alternant [karteʐ]: locative *Carte*[ʐ]*-e* (Rubach 1984: 84)

ko[ɲ] ‘horse’: only one stem alternant [koɲ]: locative *ko*[ɲ]*-u*

li[st] ‘letter’: normal stem alternant [list], special alternant [liɕc]: locative *li*[ɕc]*-e*

li[ɕc] ‘leaf’: only one stem alternant [liɕc]: locative *li*[ɕc]*-u*

In earlier Polish the vowel [e] generally triggered palatalization, but this is no longer the case, as is shown by (for example) the lack of palatalization in instrumental singular forms such as *sy*[n]*em*, *Nixo*[n]*em*, *Carte*[r]*em* and *li*[st]*em.* Instead, there is now a default expectation that a special stem alternant should exist for nouns with certain phonological shapes, including ones ending in non-palatalized coronal consonants. That is why the two-stem pattern (and consequently the locative suffix -*e*) is found in foreign names such as *Nixon* and *Carter*. Only in a few common nouns such as *sy*[n] is this expectation overridden; they must be learned as having only one alternant. The suffix -*u* can thus now be glossed as simply 'Locative', while -*e* is distinguished from it (thus satisfying the Principle of Contrast) in that its information content is 'Locative, with special stem alternant'.

The pair *li*[st] and *li*[ɕc] is interesting. They have the same etymological source, but split into two lexemes with distinct meanings and stem behaviour. This difference in stem behaviour has been accompanied by a divergence in their choice of locative suffix too, just as our generalization predicts. The fact that -*u* rather than -*e* shows up not only on nouns which have a palatal stem nowhere (e.g. *sy*[n]) but also on ones with a palatal stem everywhere (e.g. *ko*[ɲ], *li*[ɕc]) looks strange from a phonological point of view, but it falls into place neatly when one appreciates the contemporary rationale for the distribution of the two rival affixes. As Baudouin de Courtenay puts it (1972 [1927]: 282): '... in Polish the connection between the various endings of the declension and the final consonants of the stem was once different from what it is now ... In the past the chief distinction was between palatal and nonpalatal consonants: at present it is between consonants which change psychophonetically [i.e. alternate] in the declension vs. consonants which remain unchanged.'

My third example involves stem alternant distribution in Italian verbs, as discussed by Maiden (1992). In (1) are given the active present indicative and subjunctive forms of three Latin verbs *legere* 'read', *fugere* 'flee' and *trahere* 'pull'. The shaded forms are ones where a velar consonant is a candidate for palatalization because it precedes the high front vowel *i*.

(1)

		Indic	Subjunc	Indic	Subjunc	Indic	Subjunc
Sg	1	lego	legam	fugio	fugiam	traho	traham
	2	legis	legas	fugis	fugias	trahis	trahas
	3	legit	legat	fugit	fugiat	trahit	trahat
Pl	1	legimus	legamus	fugimus	fugiamus	trahimus	trahamus
	2	legitis	legatis	fugitis	fugiatis	trahitis	trahatis
	3	legunt	legant	fugiunt	fugiant	trahunt	trahant

However, though palatalization occurs in the Italian reflexes of these verbs, its distribution does not follow the pattern in (1). Instead, we find a pattern of stem alternation for *leggere* 'read', *fuggire* 'flee' and *trarre* 'draw, derive' as in (2):

(2)

		Indic	Subjunc	Indic	Subjunc	Indic	Subjunc
Sg	1	lé[gg]o	lé[gg]a	fú[gg]o	fú[gg]a	trá[gg]o	trá[gg]a
	2	lé[ddʒ]i	lé[gg]a	fú[ddʒ]i	fú[gg]a	trái	trá[gg]a
	3	lé[ddʒ]e	lé[gg]a	fú[ddʒ]e	fú[gg]a	tráe	trá[gg]a
Pl	1	le[ddʒ]ámo	le[ddʒ]ámo	fu[ddʒ]ámo	fu[ddʒ]ámo	traiámo	traiámo
	2	le[ddʒ]éte	le[ddʒ]áte	fu[ddʒ]íte	fu[ddʒ]áte	traéte	traiáte
	3	lé[gg]ono	lé[gg]ano	fú[gg]ono	fú[gg]ano	trá[gg]ono	trá[gg]ano

The pattern of stem alternants for Italian *leggere* is the same as what Latin *legere* leads us to expect, except that only the palatalized alternant is allowed in forms where the stem is unstressed (hence the intrusion of this alternant into two plural subjunctive forms). In *fuggire* and *trarre*, however, we find unexpectedly the same alternation pattern as in *leggere*. This pattern has in fact become moderately productive, so as to be extended to a range of verbs where it has no diachronic phonological motivation. But without this motivation, what difference in information content distinguishes *lé*[ɡɡ]- from *le*[ddʒ]-, *fú*[ɡɡ]- from *fu*[ddʒ]-, and *trá*[ɡɡ]- from *tra*-? If there is no such difference (that is, if the distribution of the alternants is merely random and lexically stipulated independently for each verb), then the Principle of Contrast seems clearly violated. However, a striking thing about this distributional pattern is its consistency. An Italian verb either conforms to it *in toto* or not at all. There is no stem-alternating verb in which, for example, the 3rd plural present indicative has the same stem alternant as the 2nd plural rather than the 1st singular. That permits us to say that the difference in information content between the stem alternants is precisely their own distribution. The alternant *le*[ddʒ]- is the default, found in tenses other than the present, so it can be treated as meaning simply 'read'. The alternant *le*[ɡɡ]- is distinguished as meaning 'read, plus the usual special present tense distribution pattern (2nd and 3rd singular and 1st and 2nd plural indicative, and plural subjunctive)'. How successful such an approach will be depends on whether other seemingly unmotivated stem alternation patterns in other languages display similar consistency (Carstairs-McCarthy 2002). If such consistency turns out to be general, then we have here another instance of morphology displaying its aptitude for synonymy avoidance, even if the kind of difference in 'meaning' that it latches on to is wholely intramorphological.

Superficially, the strongest counterevidence to the Principle of Contrast in morphology shows up in inflection class differences. Doesn't a language violate the Principle if it has (say) two or more genitive singular suffixes, each associated with a different inflection class or classes? Assuming that the membership of these classes is arbitrary (not associated with, say, gender or phonological structure), doesn't that imply that the distinct genitive singular suffixes have exactly the same information content? That brings us to my fourth example, involving the way in which rival affixes for the same paradigmatic cell convey information about inflection class (Carstairs-McCarthy 1994). In (3) are two hypothetical inflection class systems, represented schematically, one of them labelled 'possible' and the other 'impossible':

(3)

	Possible inflection class system:				Impossible inflection class system:			
Classes:	A	B	C	D	A	B	C	D
cell 1	P	Q	r	r	P	Q	r	r
cell 2	t	t	S	t	t	t	S	t
cell 3	u	u	u	u	u	u	u	u
cell 4	V	w	w	w	*v*	*w*	*w*	*v*

The only difference between the two systems is that the realization for cell 4 in class D is *w* while in the impossible system it is *v*. But that small difference is enough to introduce 'blurring' in the technical sense introduced by Carstairs-McCarthy (1994): neither *v* nor *w* identifies unambiguously the inflection class of the lexemes which display it, yet neither is the sole 'elsewhere' exponent for cell 4. This blurring is indicated by italicization in (3). By contrast, in the system labelled 'possible', there are no italics. Here, all the affixes are either in underlined small capitals, indicating that they are associated with a single inflection class, or else plain, indicating that they are the sole default affix for the cell in question — the only affix shared by more than one class. In the possible system, Contrast is achieved by a clearcut difference between the default affix *w*, meaning simply 'cell 4', and the class-identifying affix *v*, meaning 'cell 4, class D'. On the other hand, in the impossible system, *v* and *w* are not cleanly differentiable as class-identifier versus default. If inflection class systems always turn out to avoid 'blurring' in this fashion, we have here another purely intramorphological mode of compliance with the Principle of Contrast.

Morphology is thus good at avoiding synonymy in ways that serve no extramorphological function, whether communicative or cognitive. The moral for syntacticians is that they should be aware of the possibility that aspects of syntax may be like this too. Commenting on the cross-over of the alimentary tract and the respiratory system, Williams (1992:7) says: 'This evolutionary short-sightedness has never been correctable. There has never been an initial step, towards uncrossing these systems, that could be favored by selection.' So what fundamental characteristics of syntax too may owe their existence to 'evolutionary short-sightedness' that 'has never been correctable'? One example, I have suggested, is grammatical functions (Carstairs-McCarthy 1999). In many if not all languages, basic sentence structure incorporates a single clearly identifiable argument that is privileged over other arguments, and is labelled 'subject' or 'topic'. According to my scenario, it is not an accident that in phonology, too, basic syllable structure privileges in various ways one margin (the onset) over the other (the coda). Syntax needs some neural mechanism to operate it, but before syntax existed there was of course no mechanism ideally designed for that purpose. What was available, however, was a neural mechanism for controlling the vocal apparatus during syllabically segmented vocalization. If this was the mechanism that the brain latched on to for syntactic purposes, then much about syntax that is otherwise mysterious — or that would seem mysterious to a Martian observer, not blinkered by being a human language user itself — falls into place.

References

Baudouin de Courtenay, Jan. 1972. *A Baudouin de Courtenay anthology*, ed. by Edward Stankiewicz. Bloomington: Indiana University Press.

Bickerton, Derek and William H. Calvin. 2000. *Lingua ex machina: reconciling Darwin and Chomsky with the human brain.* Cambridge, MA: MIT Press. [Reviewed by Carstairs-McCarthy in *Journal of Linguistics* 37 (2001).]

Bloom, Paul. 2004. 'Can a dog learn a word?' *Science* 304, issue 5677 (Jun 11, 2004): 1605-7.

Bouman, A.C. and E.C. Pienaar. 1944. *Afrikaanse spraakkuns* (4th ed.). Stellenbosch: Pro Ecclesia.

Carstairs-McCarthy, Andrew. 1994. 'Inflection classes, gender and the Principle of Contrast.' Language 70: 737-88.

Carstairs-McCarthy, Andrew. 1999. *The origins of complex language: an inquiry into the evolutionary origins of sentences, syllables and truth*. Oxford: OUP.

Carstairs-McCarthy, Andrew. 2002. 'How stems and affixes interact: stem alternants as morphological signata.' In: *Morphology 2000*, ed. by S.

Bendjaballah, W.U. Dressler, O.E. Pfeiffer and M. Voeikova, 49-57. Amsterdam: Benjamins.

Carstairs-McCarthy, Andrew. 2005. 'The evolutionary origin of morphology.' In Tallerman, M., (ed.) *Language origins: perspectives on evolution*. Oxford: OUP.

Chomsky, Noam. 2001. 'Beyond explanatory adequacy.' *MIT Occasional Papers in Linguistics* 20: 1-28. Cambridge, MA: MITWPL.

Christiansen, Morten H. and Simon Kirby (eds.). 2003. *Language evolution*. Oxford: OUP.

Clark, Eve V. 1992. *The lexicon in acquisition*. Cambridge: CUP.

Donaldson, Bruce C. 1993. *Afrikaans*. Berlin: Mouton de Gruyter.

Givón, Talmy. 2002. *Bio-linguistics : the Santa Barbara lectures*. Amsterdam: Benjamins.

Hauser, Marc D., Noam Chomsky, and W. Tecumseh Fitch. 2002. 'The faculty of language: what is it, who has it, and how did it evolve?' *Science* 298: 1567-79.

Jackendoff, Ray. 2002. *Foundations of language: brain, meaning, grammar, evolution.* Oxford: Oxford University Press.

Jenkins, Lyle. 1999. *Biolinguistics: exploring the biology of language*. Cambridge: Cambridge University Press. [Reviewed by Carstairs-McCarthy in *Diachronica* 18 (2001).]

Kaminski, Juliane, Josep Call, and Julia Fischer. 2004. 'Learning in a domestic dog: evidence for "fast mapping".' *Science* 304, issue 5677 (Jun 11, 2004): 1682-4.

Lass, Roger. 1990. 'How to do things with junk: exaptation in linguistic evolution.' *Journal of Linguistics* 26: 79-102.

Maiden, Martin. 1992. 'Irregularity as a determinant of morphological change.' *Journal of Linguistics* 28: 285-312.

Piattelli-Palmarini, Massimo (ed.). 1980. *Language and learning: the debate between Jean Piaget and Noam Chomsky.* London: Routledge & Kegan Paul.

Pinker, Steven and Paul Bloom. 1990. 'Natural language and natural selection' [with peer commentary and response]. *Behavioral and Brain Sciences* 13.707-784. Reprinted (1992) as chapter 12 in *The adapted mind: evolutionary psychology and the generation of culture* ed. by Jerome Barkow, Leda Cosmides and John Tooby, New York: Oxford University Press.

Rubach, Jerzy. 1984. *Cyclic and lexical phonology: the structure of Polish.* Dordrecht: Foris.

Savage-Rumbaugh, E. Sue. 1986. *Ape language: from conditioned response to symbol.* New York: Columbia University Press.

Uriagereka, Juan. 1998. *Rhyme and reason: an introduction to minimalist syntax.* Cambridge, MA: MIT Press.

Williams, George C. 1992. *Natural selection: domains, levels and challenges.* New York: Oxford University Press.

FUNCTIONAL UNCERTAINTY IN THE MANDARIN NOMINAL:

A UNIFIED ANALYSIS OF RELATIVE CLAUSES AND LOCATIVE STRUCTURES

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Abstract

Bresnan's Endocentric Mapping Principles (Bresnan, 2001) are used as diagnostics to demonstrate that the Mandarin relative clause structure is an endocentric one, in which the particle *de* is the sole functional *and* c-structural head, and the modified noun is one of two specifiers. The relative clause occupies a phrase-initial specifier position associated with a Modifier DF, and the final NP occupies a phrase-final specifier position associated with the DF, Focus. Support for this analysis comes from a comparison of relative clauses and main clauses with post-posed topics, and from theory-internal arguments relating to the linking of DFs and GFs in functional uncertainty equations (based on Dalrymple, 2001). The same analysis accounts for associative structures, where a nominal phrase modifies a noun, including locative structures where a nominal predicate selects a nominal argument.

1 Introduction

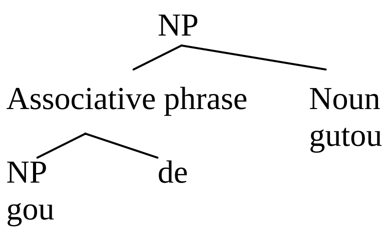
When Mandarin nouns are modified, the modifier and modified noun are generally separated by a particle *de*. The Mandarin relative clause (RC) structure shown in (1a) and associative structures like (1b), where the modifier is nominal, are both examples of this.

(1) a. nà wèi [niàn shū] de rén
that CL [read book] DE person
That person (who) reads books

b. wǒ de shū
1sg DE book
My book

Two quite different analyses have been proposed for these structures, reflecting fundamentally different views of nominal structure. Li and Thompson (1981), who coined the label 'associative phrase', describe it as "the first noun phrase together with the particle *de*" (Li and Thompson, 1981:113), and depict the whole structure as shown in (2). The associative phrase is the sister of the second noun which heads a matrix NP containing both.

(2) Associative Phrase (after Li &Thompson, 1981:126)



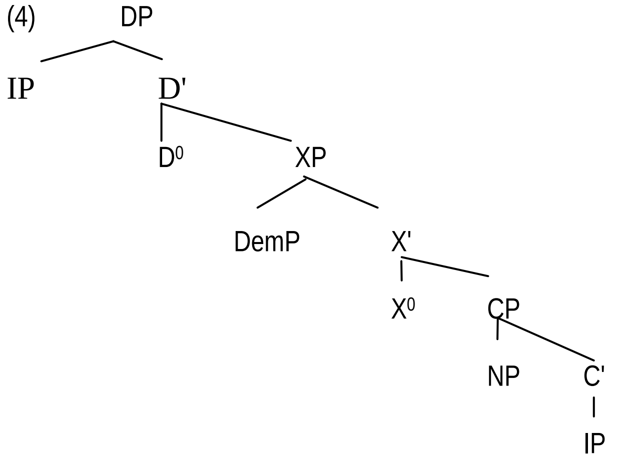
They describe the relative clause similarly, as a constituent formed by "placing the particle *de* after a verb, a verb phrase, a sentence, or a portion of a sentence including the verb" (Li and Thompson, 1981:575), which is then placed in an NP headed by the noun it modifies. This then is an NP analysis that unifies associative and RC structures.

On the other hand, Simpson (2001) proposes a DP analysis for both structures. Drawing on distributional and functional similarities between the Mandarin particle *de*, Japanese *no*, and Burmese *thii*, and on an analysis of RCs proposed by Kayne (1994), Simpson argues that *de* is, in fact, a determiner, and the Mandarin RC and associative structures are derived by movement from (unattested) structures like those at (3).

(3) a. *de [$_{XP}$[nà wèi] [$_{CP}$ [$_{IP}$rén niàn shū]]]
DE [[$_{DemP}$ that CL] [$_{CP}$ [$_{IP}$ person read book]]]

b. *de [$_{XP}$ [$_{IP}$ wǒ e shū]]
DE 1sg have book

The determiner *de* selects as its complement, a functional phrase, XP, that in turn selects a clausal complement, CP and, optionally, a DemP specifier. An NP is extracted from within the clause to the specifier of CP, then the IP from which it came – now with a gap - moves past CP and DemP to land in the specifier of DP, producing the structure shown in (4).

(4)


a. [t_i nian shu]$_k$de [nawei] ren$_i$ t_k

b. [wo e t_j]$_k$ de shu$_j$ t_k

Simpson suggests that the IP must move, rather than the closer DemP or NP, because *de* is a clitic that can only attract and attach to an IP. Because of this, he suggests the possessor in (1b) is in an embedded IP with a covert predicate. This predicate is said to be a possessive predicate that occurs in RCs but not main clauses because null copulas occur in the latter, blocking the use of any other null predicate. Copulas do not appear in RCs, so, Simpson suggests, the null possessive predicate can surface there.

This paper presents evidence against both these analyses, and proposes instead an analysis within the framework of LFG, where both RC and associative structures are accommodated in a relatively simple phrase structure in which CP is not involved, the nominal is not necessarily a DP, and the modifier and *de* do not form a constituent. This new analysis makes use of functional uncertainty equations that link discourse functions to argument functions along lines proposed by Sells (1985) and Dalrymple (2001). It accounts for variations in co-reference patterns and interpretations of associative structures, and also explains variation in the optionality of *de*.

The paper is organised as follows. Section 2 illustrates some basic facts about modification in Mandarin nominal structures, then outlines problems with accounts that treat Mandarin RCs as CPs or as any other kind of phrasal modifier *inside* NP. Section 3 introduces Dalrymple's (2001) account of English RCs, and argues that the mapping processes proposed by Dalrymple can be readily applied to Mandarin nominal structure, but the analysis as a whole cannot be transferred to Mandarin because Mandarin nominal c-structure differs significantly from that assumed for English. Specifically, English nominals support adjunction, and Mandarin nominals do not. Section 4 reviews proposals by Grimshaw (1998) and Bresnan (2001) about the nature of endocentric phrases, and the implications of those proposals for Mandarin nominal structure. Section 5 determines the nature of the functional uncertainty equations and the path necessary to account for co-reference in the

Mandarin RC structures. Section 6 explains how the same analysis accounts in a straightforward way for most associative structures, and then presents evidence to show that locative structures, where the final noun is a predicate involve a slightly different c-structure. Nonetheless, the possibility for such structures 'falls out' of the analysis proposed for RC structures.

2 Modified Nouns in Mandarin

Mandarin nominal structures, unlike those of most Indo-European languages, have no obvious counterpart for the articles that are said to head DP. On the other hand, they do have classifiers (Class), which vary with the choice of noun. Demonstratives (Dem) and numbers (Num) can combine with count nouns only if a classifier is present, but otherwise all nominal elements, including N, are optional.

The relative order of most nominal elements is fixed, and the noun is always last, but the position of RCs is somewhat variable. Though they must be followed immediately by the particle *de,* that particle can appear either immediately to the left of the modified noun, or immediately to the left of a demonstrative preceding the modified noun. This is often taken as evidence that *de* and the modifier that precedes it form a constituent (Li and Thompson, 1981; Gao, 1994; but see also, Pan, 1990, 1999; Tang, 1990a, 1990b).

A comparison of Mandarin independent and relative clauses is shown in (5) – (7); the alternative word orders are shown just once, in (5b) and (c), but are available in each case.

(5) a. nà wèi rén bù hùi niàn shū
that CL person NEG can read book
That person can't read books.

b. nà wèi [e bù hùi niàn shū] *(de) rén jiào Lǐsì
that CL [e NEG can read book DE person call Lisi
That person [that] can't read books is called Lisi.

c. [e bù hùi niàn shū] *(de) nà wèi rén jiào Lǐsì
[e NEG can read book DE that CL person call Lisi
That person [that] can't read books is called Lisi.

(6) a. nà běn shū wǒmen bù hùi niàn e
that CL book 1pl NEG can read
That book, we would not read.

b. nà běn [wǒmen bù hùi niàn e] *(de) shū
that CL 1pl NEG can read DE book
That book [that] we would not read.

(7) a. wǒmen gěi tā niàn shū
1pl to 3sg read book
We read books to him/her.

b. nà wèi [wǒmen gěi tā niàn shū] *(de) rén
that CL 1pl to 3sg read book DE person
That person to [whom] we read books

(5a) shows a clause with a transitive verb whose Subject contains a demonstrative and a classifier; this illustrates the basic SVO word order within the sentence, and the basic Dem (Num) Class N order within the nominal. (5b) shows a clause like (5a) used as a relative clause; the gap in the RC is indicated by 'e'. (5c) shows the RC in initial position.

(6a) shows the verb from (5) in a clause with a topical Object; i.e. one whose referent is already active in discourse; the 'OSV' order seen here is the norm in such cases. (6b) shows the corresponding relative clause. The Object of the RC is *not* a

Topic: its referent is *not* already active in discourse. In fact, the very function of an RC is to anchor or locate an otherwise unlocatable referent (Fox and Thompson, 1990). NPs denoting such referents are Foci, not Topics (Lambrecht, 1987).

Note that the classifier preceding the RC agrees in each case with the final noun; in (5b) it is the classifier for people *wèi*; in (6b) it is the classifier for books, *běn.* This shows that the final noun specifies the gender value for the nominal as a whole, or at least that part containing itself, the classifier, the RC, and *de*.

In (7a), the same verb is shown again, in a clause with an oblique argument introduced by the co-verb[1] *gěi;* this co-verb and its Object both precede the main verb. In the corresponding RC in (7b), there is no gap; a 3rd person pronoun still follows the co-verb and functions as its Object. Despite the fact that Mandarin is a pro-drop language, the pronoun is obligatory in this context; gaps occur only in core GF positions (Subject, Object, Obj2).

In associative structures word order is also variable, but each noun can be associated with its own demonstrative and classifier which complicates the issue somewhat. Moreover, associative structures fall into several semantic sub-types with slightly different characteristics as far as word orders are concerned. As well as structures where the modifier is interpreted as a possessor, like (8) below, there are also associative structures where modifiers denote attributes as at (9). In possessive structures like (8), the modifier and *de* generally precede the demonstrative, as in (8a); reversing the order, as in (8b) sounds odd.

(8) a. zhè ge rén de nà běn shū
this Class person DE that class book
That book (belonging to) this person.

b. ?nà běn zhè ge rén de shū
that class this Class person DE book
?That book of this person's

However, this may simply reflect the preference for human referents to be accorded greater salience than inanimates (Dubois, 1987). This makes it preferable for a possessor to precede any nominal element associated with the inanimate possessed item. In attributive structures like (9), the modifier usually follows the demonstrative; but the alternative order is also possible, with a shift in emphasis. In (9a), the classifier agrees with the final noun, not the closer noun, *mùtóu*, showing that the associative phrase occupies a position between the final noun and the classifier associated with it; in (9b) it precedes that classifier and the demonstrative it licenses.

(9) a. nàzhāng yíng mùtóu de zhuōzi
that class hard wood DE table
That table made of hard wood

b. yíng mùtóu de nàzhāng zhuōzi
hard wood DE that class table
The table that is made of hard wood

There are also associative structures in which the phrase preceding *de* functions as an argument of the final noun, as in (10) and (11) below. The argument and *de* can precede the demonstrative associated with the predicate noun, as shown in (10a) and (11a), but, if agreement features allow, the final noun can also be associated with a demonstrative and classifier that precedes that argument as shown in (10b). The

[1] Coverbs are defined by Li and Thompson as lexemes that function either as main verbs, or as prepositions introducing oblique arguments, as here.

classifier there can accompany virtually any noun, and as a consequence (10b) is ambiguous.

(10) a liǎng zhǒng kēxué de zhè zhǒng fāzhǎn
two kind science DE this kind development
This kind of development in (these) two kinds of science

b zhè liǎng zhǒng kēxué de fāzhǎn
this two kind science DE development
These two kinds of scientific development .
Development in these two kinds of science.

(11) nà liàng chē de zhè liǎng bian
that classifier car DE this two side
On these two sides of that car

2.1 The NP analysis

The variable order of the Dem-Class combination and so-called associative phrase is the most convincing evidence in favour of the NP analysis proposed by Li and Thompson (1981). The most immediate evidence *against* that analysis is that suggesting that a) Mandarin Nouns generally do not tolerate adjacent phrases, and b) *de* and the phrase that precedes it do not form a constituent.

First, as indicated by the starred brackets in (5) – (7) above, omission of the particle *de* from an RC structure gives rise to ungrammaticality. This shows that Mandarin nouns do not tolerate adjacent *clauses* or at least adjacent IPs. Second, the associative structures at (12) and (13) below show that they do not tolerate adjacent nominal phrases either. In (12), the particle *de must* intervene between the modifying nominal phrase and modified N.

(12) a. wǒ rènshi [tāmen liǎngr] *(de) bàbà
1sg recognise 3pl two DE father
I recognise the father(s) of / drawn by/ described by/ portrayed by those two

b. wǒ zhǎo [nàzhī gǒu] *(de) gǔtou
1sg find that class dog DE bone
I am looking for the bone of/ for/from that dog

In (13) omission of *de* does not lead to ungrammaticality, but it does impose a particular interpretation which excludes a string preceding N from being construed as a single constituent.

(13) a. wǒ māmā de bàbà
1sg mother DE father
My mother's father.

a′. wǒ māmā bàbà
1sg mother father
My [mother and father].
NOT *[My mother's] father.

b. zìjǐ zhòngde mùtóu de zhuōzi
self grow DE wood DE table
The table made of wood we grew ourselves

b′. ?zìjǐ zhòngde mùtóu zhuōzi
self grow DE wood table
The wooden table we grew ourselves

NOT The table made of wood we grew ourselves

c. tā xuéxí liǎngzhǒng kēxué de fāzhǎn
3sg study two kinds science DE development
She studies the development of two kinds of science

c′. tā xuéxí liǎngzhǒng kēxué fāzhǎn
3sg study two kinds science development
She studies two kinds of [development in science]
NOT She studies the development of [two kinds of science]

In (13) a, b, and c, where *de* occurs, the string preceding it is interpreted as a phrase; in (13)a', b', and c', where *de* is omitted, that interpretation is no longer available. In (13a), the pronoun and the first of two relational nouns must be interpreted as a complex possessor; in (13a'), where *de* is omitted, the two relational nouns must be understood as a conjunct: [*mother and father*]. In (13b) the complex structure *zìjǐ zhǒng de mùtóu wood we grew ourselves'* modifies a common noun, '*table'*. In (13b') the last two nouns must be construed as a compound *wooden table*, modified by the RC '*that we grew ourselves*', giving rise to an absurd interpretation in which the table has been grown, rather than the wood. In (13c), a quantity expression followed by a noun can be construed as a single complex argument of the following predicate *fāzhǎn*; but again in (13c'), the two nouns must be understood as a compound; when *de* is omitted the quantifier and the first noun cannot be construed as a single phrase.

Of course, Simpson suggests that the apparently nominal modifiers in these associative structures are really clauses, or IPs. If this is correct, these restrictions would simply be more evidence that Mandarin nouns don't tolerate adjacent IPs. However clear evidence is available to show that they are not IPs as Simpson suggests. IPs containing the overt verb of possession yǒu can include the negative aspect morph méi (14a). As expected, this morph can also appear in RCs constructed with that verb (14b). If possessors are simply NPs in a clause with a covert verb of possession, then the same negative morph should be able to negate possessors too, but it cannot, as shown in (14c).

(14) a. wǒ méi yǒu shū
1sg have book
My book.

b. wǒ méi yǒu de shū
1sg have DE book
The book(s) that I don't have.

c. *wǒ méi de shū
1sg DE book

The modifiers in associative phrases are just what they seem: nominal phrases. The fact that *de* cannot be omitted from (12), and the strings preceding N in (13) cannot be construed as a single constituent shows that Mandarin nouns do not generally tolerate adjacent nominal phrases any better than adjacent IPs. In short, the Mandarin NP cannot generally accommodate modifying or argument phrases of any kind.

Independent evidence that *de* and the modifier that precedes it do not form a constituent comes from examples like those at (15). (15a) shows that a modifier, *de*, and a noun can appear *together* in sentence-initial position and control a gap within a nominal that follows the verb. As the three items occupy one sentence-initial topic position, they must form a single constituent. (15b) shows that the noun on its own can do the same: the NP is a complete sub-constituent within the more complex structure, formed by a modifier, de and NP. (15c) shows that the combination of a modifier and *de* cannot do occupy the Topic position and control a gap: they do not form a complete constituent.

(15) a. hěn dà de zhuōzi wǒ mǎi.le nà yī zhāng
very big DE table 1 sg buy.ASP Dem one CL
'(As for) big tables, I bought that one '

b. zhuōzi wǒ mǎi.le nà yī zhāng hěn dà de
table 1 sg buy.ASP Dem one CL very big DE
'(As for) tables I bought that big one '

c. *hěn dà de wǒ mǎi.le nà yī zhāng zhuōzi
very big DE 1 sg buy.ASPDem one CL table

On this basis, we must conclude that the modifying clause and *de* do *not* form a single constituent adjoined or otherwise adjacent to N. This and the Mandarin noun's clear aversion to either nominal or clausal neighbours seriously undermines Li and Thompson's claim that a nominal modifier and *de* form an 'associative phrase' adjacent to N, and dominated only by NP.

2.2 Movement through DP

However, Simpson's (2001) transformational account is also difficult to maintain. Firstly, as we have already seen, the possessor in associative structures cannot be plausibly understood as an IP, because it cannot be negated by the verbal negator *méi*. In fact, if associative structures were formed with a null possessive verb, then all associative structures would have to have possessive interpretations, and they do not. Attributive structures and argument predicate structures are not open to possessive interpretations at all. Moreover, even in a structure like (1b) above, repeated below as (16), the 'possessor' could be the creator, publisher or would-be purchaser of the book, or simply in habitual or even temporary proximity to it. It is because these structures are generally semantically so vague that Li and Thompson label them 'associative'.

(16) wǒ de shū
1sg DE book
My book

To further complicate matters, locative structures like (17b), which clearly do *not* have a possessive interpretation, might be plausibly derived by extraction from structures like (17a) below, but they do *not* pattern like RC structures in terms of predicate and argument order.

(17) a. nà liàng chē lǐmian
That Class car inside
Inside that car

b. nà liàng chē de lǐmian
that classifier car DE inside
Inside of that car

According to Simpson's analysis, the structure at (17a) could follow *de* with *nà liàng chē lǐmiàn* being a CP (I assume the specifier of XP is empty). In (17b) the NP *lǐmian* has been extracted *past nà liàng chē* to land in Spec CP, and the residue of the IP containing *nà liàng chē* and a null predicate has been extracted to the Specifier of DP. The problem with this proposal is that the noun *lǐmian* that *follows de* is a relational noun and the NP *chē* that *precedes de* is *its* semantic argument, not the argument of a covert verb of possession. The order of argument and predicate is the opposite of that in RC structures. This reversal is unexpected and unaccounted for.

An obvious alternative account of (17b) is that the extracted phrase is not an IP, but the nominal constituent, *nà liàng che*, but this is excluded in Simpson's analysis by the explicit claim that *de* can only attract and attach to an IP. Moreover, an extraction analysis is not available for the argument-predicate structure at (18a) below, because the counterpart without *de* at (18b) has a different meaning from the structure with *de*, as discussed above.

(18) a. tā xuéxí liǎngzhǒng kēxué de fāzhǎn
3sg study two kinds science DE development
She studies the development of two kinds of science

b. tā xuéxí liǎngzhǒng kēxué fāzhǎn
3sg study two kinds science development
She studies two kinds of [development in science]
NOT She studies the development of [two kinds of science]

(18a) cannot be derived by extraction of *liǎng zhǒng kèxué* from (18b) because that string in (18b) cannot be interpreted as a single constituent.

The obvious implication of these differences in co-reference is that associative structures fall into two categories, each sharing different characteristics with RCs. Most associative structures serve the same function as RCs, restrictive modification, but do not exhibit evidence of argument sharing. So the association between the nominal modifier and the final noun is open to various interpretations. On the other hand, associative structures where the final noun is a predicate exhibit fixed thematic interpretations and argument sharing like RC structures, but exhibit a different correspondence between linear order and *functional* relationships: NP1 functions as an argument, not as a restrictive modifier, but the order of predicate and argument is the reverse of that seen in RC structures.

It is clear that associative structures cannot be explained on the basis of extraction from a clausal or a complex nominal constituent along lines suggested by Simpson. Nor can they be explained as a *deP* constituent included in NP as suggested by Li and Thompson. The next section shows how Dalrymple's (2001) analysis of English relative clauses, in the LFG framework provides the basis of an analysis where both can be explained in terms of a single c-structure.

3 Functional Uncertainty

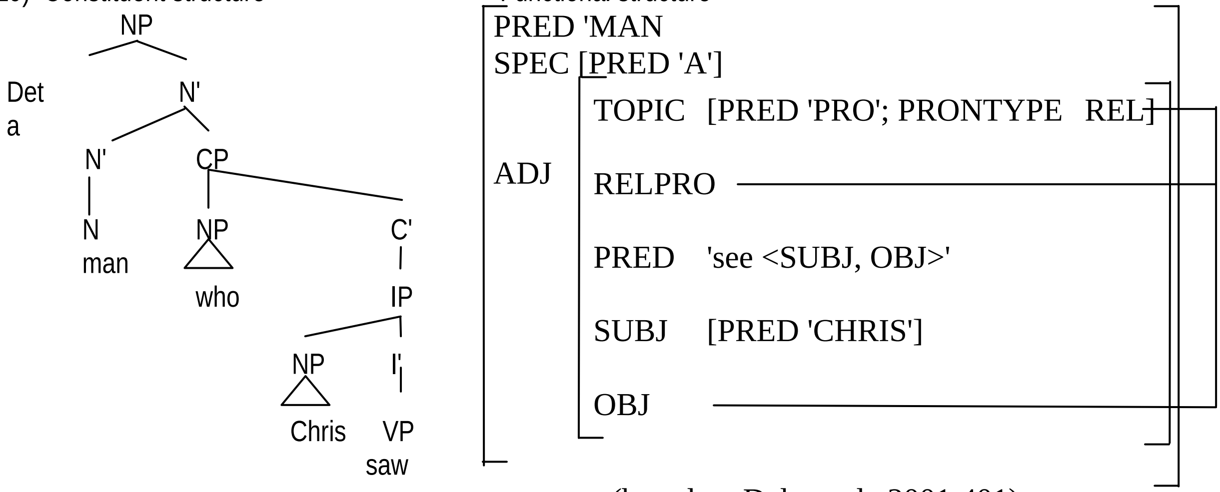
3.1 English Relative Clauses

Dalrymple's analysis of English RCs, illustrated at (19) below, links constituents to grammatical and discourse functions by way of functional uncertainty equations implemented in functional structure. This separation of constituent and functional structures makes it possible in principle for different functional relationships to be played out across a single constituent structure.

Dalrymple takes the view that English RC structures involve a CP with an overt specifier, introduced into nominal structure. However, where Simpson's analysis has CP as a complement within DP, Dalrymple's has CP adjoined to NP, much like Li and Thompson's (1981) NP analysis of Mandarin RCs. Dalrymple suggests, following Sells (1985), that the specifier of this CP is associated with a DF linked to a GF of the RC by way of a functional identity equation. This link is shown as a line in the functional-structure at (19).

Sells (1985), suggests that the path linking a focus DF to a GF can “range over arbitrary sequences of function names (such as COMP COMP SUBJ, etc.)” so that it "effectively …. builds in the Extended Coherence Condition" (Sells, 1985:182, footnote 22). The uniqueness condition ensures that the GF selected is one associated with no other PRED value. However, Dalrymple (2001) reviews evidence firstly, that the peripheral constituent in RC structures is a Topic, not a Focus, and secondly, that the path that links the Topic to a GF is not arbitrary, but subject to certain constraints. She argues that the Focus in an RC is the relative pronoun, which may be contained within a larger constituent, and it is this constituent that is linked to a GF in the RC.

(19) Constituent structure Functional structure



(based on Dalrymple 2001:401)

Furthermore, restrictions on the choice of constituent in English RCs are much the same as restrictions on clause-initial topics. This is illustrated in (20) and (21) below (taken from Dalrymple 2001:404)

(20) a. Chris, we think that David saw.

b. A man who we think that David saw

(21) a. *Chris, that David saw surprised me.

b. *A man who that David saw surprised me

This parallel between RCs and Topic structures supports the idea that the English RC involves an embedded CP, with an initial topic.

Dalrymple proposes that the path linking the Topic to some GF is stored at the c-structural node where the Topic itself appears, as part of a functional equation. Simplified somewhat that equation takes the form:

(22) $(\uparrow \text{TOPIC}) = (\uparrow \text{COMP* GF})$.

The first side of the equation identifies a DF; the second represents the path. The component COMP* indicates that the DF can be linked to a GF embedded at any depth within a series of complements. The final GF represents the target of the search. Heads which block the link between the Topic and a GF in their functional structure have a lexical feature indicating that they do not permit long-distance dependencies: [– LDD]. The full definition of the path excludes GFs of heads with this feature.

Clearly then, functional uncertainty equations offer a means by which arguments in Mandarin RC structures and associative structures can be linked to alternative GF and DF positions within a single nominal c-structure. However, since functional identity equations are implemented with respect to specific nodes in c-structure, it is vital to have a clear picture of the c-structural positions occupied by the constituents within the Mandarin structures.

3.2 Mandarin Relative Clauses

As shown above, Mandarin nouns do not tolerate adjacent clauses, and the RC does not form a constituent with the particle *de*. In addition, the Mandarin RC structure contains only one nominal element, the *final* modified noun, not a head *and* a relative pronoun, like the English structure. This is shown again in (23) below, where the RC is initial.

(23) [e niàn shū] de nà wèi rén
[read book DE that CL person
That person [that] reads books

Therefore we cannot assume the English c-structural analysis of RCs for Mandarin.

Of course, Mandarin is a pro-drop language, so it could be argued that the Mandarin RC simply has a null topic under anaphoric control. However, there is good reason to think that this is not the case. First, a conventional null pronoun in Mandarin can *always* be replaced by an overt counterpart, either a personal or a reflexive form. Neither of these can appear in an initial position of a Mandarin RC, *or* in the position of a core argument:

(24) a. nà wèi (*ta/*ziji) niàn shū de rén
that CL (*3 sg / *self) read book DE person

b. nà běn [(*ta) wǒmen bù hùi niàn (*ta)] de shū
that CL 3 sg 1pl NEG can read 3 sg DE book
That book [we would not read].

Second, Mandarin has no overt relative pronoun, so there is no basis on which to postulate a covert one. Note that *de* itself cannot be understood as a relative pronoun because it appears even in associative structures like (12) and (13) above, where no arguments are shared.

Simpson's proposal is that it is not the Topical NP that is missing in the Mandarin structure, but the head noun. In other words, Mandarin RCs are headless RCs, and the final NP is the controller of the gap, functionally comparable to the Topic in English RCs, not a co-referent head licensed by a GF of the main predicate. This finds some support from a comparison of Mandarin RC structures and main clauses with *post*-posed Topics. (25a) shows a Mandarin main clause with an interrogative particle *ma.* This is just one of several illocutionary force particles that appear clause-finally, and take scope over the entire sentence. This makes illocutionary force particles the best candidates in Mandarin for heads of CP. (25b) shows the same interrogative with a clause final topic, following the particle ma. It is constrained to co-reference with a missing Subject. (25c) shows a post-posed Topic co-referent with a missing Object, and (25d) shows that the object of an oblique must still appear, as a pronoun, when a clause-final Topic is co-referent with it.

(25) a. nǐ niàn shū ma?
3sg read book Q-PRT
Reading are you?

b. e niàn shū ma? nǐ
read book Q-PRT 3sg
Reading are you?

c. nǐ niàn e ma? nà běn shū
2 sg read Q-PRT that CL book
You're reading [it] are you, that book?

d. nǐ gěi *(tā) niàn ma? nà wèi rén
2 sg to 3sg read Q-PRT that CL person
You're reading to him are you, that person?

These main clauses exhibit precisely the same word order as Mandarin nominals modifier by a relative clause, and the same constraints on co-occurrence of co-referent nominals. Since the final NP in the main clauses is clearly not a nominal head of an external clause, there is no reason to assume such an analysis for the final NP relative clause structures. Instead the phrase whose head is *de* must function as an argument, just as the IP whose head is *ma* functions as a clause.

The examples above also show that Mandarin has functional phrases with two specifiers, one pre-posed, the other postposed: (25c) involves both a sentence initial Subject, and a sentence-final Topic, but only one overt functional head, the question-particle.

We might reasonably hypothesize therefore that *de*, another clause–final particle is after all just another head of CP. However, this cannot be the case. As we have already seen, a modifying clause does not form a constituent with *de* and Mandarin nouns do not tolerate an adjacent constituent. Conversely, illocutionary force-markers cannot select a preceding NP complement; the minimal Mandarin sentence consists of a *verbal* predicate, not a nominal one as shown in (26).

(26) a. *gǒu ma
dog PRT
*[Is it a] dog?
b. gòu ma
enough PRT
[Is it] enough?

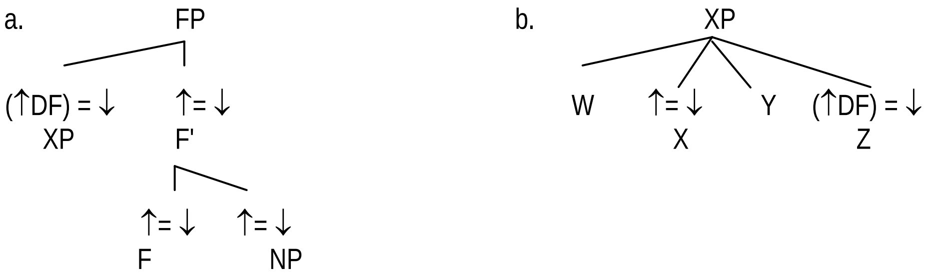
Finally, *de* can come between two nominals: it clearly needs *no* clausal complement. This means *de* cannot head the Mandarin CP. Nonethless, it can still be understood as a functional head that selects a post-posed specifier. In fact, Bresnan's endocentric mapping principles also indicate that this is the best analysis for *de*.

4. Endocentric Mapping Principles

According to Grimshaw (1998), phrases tend to be endocentric structures where a lexical head may select a complement that fills an argument function and the resulting phrase may then be selected as the complement or specifier, of a functional head. The phrase resulting from that merger may then be selected in turn as the complement or specifier of another functional head. Specifiers and complements are not sisters; they occupy distinct levels in c-structure.

On the basis of these generalisations, Bresnan (2001) proposes a set of mapping principles for endocentric phrases (EMPs), relating certain functional attributes with certain c-structural attributes. According to these principles the annotation $\uparrow$GF = $\downarrow$, is added to the c-structural sister of any lexical head, linking it to an argument function. The annotation $\uparrow$= $\downarrow$ is added to the c-structural sister of a functional head making them f-structural co-heads which share all their features. The specifier of a functional head is annotated $\uparrow$DF = $\downarrow$, linking a constituent in that position to a discourse function (DF). This is shown schematically in (27a), below. However phrases may also be lexocentric, having multiple sisters, with the head and other functions specified by language-specific c-structure rules. This is shown schematically in (27b).

(27) a.



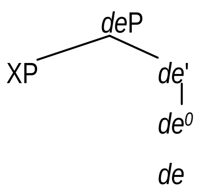
Bresnan suggests that "any c-structural pattern can be considered *unmarked* if it is an instantiation of these universal endocentric constraints" (Bresnan, 2001:101, emphasis added). Moreover, endocentric structures can be recognised as such because they are associated with fixed word order, differential access to permutations, and the inability of a specifier and functional head to form a constituent. This means, on the basis of evidence reviewed thus far, we can conclude that Mandarin nominals are endocentric: we have seen that the order of Dem, Num, Class and N is fixed; NP alone can appear *outside* the matrix nominal structure, and the combination of a modifier and *de* do not form a constituent.

Further, according to the EMPs, a lexical NP should have no phrasal sisters except its arguments, while the functional head that selects that NP may select a specifier, associated with a DF. We have seen that Mandarin common nouns tolerate no phrasal sisters, and the modifiers that precede *de* do not have a specific thematic roles they way arguments would. On the other hand, those constituents do share a common *discourse* function: they restrict the reference of a focal noun.

Restrictive modification is generally understood to be an Adjunct function, and this is conventionally treated as a kind of freely available GF, rather than a DF. Thus, even though Mandarin nominal structures do not allow c-structural adjunction, the GF called Adjunct should still be freely available in f-structure. The question is then: how can completeness be satisfied with respect to an optionally introduced Adjunct GF, if no adjoined position is available in c-structure. The only possible answer is that the Adjunct GF is linked to a DF, which, according to the EMPs is associated with a *specifier* position. Conversely, as DFs are subject to the extended coherence condition, they must be linked to some GF, and the optionally available Adjunct GF provides one when no predicate is otherwise available. To differentiate the DF associated with specifiers in c-structure from the freely available Adjunct GF represented only in Mandarin f-structure, I will refer to the former as Modifier (Mod).

The facts we've reviewed so far - the fixed order of Dem-Num-Class and N, the extractability of NP, its intolerance of phrasal sisters, and the presence of a DF position immediately to the left of *de* - all point overwhelmingly to the same conclusion: the Mandarin nominal is an endocentric structure whose functional head is the particle *de*, and it selects RCs and other restrictive modifiers as specifiers. This gives Mandarin RCs the partial structure:

(28)



4.1 Headless Relative Clause

The other rather natural conclusion to draw is that the final NP is the c-structural sister and lexical co-head of *de*. However there is one obvious argument against this position: the final NP in an RC structure clearly occupies a DF position. This is evident firstly from the fact that its status can be best generalised in terms of pragmatic considerations: it is a focal NP, in the sense that its referent is not within the pragmatic presupposition. That is why it must be modified. Secondly, it is linked to *different* GFs within the nominal structure at different times. In RC structures it is linked to various argument GFs, SUBJ or OBJ, but in associative structures, it is linked to the Adjunct GF. Under the EMPs, this indicates that the final NP occupies a DF position, not a head or complement position. This means the final NP must also be a specifier of *de* and *not* its complement.

In short *deP* does have some of the characteristics entailed by Simpson's DP analysis: the structure as a whole is a functional phrase headed by *de*; there is no lexical head NP; and both the RC and the final NP occupy *specifier* positions. *DeP* has *two specifiers* and *no* lexical head, just like the Mandarin CP shown in (25) above. However, this does not make *de* a head of CP, or a determiner. There is no evidence for an empty CP, or XP introducing CP, and no movement is required.

Two questions remains: firstly, how are the DFs, Focus and Mod, linked to GFs in order to satisfy extended coherence? Secondly, how is the completeness condition satisfied with respect to the predicate that selects this entire modified nominal structure as an argument? The second issue is straightforward, *de* must introduce a PRED value, 'pro'. In this sense, *de is* a relative pronoun after all. Its ability to supply a PRED value accounts for its obligatory presence in RC and most Associative structures. However, we'll see shortly that the PRED 'pro' value of *de* must be optional, because at times *de* does have a lexical co-head.

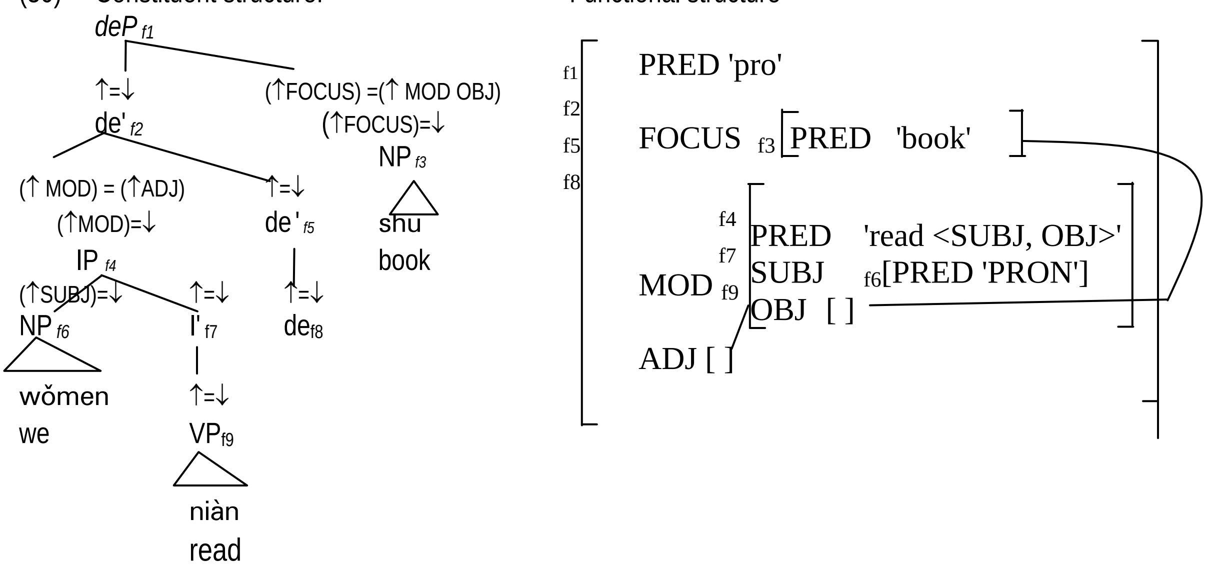
5 The Focus-Path in Mandarin

In simple RC structures like that at (29) below, the focal NP is linked to a GF within a clause that bears the DF Mod. The uniqueness condition restricts the choice of GF to the Object GF, which is otherwise unassigned.

(29)	wǒmen	niàn	de	shū
	we	read	de	book

In the illustration of this Mandarin RC structure at (30) below, this relationship is captured by the annotation on the right-hand specifier of the equation, (↑FOCUS) = (↑ MOD OBJ).

(30) Constituent structure: Functional structure



This equates the f-structure of the Focus NP with the f-structure of the Object GF introduced by the verb in the RC. This satisfies the extended coherence condition with respect to the DF Focus, and the completeness condition with respect to the GF OBJ. Under the EMPs, the initial specifier position, where the RC is located, also necessarily bears a DF, the DF Mod. The equation: (↑MOD) = (↑ADJ) equates the f-structure of this DF with that of an Adjunct *GF* contained within *deP*. This is necessary to satisfy the extended coherence condition with respect to the DF Mod[2].

Both equations can be understood as specific solutions to a general functional uncertainty equation: (↑DF) = (↑(DF) GF). This differs from the equation proposed by Dalrymple for English because the Mandarin Focus path links a specifier to a GF within another *specifier*, so the path must include reference to DFs (rather than GFs).

The target GF to which a focal DF is linked can also be deeply embedded within Mod, as in (31) and (32).

(31) tā shuō wǒ rènwéi e bù hùi jiè qián de rén
[$_{MOD}$3sg says [$_{COMP}$1sg reckon [$_{COMP}$e NEG can borrow money]]] DE person
The person [he says [I reckon [e would not borrow money]

(32) tā shuō wǒ rènwéi tā bù hùi jiè e]]] de qián
[$_{MOD}$3sg says [$_{COMP}$1sg reckon [$_{COMP}$ 3sg NEG can borrow e]]] DE money
The money [he says [I reckon [he would not borrow]

To allow for this possibility, the general focus path must actually have the form: (↑DF) = (↑MOD COMP* GF), where any number of COMPS (including none) may be traversed. (The complements of co-verbs must also be excluded by annotating the path further with the specification that the complement must not have a – value for its LDD feature: COMP [LDD ≠ -].)

6 Associative Structures

We can now turn to associative structures. Associative structures that do not contain a final predicate noun can be accounted for within the RC analysis. The initial nominal, which, for convenience I will refer to as NP1, functions as a restrictive modifier for a focal nominal, NP2, just as an RC does. So, NP1 bears the DF Mod, which is linked to an Adjunct GF, just as in RC structures. The extended coherence condition requires NP2 to be linked to a GF as before, but the nominal modifier NP1 introduces no unassigned GF, the way an RC does. Extended coherence and uniqueness are both satisfied by inclusion of a *second* Adjunct GF in f-structure. In this case, the resolved form of the functional uncertainty equation associated with the focal NP would be: ↑FOCUS = ↑ADJUNCT. This indicates that the DF is also an optional step in the focus path; the general path is therefore : (↑DF) = (↑(DF) COMP* GF).

Structurally, both NPs are specifiers; syntactically, both are adjuncts of *de;* but pragmatically, NP1 restrictively modifies NP2 as a consequence of their respective DFs. This explains why interpretation of the thematic relations between these two NPs is so variable. There is no need to postulate null predicates.

6.1 Locative structures

Structures where NP2 is a *predicate* are clearly different from thematically unrestricted associative structures. In (33), the final noun is *not* a referent-denoting focal NP, it is a nominal predicate, and the *initial* NP is not a restrictive modifier, it is forced to co-reference with a semantic argument of the predicate noun.

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[2] Since an English RC involves only ADJ, the involvement of MOD as well as ADJ in the Mandarin RC may seem an unnecessary complication. However, it is a direct consequence of a) c-structural differences between Mandarin and English; b) the classification of ADJ as a GF, c) the assumptions encoded in the EMPs; and d) the extended coherence condition. As mentioned earlier, Mandarin c-structure does not accommodate adjunction to NP; an optional item can only be represented in c-structure as a specifier. The EMPs map specifiers of functional heads to *DFs*, not to *GF*s and each DF must be linked to a *GF*. ADJ is the only *GF* that can be introduced to license MOD without itself needing to be licensed by a predicate.

(33) a. tā xuéxí liǎngzhǒng kēxué de fāzhǎn
3sg study science DE development
She studies the development of two kinds of science

b. tā zài [nà liàng chē] de lǐmian
3sg at that classifier car DE inside
He is in that car

Actually, the predicate *fāzhǎn* 'development' is indistinguishable from a verb. As we have seen, Mandarin nouns and verbs have similar distributions: both select classifiers in quantification, and clearly, both can function as the lexical head of an argument. However most verbs (including co-verbs, and adjective-like stative verbs) can be negated by the negator, *bu*, and can function as a minimal sentence, while nouns cannot. Conversely, certain count nouns can be quantified *without* a classifier, something that cannot be done with any verbs. By these tests *fāzhǎn* is indistinguishable from a verb, but locatives like the NP2 in (33b) are clearly nouns. When semantics allow, they can be quantified without a classifier, but they cannot be negated by the verbal negator or function as a minimal sentence (see Li and Cheng, 1982 for further discussion):

(34) zhè liǎng biān dōu yīyàng cháng
This two side all same long
The two sides are the same length

(35) a. tā zài bù zài zhè.bian
3sg at NEG at this side
Lit: Is she or is she not present on this side?

b. bù zài / *bù zhè.bian
Neg at / NEG this side
Not present / * not this side

Locative nouns also form a distributional sub-class of noun; unlike other nouns they can take an immediately preceding phrasal argument. Li and Thompson refer to such locative structures without *de* as "locative phrases". The examples at (3) illustrate the relevant facts.

(36) a. tā zài nà liàng chē (de) lǐmian
3sg at that classifier car DE inside
He is in that car

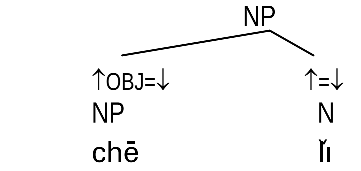
b. nà tiáo lù (de) nánbian yǒu hěn duō dōngxi
that classifier road DE isouth have adv many thing
South of that road are many things

c. chē (*de) lǐ yǒu hěn duō dōngxi
car DE in have adv many thing
In the car are many things

d. *lù (*de) nán yǒu hěn duō dōngxi
road DE isouth have adv many thing
South of the road are many things

In (36a) and (b), the particle *de* is optional. (36c) and (d) show monosyllabic variants of locatives, and these *must* be immediately preceded by their argument; the particle *de* may not intervene. A morphological account of this restriction is that these monosyllabic locatives are clitics like *de* and contra Simpson, they compete for a prosodic host, in the form of the *nominal* argument. More relevant here is the fact that the locative noun is a predicate and the NP1 that precedes it is its argument. According to the EMPs an argument function is associated with the sister of a lexical head, and is annotated with the equation ↑GF =↓. Since this GF is assigned to a nominal sister of the predicate I call it simply OBJ. (37) below shows the functional and constituent structure for locative phrases.

(37) Constituent structure



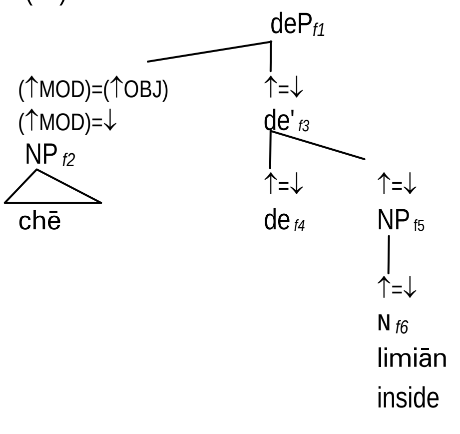
Functional structure

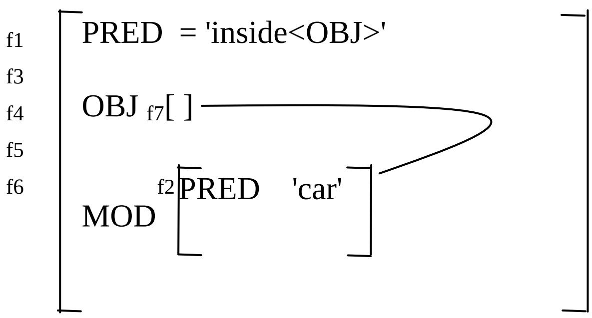
$$\begin{bmatrix} \text{PRED} & \text{'inside <OBJ>'} \\ \text{OBJ} & [\text{PRED 'car'}] \end{bmatrix}$$

Obviously, when locative nouns combine with *de*, the initial NP is still understood as the argument of the final locative NP. The locative noun is *not* focal and therefore does not occupy the specifier of *de*. It functions as a predicate and therefore, under the EMPs, it must occupy the complement position, as co-head of *de*. Since we know *de* is preceded by a specifier with a DF function, Mod, it follows that this DF is linked to the GF OBJ in locative structures. It also follows that the PRED 'pro' value of *de* must be optional, as noted above: the locative co-head has a PRED value of its own.

Above I argued that the MOD position must be annotated with a functional uncertainty equation (↑DF) = (↑(DF) COMP* GF). Since the locative noun and *de* are functional co-heads, the OBJ of the lexical noun is also the OBJ of *deP*. Therefore the same functional uncertainty equation that links the modifying clause to an adjunct GF in RC structures will link NP1 to an OBJ function in locative structures. The resolved value of the equation would be (↑MOD) = (↑OBJ), resulting in the structural analysis illustrated in (38) below.

(38) Constituent structure: Functional structure





Not only is this analysis of locative structures *consistent* with the analysis of RC structures it virtually falls out as an inevitable option within that analysis.

As for predicates like fāzhǎn they must introduce a GF, because that GF is clearly linked to the 'modifier' in an associative structure. However the GF must be somehow distinct from that generally assigned to the sister of N. Whether this is because locative nouns actually assign a GF other than OBJ, or de-verbal nouns like fāzhǎn introduce a different GF is left for future research to resolve.

7 Conclusion

To conclude, it has been demonstrated that *de* is a functional head that selects an initial specifier which bears a DF Mod. When *de* is followed by a predicate, that predicate is its lexical co-head. Otherwise nominals that follow *de* are specifiers and bear a DF, focus. In locative and other structures headed by predicates the Mod DF is linked to a core GF within the lexical NP. In RC structures it is linked to an Adjunct GF, and the Focus DF is linked to a core GF within RC. In all other associative structures both DFs are linked to independent Adjunct GFs. This analysis based as it is on functional uncertainty equations, can readily accommodate Mandarin RC and Associative structures of any kind, including those for which a movement analysis is not plausible.

References

Bresnan, Joan. 2001. *Lexical Functional Syntax*. Blackwell Textbooks in Linguistics. Malden, Mass: Blackwell.

Dalrymple, Mary. 2001. *Lexical-Functional Grammar.* San Diego, Calif; London: Academic Press.

Dubois, J. 1987. The discourse basis of ergativity. Language 63:805-855.

Fox, Barbara A., and Thompson, Sandra. 1990. A discourse explanation of the grammar of relative clauses in English Conversation. *Language* 66:297-316.

Gao, Qian. 1994. Chinese NP structure. Linguistics 32:475-510.

Grimshaw, Jane. 1998. Locality and Extended Projection. In *Lexical specification and Insertion,* eds. Peter Coopmans, Martin Everaert and Jane Grimshaw, 115-133. Mahwah, NJ: Lawrence Erlbaum.

Kayne, Richard S. 1994. The Antisymmetry of Syntax: *Linguistic Inquiry* Monographs. Cambridge, Massachusetts

Lambrecht, Knud. 1987. Sentence focus, information structure and the thetic-categorial distinction. Paper presented at *Proceedings of the 13th annual meeting of the Berkeley Linguistics Society*.

Li, Charles N., and Thompson, Sandra. 1981. Mandarin Chinese. *A functional reference grammar*. Berkeley /Los Angeles / London: University of California Press.

Li, Dejin, and Cheng, Meizhen. 1982. *A Practical Chinese Grammar for Foreigners*. Beijing: Sinolingua.

Pan, Haihua. 1990. Head Noun Movement in Chinese. In Second Northeastern Conference on Chinese Linguistics. Philadelphia, Pennsylvania.

Pan, Haihua. 1999. Structures and Interpretations of Chinese Noun Phrases. In 11th North-American Conference on Chinese Linguistics. Harvard University, Boston.

Sells, P. 1985. Lectures on Contemporary Syntactic theories. Stanford, CA: Centre for the Study of Language and Information.

Simpson, Andrew. 2001. Definiteness Agreement and the Chinese DP. *Language and Linguistics* 2:125-156.

Tang, C-C Jane. 1990a. Chinese Phrase Structure and the extended X'-theory, Cornell University: PhD thesis.

Tang, C.- C. Jane. 1990b. A note on the DP analysis of the Chinese Noun phrase. Linguistics 28:337-354.

EXPLOITING F-STRUCTURE INPUT FOR SENTENCE CONDENSATION

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Abstract

In this paper, we describe the types of sentence condensation rules used in the sentence condensation of Riezler et al. 2003 in detail. We show how the distinctions made in LFG f-structures as to grammatical functions and features make it possible to state simple but accurate rules to create smaller, well-formed f-structures from which the condensed sentence can be generated.

1 Introduction

The aim of sentence condensation is to keep only the essential elements of a sentence and the relations among them and to produce a grammatical, condensed output, which can then be used in applications such as text summarization. Keeping the essential elements could conceivably be achieved by selecting key terms; however, keeping the relations and producing grammatical output requires a structure-based approach. An example of sentence condensation is shown in (1).

(1) The UNIX operating system, with implementations from Apples to Crays, appears to have the advantage. $\Longrightarrow$ UNIX appears to have the advantage.

In this paper, we show how the LFG formalism, in particular the f(unctional)-structure, provides the necessary format for manipulating sentences in a condensation system. In particular, LFG f-structures provide the necessary distinctions to alter the structure of the sentence and then allow for the generation of grammatically well-formed output strings. For example, LFG allows the easy statement of rules which delete adjuncts (2a), passivize active sentences (2b), delete conjuncts from coordinate structures (2c), and decleft sentences (2d).

(2) a. They left quickly. $\Longrightarrow$ They left.

b. They shattered the glass. $\Longrightarrow$ The glass was shattered.

c. John and Mary left. $\Longrightarrow$ John left.

d. It is Mary who left. $\Longrightarrow$ Mary left.

The paper is organized as follows. Section 2 describes the basic system: the parser, transfer component, and generator. Section 3 comprises the bulk of the paper. It describes the sentence condensation rules themselves and demonstrates how these apply to the LFG f-structure analyses, focussing on adjunct deletion, passivization/activization, and factive verb deletion. Finally, section 4 provides a brief conclusion.

2 The Basic System

Our basic sentence condensation system (Riezler et al. 2003) was developed on and runs in the XLE development environment (Maxwell and Kaplan 1993). In this system, to produce a condensed version of a sentence, the sentence is first parsed using a broad-coverage LFG grammar for English. The parser produces a set of f-structures for an ambiguous sentence in a packed format. It presents these to the transfer component in a single packed data structure that represents in one place the substructures shared by several different interpretations. The transfer component operates on these packed representations and modifies the parser output to produce reduced f-structures.

The reduced f-structures are then filtered by the generator to determine syntactic well-formedness. A stochastic disambiguator using a maximum entropy model was trained on parsed and manually disambiguated f-structures for pairs of sentences and their condensations. Using the disambiguator, the string generated from the most probable reduced f-structure produced by the transfer system is chosen. In contrast to many approaches to sentence condensation (e.g., Knight and Marcu 2000, Witbrock and Mittal 1999), our system guarantees the grammaticality of generated strings through the use of the XLE constraint-based generator for LFG which uses a slightly tighter version of the grammar than is used by the parser.

This section describes the XLE parser, transfer component, and generator. XLE consists of cutting-edge algorithms for parsing and generating LFG grammars along with a rich graphical user interface for writing and debugging such grammars.

2.1 The Parser

One of the main goals of XLE is to efficiently parse and generate with LFG grammars. This is difficult because the LFG formalism, like most unification-based grammar formalisms, is NP complete. This means that in the worst case the time that it takes to parse or generate with an LFG grammar can be exponential to the length of the input. However, natural languages are mostly context-free equivalent, and one should be able to parse them in mostly cubic time. XLE is designed to automatically take advantage of context-freeness in the grammar of a natural language so that it typically parses in cubic time and generates in linear time when the input is fully specified. This allows grammar writers to write grammars in the expressive LFG formalism without necessarily sacrificing performance.

There are three key ideas that XLE uses to make its parser efficient. The first idea is to pay careful attention to the interface between the phrasal and functional constraints (Maxwell and Kaplan 1993). In particular, XLE processes all of the phrasal constraints first using a chart, and then uses the results to decide which functional constraints to process. This is more efficient than interleaving phrasal and functional constraints because the phrasal constraints can be processed in cubic time, whereas the functional constraints may take exponential time. Thus, the phrasal constraints make a good polynomial filter for the functional constraints.

The second key idea is to use contexted unification to merge multiple feature structures together into a single, packed feature structure (Maxwell and Kaplan 1991). For instance, (3) is a contexted feature structure for the sentence *They saw the girl with the telescope*. In this sentence, *saw* is ambiguous between the present tense of *saw* (labeled `a:1`) and the past tense of *see* (`a:2`). Also, *with the telescope* is either an adjunct of *saw* (`b:1`) or *the girl* (`b:2`). The contexts `a:1` and `a:2` are mutually exclusive. Similarly for `b:1` and `b:2`. Furthermore, `a:1` and `a:2` are independent from `b:1` and `b:2`. So this feature structure represents four different solutions. XLE uses a contexted feature structure like this for each edge in a chart to represent all of the possible feature structures that the edge can have.

$$
(3)\quad \left[\begin{array}{ll}
\text{PRED} & \left[\begin{array}{ll} \texttt{a:1} & \text{'saw}<\text{SUBJ,OBJ}>\text{'} \\ \texttt{a:2} & \text{'see}<\text{SUBJ,OBJ}>\text{'} \end{array}\right] \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'pro'} \\ \text{PRON-FORM} & \text{they} \end{array}\right] \\
\text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'girl'} \\ \text{SPEC} & \left[\begin{array}{ll} \text{PRED} & \text{'the'} \end{array}\right] \\ \text{ADJUNCT} & \texttt{b:2}\left\{ [\ 1\text{:with}\ ] \right\} \end{array}\right] \\
\text{ADJUNCT} & \texttt{b:1}\left\{ \left[\begin{array}{ll} \text{PRED} & \text{'with}<\text{OBJ}>\text{'} \\ \text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'telescope'} \\ \text{SPEC} & \left[\begin{array}{ll} \text{PRED} & \text{'a'} \end{array}\right] \end{array}\right]\text{:1} \end{array}\right] \right\} \\
\text{TENSE} & \left[\begin{array}{ll} \texttt{a:1} & \text{present} \\ \texttt{a:2} & \text{past} \end{array}\right]
\end{array}\right]
$$

The third key idea is to use lazy contexted copying during unification (Maxwell and Kaplan 1996). Lazy contexted unification only copies up as much of the two daughter feature structures of a subtree as is needed to determine whether the feature structures are unifiable. If the interactions between the daughter feature structures are bounded, then XLE will do a bounded amount of work per subtree. Since there are at most a cubic number of subtrees in the chart, then XLE can parse sentences in cubic time when the interactions between daughter feature structures are bounded.

For more details on the XLE parser, see Maxwell and Kaplan 1996.

2.2 The Transfer System

The transfer system is a general purpose packed rewriting system. In the sentence condensation application described in this paper, the transfer system takes a packed f-structure produced by the parser, converts it a to a (multi)set of packed input facts, transfers this to a set of packed output facts, and converts this into a packed output f-structure. The generator then produces the condensed strings from the transfer output.[1]

The transfer rules for sentence condensation consist of an ordered set of rules that rewrite one f-structure into another. Structures are broken down into flat lists of facts, and rules may add, delete, or change individual facts. Rules may be optional or obligatory. In the case of optional rules, transfer of a single input structure may lead to multiple alternate output structures.

Packed transfer rewriting is significant, since an ambiguous sentence gives rise to more than one structure and it is possible for the number of structures to be in the thousands. However, the set of structures for a given sentence is packed into a single representation making it possible for common parts to appear only once (cf. (3) in the previous section). Thanks to the fact that the structures are packed, common parts of alternative structures can often be operated on by the transfer system as a unit, the results being reflected in each of the alternatives.

The transfer system operates on a source f-structure, represented as a set of (transfer) facts, to transform it, little by little, into a target structure. This operation is controlled by a transfer grammar consisting of a list of rules. The order of these rules is important because each rule has the potential of

[1] While this paper focuses on f-structure to f-structure transfer, the transfer system is not restricted to applications involving f-structure input or output, but instead is a general purpose rewrite system.

changing the situation that following rules will encounter (see section 3.1.4). In this respect, the rules are like phonological rules of the Chomsky/Halle variety. In particular, rules can prevent later rules from applying by removing material that they would otherwise have applied to (bleeding) or they can enable the application of later rules by introducing material that they need (feeding). In this respect, this is different from other systems that have been proposed for transfer that build new structures based on observation, but not modification, of existing ones. In this system, as the process continues, the initial source f-structure takes on more and more of the properties of a target f-structure. Source facts that no rule in the sequence applies to simply become part of the target structure. As such, the transfer process never fails. Even if no rules apply, the output would simply be identical to the input. This is crucial for sentence condensation since many shorter sentences will remain unchanged by the rules.

2.2.1 Transfer Facts

The first thing to consider is the nature of transfer facts, and then how f-structures are converted to transfer facts. Transfer facts typically are encoded as a predicate, an opening parenthesis, a comma separated list of arguments,[2] and a closing parenthesis, as in (4). Since sentence condensation applies to f-structures, most facts involve two arguments.

(4) predicate(argument1, argument2)

Predicates are atomic symbols, while arguments can be either atomic or non-atomic (i.e. embedded predicates).

Consider how the f-structure in (5) for the sentence *Mary sleeps.* can be represented as a set of transfer facts, shown in (6).

(5)
$$\left[\begin{array}{ll} \text{PRED} & \text{'sleep<SUBJ>'} \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Mary'} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \end{array}\right]_1 \\ \text{TNS-ASP} & \left[\begin{array}{ll} \text{TENSE} & \text{present} \\ \text{MOOD} & \text{indicative} \end{array}\right]_2 \\ \text{STMT-TYPE} & \text{declarative} \end{array}\right]_0$$

[2] It is also possible to have atomic facts with no arguments: predicate.

(6)

```
PRED(var(0),sleep)                 the outermost f-structure
SUBJ(var(0),var(1))
STMT-TYPE(var(0),declarative)
TNS-ASP(var(0),var(2))
arg(var(0),1,var(1))
lex_id(var(0),3)

PRED(var(1),Mary)                  the SUBJ f-structure
lex_id(var(1),1)
NUM(var(1),sg)
PERS(var(1),3)

MOOD(var(2),indicative)            the TNS-ASP f-structure
TENSE(var(2),pres)
```

To see how these facts correspond to the f-structure, it is first necessary to understand the convention lying behind the use of `var(n)` arguments. These are to be interpreted as standing for f-structure nodes. Thus the outermost node labeled 0 in the f-structure is represented by `var(0)`, and the value of the SUBJ attribute labeled as 1 is represented by `var(1)`. The same holds for f-structures without PREDs, as seen for the value of the TNS-ASP attribute. This is assigned the index `var(2)` in the transfer facts.

Looking at the facts with `var(0)` as their first argument, most of them correspond directly to attribute value pairs in the f-structure. The fact that f-structure 1 is the value of the SUBJ attribute of f-structure 0 is represented as `SUBJ(var(0), var(1))`. The fact that the value of the STMT-TYPE attribute of f-structure 0 is `declarative` is represented as `STMT-TYPE(var(0), declarative)`. The fact that the value of the TNS-ASP attribute of f-structure 0 is a complex structure is represented as `TNS-ASP(var(0), var(2))`.

The representation of the semantic forms, i.e., the PREDs, is described below in section 3.1. Basically, PREDs are decomposed into the predicate name itself, e.g. *sleep*, the arguments, e.g., SUBJ, and an identifier, e.g., `lex_id`. Each of these can be manipulated separately by the transfer rules, although in sentence condensation this is rarely necessary.

A final point to be made about the representation of f-structures involves sets. Consider the f-structure in (7) for the noun phrase *big black dogs*.

(7) $$\left[\begin{array}{ll} \text{PRED} & \text{'dog'} \\ \text{NUM} & \text{pl} \\ \text{ADJUNCT} & \left\{\begin{array}{l} \left[\text{PRED} \quad \text{'big'}\right]_2 \\ \left[\text{PRED} \quad \text{'black'}\right]_3 \end{array}\right\}_1 \end{array}\right]_0$$

The ADJUNCT of the f-structure is a structure enclosed in curly brackets, the standard representation for sets. In the transfer system, sets are represented by the `in_set` predicate. For the structure in (7), it would be as in (8).

(8)

```
ADJUNCT(var(0), var(1))
in_set(var(2), var(1))
in_set(var(3), var(1))
```

The value of 0's ADJUNCT attribute is a set value, that we have indexed as `var(1)`. There are two items in the set, namely `var(2)` and `var(3)`. The use of the `in_set` predicate is demonstrated in section 3 for the deletion of adjuncts in sentence condensation.

2.2.2 Transfer Rules

Having seen how f-structure facts are represented, this section briefly discusses how to manipulate these facts using transfer rules to produce a modified f-structure. Transfer rules are demonstrated in detail in section 3 in the context of sentence condensation. Here we just introduce the basic forms of the rules.[3] Transfer rules consist of a list of input facts, a rewrite system, and a list of output facts.[4] A very simple transfer rule that rewrites NUM sg to NUM pl is shown in (9).

(9) `NUM(%Fstr,sg) ==> NUM(%Fstr,pl).`

There is only one input fact `NUM(%Fstr,sg)`. The `%Fstr` is a variable which can match an f-structure. All mentions of the same variable in a rule must refer to the same f-structure (variables are preceded by a %). This is an obligatory rule as indicated by the rewrite symbol `==>`; an optional rule would have used the rewrite symbol `?=>`, as is demonstrated in most of the sentence condensation rules in section 3. There is only one output fact `NUM(%Fstr,pl)`. If an f-structure is found with NUM `sg`, then the rule deletes the NUM attribute and its value, and then replaces them by the attribute NUM and value `pl` listed in the output facts. The use of the same variable `%Fstr` in the input and output guarantees that the same f-structure will have the feature deleted and then added.

It is possible to have input facts that are not deleted. This is indicated by preceding the facts with a +. The rule in (10) deletes NUM `sg` and inserts NUM `pl` only when the f-structure is also third person.

(10) `NUM(%Fstr,sg), +PERS(%Fstr,3) ==> NUM(%Fstr,pl).`

The + in front of the `PERS` means that `PERS` will still be present after the rule has applied.

It is also possible to state facts which may not be present for the rule to apply. This is indicated by preceding the facts with a −. (11) is a rule which deletes NUM `sg` and inserts NUM `pl` only when the f-structure is not third person.

(11) `NUM(%Fstr,sg), -PERS(%Fstr,3) ==> NUM(%Fstr,pl).`

This use of the − operator can be seen in rule (23) in which adjuncts are deleted only if they are not negative adjuncts. This prevents *not* from being deleted in condensations, while allowing adverbs like *quickly* to be deleted.

The final important fact about the transfer rules is that they are ordered. This ordering can result in the application of some rules blocking the application of other rules or providing the necessary environment for their application. This is discussed in section 3.1.4. A simple example of this is seen in the two rules in (12).

(12) a.
```
NUM(%Fstr,sg)
==> NUM(%Fstr,pl).
```
b.
```
+NUM(%Fstr,pl)
==> NTYPE(%Fstr,count).
```

[3]There are a number of other operations that can be used in transfer rules that are not described in this paper, but are described in the XLE documentation.

[4]The list of input facts or output facts can be empty, represented by 0. This is seen in rule (36) in section 3.1.

Rule (12a) rewrites NUM `sg` as NUM `pl`; rule (12b) adds a NTYPE `count` feature to a plural f-structure. If (12a) is ordered before (12b), then all f-structures with a NUM feature will have the value `pl` for this feature and hence will end up with NTYPE `count` as well. If (12a) is ordered after (12b), then f-structures with NUM `sg` will not have NTYPE `count` inserted, although they will ultimately end up with NUM `pl`.

To summarize, in sentence condensation, the transfer component takes an f-structure as input, rewrites the f-structure facts according to an ordered set of rules, and produces an output f-structure. This f-structure is then the input to the generator which produces the string(s) corresponding to the f-structure; this string is the condensed sentence. The next section describes how the generator works; the remainder of the paper describes the sentence condensation rules in more detail.

2.3 The Generator

The sentence condensation rules manipulate the f-structure to produce new, smaller f-structures. Most of these f-structures are well formed in that the grammar can use them to generate well-formed English strings. Those that are not well formed will result in no output. Thus, it is possible to avoid generating ill-formed sentences in the condensation system by using the LFG grammar as a filter. A generator is the inverse of a parser. A parser takes a string as input and produces f-structures as output. A generator takes an f-structure as input and produces all of the strings that, when parsed, could have that f-structure as output. The generator can be useful as a component of translation (Frank 1999), sentence condensation (Riezler et al. 2003), computer assisted language learning (Butt et al. 2004), or natural language interfaces.

The XLE generator produces a packed representation of all of its output strings using a regular expression notation. An example of this is shown in (13).

(13) You {can't|cannot} {quickly print documents|print documents quickly}.

The generator can be set to only produce one output: either the shortest or the longest string. If two strings are of equal length, one of them will be chosen arbitrarily. For sentence condensation, having a single string output is usually desirable, and so the shortest string option is used.

Often it is not desirable for the generator to be the exact inverse of the parser. For instance, although the parser eliminates extra spaces between tokens, the generator should not to insert arbitrary spaces between tokens. To handle this, the generation grammar can be minimally different from the parsing grammar by changing the set of optimality marks used (Frank et al. 2001), which (dis)prefers that application of certain rules, and by changing the tokenizers or morphology that is used (Kaplan et al. 2004). These mechanisms allow minor variations in the generation grammar as needed, while still sharing as much as possible with the parsing grammar.

The remainder of this section first describes how the generator handles minor mismatches between the input f-structures produced by the sentence condensation transfer rules and the f-structures produced by the grammar when parsing. The second part of this section describes how the generator works in more detail since it is a key component in the use of LFG for sentence condensation.

2.3.1 Underspecified Input

In the default situation, the generator produces strings that, when parsed, have an f-structure that exactly matches the input f-structure. However, sometimes the generator needs to produce strings from an f-structure that matches the input except for a few features. This is true in the case of sentence condensation where the rules often affect the major parts of the f-structure, sometimes ignoring the minor ones. For example, the passivization/activization rules discussed in section 3.1 make the subject the oblique agent and the object the subject. However, they do not manipulate the case marking of these arguments, even though case marking changes with grammatical function. If the sentence in (14a) is condensed to that in (14b) the case of *glass* must change from accusative to nominative.

(14) a. The unruly children broke the glass.

b. The glass was broken.

The XLE generator used in the sentence condensation system can be specified as to which features are deleted from or can be added to an f-structure in order to allow a string to be generated. In the case marking example, CASE would be specified as both deleted and addable since it must be changed from one value to another. The generator will freely add any features that are declared to be addable if they are consistent with the input.[5] The generator always deletes any features from the input that are specified as to be deleted, while the addition of addable features is optional.

It is also possible to use the generator in a robust mode whereby every input f-structure produces some output string. The basic idea behind robust generation in the XLE generator involves two approaches. The first is to allow the generator to relax the relationship between the input f-structure and what is generated through some special optimality theory marks (Frank et al. 2001). The second approach is to allow for a fragment grammar for generation whereby strings are generated from parts of the f-structure and then stitched together. These two robustness techniques are not used in sentence condensation because the generator is needed to filter the output of the transfer rules. Sometimes the sentence condensation rules may delete too many parts of the f-structure, in which case the output string would be uninformative. For example, the sentence condensation rules can delete conjuncts in a coordination. A sentence like (15) could be condensed to any of the possibilities in (16).

(15) Mary, Jane, and Susan arrived.

(16)	a.	Mary arrived.	d.	Mary and Jane arrived.
	b.	Jane arrived.	e.	Mary and Susan arrived.
	c.	Susan arrived.	f.	Jane and Susan arrived.

However, these rules might overapply, resulting in all of the conjunts (the f-structures corresponding to *Mary*, *Jane*, and *Susan*) being deleted, leaving only the verb. From such a structure, robust generation might produce an imperative (*Arrive.*) or put in a pronominal subject (*It arrives.*). However, for sentence condensation, this is not a desirable result because too much information has been lost. Instead, in such cases it is better to either produce the uncondensed string or a string from some other condensation.

[5]To control the addition of features, an optimality mark can be associated with addable attributes. Whenever an addable attribute is added to the f-structure of a generation string, then its optimality mark will also be added. The effect of this depends on the optimality mark's rank. For example, consider the additions in (i).

(i) set-gen-adds add @ALL AddedFact
set-gen-adds add @INTERNALATTRIBUTES NEUTRAL
set-gen-adds add @GOVERNABLERELATIONS NOGOOD

In this example, all of the attributes (@ALL) are first assigned the user-specified AddedFact mark. Then the internal attributes (@INTERNALATTRIBUTES), which are defined by the grammar and usually contain such features as CASE and syntactic GENDER, are assigned the NEUTRAL mark, which makes them freely addable in generation. Then the governable relations such as SUBJ and OBJ are assigned the NOGOOD mark, which means that they cannot be added. The net effect is that all of the attributes other than the internal attributes and the governable relations are assigned the AddedFact mark. These attributes can be added to the f-structure of a generation string at a cost, thus limiting the addition of features to when it is necessary to produce a string.

2.3.2 How the Generator Works

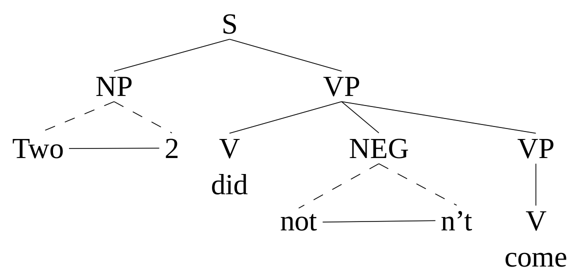
This section provides a simplified description of how the XLE generator works. A key idea in understanding generation is that it produces different equivalence classes than parsing. For every f-structure, there may be several alternative c-structures that give rise to that f-structure. For instance, parsing the sentence *Two didn't come.* and then generating from the resulting f-structure might produce the four strings in (17a) which can be packed as in (17b). This would occur if both *two* and *2* and also *n't* and *not* were canonicalized in the f-structure to the same forms. For example, the f-structure in (18) might correspond to all the strings in (17a).

(17) a. Two didn't come. Two did not come.
2 didn't come. 2 did not come.

b. {Two|2} {didn't|did not} come.

(18)
$$\left[\begin{array}{ll} \text{PRED} & \text{'do<XCOMP>SUBJ'} \\ \text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{'two'}\end{array}\right]1 \\ \text{XCOMP} & \left[\begin{array}{ll}\text{PRED} & \text{'come<SUBJ>'} \\ \text{SUBJ} & [\ 1\ ]\end{array}\right] \\ \text{ADJUNCT} & \left\{\left[\begin{array}{ll}\text{PRED} & \text{'not'}\end{array}\right]\right\} \\ \text{TENSE} & \text{past} \end{array}\right]$$

The packed string in (17b) corresponds to a c-structure forest roughly like that in (19).

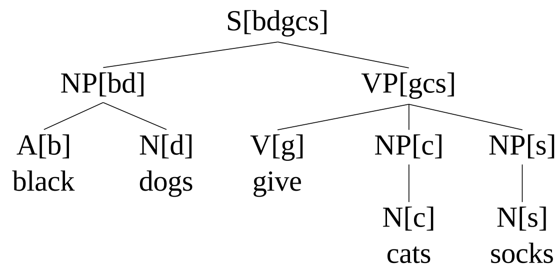
(19)


Consider the f-structure for *Two didn't come.* in (18) with links from each sub-structure to the corresponding nodes in the tree in (19). For instance, the SUBJ would map to the NP, the XCOMP to the VP over *come*, and so on. This provides a basic idea of how the generator produces alternative generations for a given f-structure. For each f-structure, the generator tries to produce all of the c-structures that are consistent with that f-structure. The result is a generation chart that is similar in spirit to a parsing chart, but with different equivalence classes.

The main performance issue with generation is to make sure that everything in the f-structure is generated at least once, and that the semantic forms are generated at most once (e.g., *the red, red dog* is not a legal regeneration of *the red dog*). Kay (1996) proposed that each edge in the generation chart would list the semantic facts that had been generated beneath it. The root edge must list all of the semantic facts in the underlying structure. If a semantic fact is missing from a root edge, then the edge is discarded.

This produces the correct result, but can be exponential in the number of adjuncts. This is because the grammar allows adjuncts to be optionally omitted, and the generator tries all paths through the grammar. If all possible combinations of optional adjuncts are considered, the result is an exponential number of root edges. For instance, the sentence *Black dogs give white cats red socks.* might have a root edge that looks like that in (20).

(20)



At the top level, the non-adjunct predicates, *dog* [d], *give* [g], *cat* [c], and *sock* [s], are always represented. However, there could be root edges with S[dgcs], S[bdgcs], S[dgwcs], S[bdgwcs], S[dgcrs], S[bdgcrs], S[dgwcrs], or S[bdgwcrs], depending on which of the adjuncts *black*, *white*, or *red* were present. Only the last of these corresponds correctly to the input f-structure. In addition, in the grammar's phrase structure rules, the OBJ and OBJ2 are optional if extraction is allowed (e.g., for relatives and interrogatives *What did the black dogs give white cats?*), and the SUBJ can be dropped in an imperative construction (*Give white cats red socks.*). Thus, the problem is significant from a computational perspective.

Kay's 1996 solution was that in a categorial grammar, it can be locally determined when an "f-structure" becomes inaccessible. Therefore, edges that are incomplete (for instance, NP[c] and NP[s] in (20)) can be locally discarded. Unfortunately, this does not work for LFG, because f-structures can always be accessed by functional uncertainties and/or zipper unifications.[6] The XLE solution to this problem is to generate in two passes. The first pass determines which f-structures are accessible from outside each edge while ignoring the semantic facts covered. The second pass uses Kay's algorithm, but determines inaccessibility based on the first pass. The result is an efficient generator for LFG grammars.

This section has outlined the main components of the sentence condensation system: the XLE parser, transfer system, and generator. The remainder of the paper focuses on how the LFG f-structure analyses of sentences can be manipulated by the transfer rewrite rules to produce well-formed sentence condensations.

3 Manipulating F-structures

The basic idea behind the sentence condensation system is to delete or rearrange elements of an f-structure and then generate a condensed string from that new f-structure. LFG's f-structures are well suited for this task because they already encode much of the work for the system.

For example, elements of a sentence that are inessential for condensation purposes often coincide with ADJUNCTs in the f-structure. This contrasts with string or tree representations of sentences in which it can be extremely difficult to determine what the adjuncts are. However, in LFG, adjuncts receive a special f-structure function ADJUNCT and hence a simple rule can be written that deletes them, as in (21). (As discussed in section 2.2.2, ?=> indicates an optional rule.)

(21) `+ADJUNCT(%Main,%AdjSet), in_set(%Adjunct,%AdjSet) ?=> 0.`

[6]Zipper unification occurs during the unification of f-structures when there are sequences of nested sub-structures that must be unified because they have common features. See Maxwell and Kaplan 1996 for processing details and Bresnan et al. 1982 for how this applies to cross-serial dependencies in Dutch.

This rule would apply to the f-structure in (22b) for sentence (22a), resulting in the possible outputs in (22c) since the rules apply optionally in the system. (The f-structures which the rule variables can match are shown in italics; these variable names are not part of the f-structure input; cf. (6).)

(22) a. Mary arrived yesterday in her car.

b.
$$\left[\begin{array}{ll} \text{PRED} & \text{'arrive} < \text{SUBJ} > \text{'} \\ \text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{'Mary'}\end{array}\right] \\ \text{ADJUNCT} & \left\{\begin{array}{l} \left[\begin{array}{ll}\text{PRED} & \text{'yesterday'}\end{array}\right]_{\%Adjunct} \\ \left[\begin{array}{ll}\text{PRED} & \text{'in} < \text{OBJ} > \text{'}\\ \text{OBJ} & [\text{ her car }]\end{array}\right]_{\%Adjunct}\end{array}\right\}_{\%AdjSet} \\ \text{TENSE} & \text{past}\end{array}\right]_{\%Main}$$

c. No deletions: Mary arrived yesterday in her car.
Both adjuncts deleted: Mary arrived.
First adjunct deleted: Mary arrived in her car.
Second adjunct deleted: Mary arrived yesterday.

The detailed feature space of LFG f-structures is particularly useful in this example because there are some adjuncts that should never be deleted, namely negatives. Because such adjuncts are assigned a feature ADJUNCT-TYPE `negative` in the grammar, a restriction can be placed on rule (21) such that it does not apply to adjuncts with this feature. This is shown in (23); the modified rule in (23a) will allow the deletions in (22c), but not that in (23b).

(23) a.
```
ADJUNCT(%Main,%AdjSet), in_set(%Adjunct,%AdjSet),
−ADJUNCT-TYPE(%Adjunct,negative)
?=> 0.
```

b. Mary did not arrive. ⟹ *Mary arrived.

The deletion of adjuncts is a common strategy in sentence condensation systems, albeit one that is difficult to implement without something like LFG's f-structures. However, f-structures allow for more complex manipulations which can provide for more natural sounding condensations. For example, the LFG f-structures provided by the grammar allow for rules which turn clauses with *you should* ... into imperatives, remove phrases like *it is clear that* ... leaving only the subordinate clause, decleft sentences, and remove conjuncts from coordinations. More than one rule can apply to a given sentence, and rule ordering allows for feeding and bleeding. Here we discuss two of these more complex rules: passivization/activization (section 3.1) and factive verb deletion (section 3.2).

3.1 Passivization and Activization

There are a number of ways to manipulate active and passive sentences. One is to take passive sentences with *by* phrases and create their active counterparts, as in (24a). Another is to take a passive without a *by* phrase and turn it into an active with a *they* subject, as in (24b). A third is to passivize an active sentence, as in (24c). Although these do not always result in fewer words in the sentence, they may simplify the content for the reader.

(24) a. The town was flooded by torrential rains. ⟹ Torrential rains flooded the town.

b. The car was pushed off the tracks. ⟹ They pushed the car off the tracks.

c. Torrential rains flooded the town. ⟹ The town was flooded.

Rules for all three alternations appear in our system and we discuss them here in detail.

3.1.1 Activization of passives with *by* phrases

The rule for the alternation in (24a) is shown in (25) and would apply to an f-structure like that in (26). This rule takes an oblique agent phrase in a passive and makes it the subject while the subject is demoted to object. This is basically the reverse of the well-know LFG passivization lexical rule.

(25)
```
PASSIVE(%Main,+), SUBJ(%Main,%Subj), OBL-AG(%Main,%OblAg)
PFORM(%OblAg,by_), PTYPE(%OblAg,nosem) ?=>
SUBJ(%Main,%OblAg), OBJ(%Main,%Subj), PASSIVE(%Main,−).
```

(26)
$$\begin{bmatrix} \textsc{pred} & \text{'flood<OBL-AG,SUBJ>'} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{'town'} \end{bmatrix}_{\%Subj} \\ \textsc{obl-ag} & \begin{bmatrix} \textsc{pred} & \text{'rain'} \\ \textsc{pform} & \text{by\_} \\ \textsc{ptype} & \text{nosem} \\ \textsc{adjunct} & \left\{ \begin{bmatrix} \textsc{pred} & \text{'torrential'} \end{bmatrix} \right\} \end{bmatrix}_{\%OblAg} \\ \textsc{passive} & + \\ \textsc{tense} & \text{past} \end{bmatrix}_{\%Main}$$

Consider the rule in (25) in detail. Each of the facts before the rewrite symbol (?=>) exists in the f-structure in (26): there is a PASSIVE + feature, a SUBJ, and a OBL-AG with the correct PFORM and PTYPE. None of these facts is preceded by a +; this means that each of them will be deleted in the f-structure. In their place, the facts after the rewrite symbol will be inserted into the f-structure. So, there will be a new SUBJ, a new value for PASSIVE, and an OBJ will be created. The resulting f-structure will be as in (27). When this new f-structure is run through the generator, it will produce the active sentence *Torrential rains flooded the town.*

(27)
$$\begin{bmatrix} \textsc{pred} & \text{'flood<SUBJ,OBJ>'} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{'rain'} \\ \textsc{adjunct} & \left\{ \begin{bmatrix} \textsc{pred} & \text{'torrential'} \end{bmatrix} \right\} \end{bmatrix}_{\%OblAg} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{'town'} \end{bmatrix}_{\%Subj} \\ \textsc{passive} & - \\ \textsc{tense} & \text{past} \end{bmatrix}_{\%Main}$$

3.1.2 Activization of short passives with generic *they* subject

Next consider the rule in (29) which performs the condensation in (24b), repeated as (28). In this example, a passive sentence becomes an impersonal active sentence with the generic subject *they*.

(28) The car was pushed off the tracks. $\Longrightarrow$ They pushed the car off the tracks.

(29)
```
PASSIVE(%Main,+), SUBJ(%Main,%Subj), arg(%Main,1,NULL) ?=>
PASSIVE(%Main,-), OBJ(%Main,%Subj),
SUBJ(%Main,%NewSubj), arg(%Main,1,%NewSubj),
PRED(%NewSubj,pro), NUM(%NewSubj,pl), PERS(%NewSubj,3),
PRON-FORM(%NewSubj,they).
```

First consider the input facts that appear before the rewrite symbol. They require a passive verb with a subject. In addition, they require that the first argument of the predicate be NULL, as opposed to being an OBL-AG. The arguments of a predicate are referenced by the built-in predicate `arg` which takes three arguments: an f-structure, a number indicating which argument it is, and a value for this argument. In this example, the f-structure is the one containing the verb (`%Main`), the argument number is 1 since it is the first argument of the verb that we are interested in, and the value of this is NULL.[7] Looking at the facts after the rewrite symbol, PASSIVE is changed to $-$ and an OBJ is created from the original subject. Then a new SUBJ is created. All of the features are provided for this new subject: predicate, number, person, form. To guarantee that this subject appears in the correct argument slot, another mention of `arg` is used to create this new argument as the first argument of the main predicate.[8]

The f-structure in (30) will be rewritten as that in (31) by rule (29).

(30)
$$\left[\begin{array}{ll} \text{PRED} & \text{'push<NULL,SUBJ>'} \\ \text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{'car'}\end{array}\right]_{\%Subj} \\ \text{ADJUNCT} & \left\{ \left[\begin{array}{ll} \text{PRED} & \text{'off<OBJ>'} \\ \text{OBJ} & \left[\begin{array}{ll}\text{PRED} & \text{'track'}\end{array}\right]\end{array}\right] \right\} \\ \text{PASSIVE} & + \\ \text{TENSE} & \text{past}\end{array}\right]_{\%Main}$$

---

[7] This value is often another f-structure. To refer to the second argument of the passive verb in (29), `arg(%Main,2,%Subj)` would be used.

There is another built-in predicate `nonarg` which refers to non-thematic arguments. For a predicate like *'want*<SUBJ,XCOMP>OBJ' for sentences like *John wants Mary to leave.*, the arguments can be referred to as in (i).

(i)
SUBJ	`arg(%Main,1,%Subj)`
XCOMP	`arg(%Main,2,%XComp)`
OBJ	`nonarg(%Main,1,%Obj)`

[8] The rule in (25) did not have to refer to `arg` because both the subject and the oblique agent were mentioned in the original predicate in the correct order. All that was done was to change the names. Putting in a call to `arg` would not cause problems, but it is not necessary. It is only when argument slots are being added, such as when NULL is rewritten as an overt argument, that `arg` is needed.

(31) $$\left[\begin{array}{ll} \mathrm{PRED} & \text{'push}\langle\mathrm{SUBJ,OBJ}\rangle\text{'} \\ \mathrm{SUBJ} & \left[\begin{array}{ll} \mathrm{PRED} & \text{'pro'} \\ \mathrm{NUM} & \text{pl} \\ \mathrm{PERS} & 3 \\ \mathrm{PRON\text{-}FORM} & \text{they} \end{array}\right]_{\%NewSubj} \\ \mathrm{OBJ} & \left[\begin{array}{ll} \mathrm{PRED} & \text{'car'} \end{array}\right]_{\%Subj} \\ \mathrm{ADJUNCT} & \left\{\left[\begin{array}{ll} \mathrm{PRED} & \text{'off}\langle\mathrm{OBJ}\rangle\text{'} \\ \mathrm{OBJ} & \left[\begin{array}{ll} \mathrm{PRED} & \text{'track'} \end{array}\right] \end{array}\right]\right\} \\ \mathrm{PASSIVE} & + \\ \mathrm{TENSE} & \text{past} \end{array}\right]_{\%Main}$$

3.1.3 Passivization

Finally consider the passivization example repeated in (32). The active sentence can be rewritten as a passive. This passive can either have the active subject as an oblique agent or have it deleted. The first option, in which the subject becomes an oblique agent, will not result in a condensed sentence. However, we show the rule for this in (33) since it can be used to feed and bleed other rules (see section 3.1.4). We then discuss a second rule which deletes oblique agents regardless of their source.

(32) Torrential rains flooded the town.
$\Longrightarrow$ The town was flooded by torrential rains.
$\Longrightarrow$ The town was flooded.

(33)
```
PASSIVE(%Main,-), SUBJ(%Main,%Subj), OBJ(%Main,%Obj) ?=>
PASSIVE(%Main,+), SUBJ(%Main,%Obj),
OBL-AG(%Main,%Subj), PFORM(%Subj,by_), PTYPE(%Subj,nosem).
```

The rule in (33) is basically the inverse of the one in (25). The input facts are a non-passive f-structure with a subject and an object. These are deleted and the PASSIVE feature it changed to +, a new subject is created from the object's f-structure, and an oblique agent is created from the subject's f-structure. In addition, the new oblique agent is marked as having the features needed for the *by* found in *by* phrases for oblique agents. The passivization rule in (33) can apply to the f-structure in (34) to produce an f-structure as in (35).

(34) $$\left[\begin{array}{ll} \mathrm{PRED} & \text{'flood}\langle\mathrm{SUBJ,OBJ}\rangle\text{'} \\ \mathrm{SUBJ} & \left[\begin{array}{ll} \mathrm{PRED} & \text{'rain'} \\ \mathrm{ADJUNCT} & \left\{\left[\begin{array}{ll} \mathrm{PRED} & \text{'torrential'} \end{array}\right]\right\} \end{array}\right]_{\%Subj} \\ \mathrm{OBJ} & \left[\begin{array}{ll} \mathrm{PRED} & \text{'town'} \end{array}\right]_{\%Obj} \\ \mathrm{PASSIVE} & - \\ \mathrm{TENSE} & \text{past} \end{array}\right]_{\%Main}$$

(35)
$$\left[\begin{array}{ll}
\text{PRED} & \text{'flood}\langle\text{OBL-AG,SUBJ}\rangle\text{'} \\
\text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{'town'}\end{array}\right]_{\%Obj} \\
\text{OBL-AG} & \left[\begin{array}{ll}
\text{PRED} & \text{'rain'} \\
\text{PFORM} & \text{by_} \\
\text{PTYPE} & \text{nosem} \\
\text{ADJUNCT} & \left\{\left[\begin{array}{ll}\text{PRED} & \text{'torrential'}\end{array}\right]\right\}
\end{array}\right]_{\%Subj} \\
\text{PASSIVE} & + \\
\text{TENSE} & \text{past}
\end{array}\right]_{\%Main}$$

To obtain a version of the sentence which does not have an oblique agent, a separate rule can be applied that deletes the oblique agent. This rule does not discriminate between situations in which the oblique agent is the result of the passivization rule in (33) and ones in which the original sentence was a passive.

(36) `OBL-AG(%Main,%OblAg), arg(%Main,%%,%OblAg) ?=> 0.`

The rule in (36) can apply to the f-structure in (35) which was the output of the passivization rule (the variable `%OblAg` in (36) will match the f-structure labelled *%Subj* in (35)); the result is the structure in (37). The input facts are the OBL-AG and its argument position in the verbal predicate. Both of these are deleted. If the `arg(%Main,%%,%OblAg)` fact was not deleted, then the generator would not be able to generate from the resulting f-structure because that f-structure would have an argument slot with nothing to fill it.[9] The `0` after the rewrite symbol indicates that the input facts are deleted; this is exactly as in the adjunct deletion rule in (23).

(37)
$$\left[\begin{array}{ll}
\text{PRED} & \text{'flood}\langle\text{NULL,SUBJ}\rangle\text{'} \\
\text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{'town'}\end{array}\right] \\
\text{PASSIVE} & + \\
\text{TENSE} & \text{past}
\end{array}\right]_{\%Main}$$

3.1.4 Feeding and Bleeding

Consider the four rules we discussed above for activization and passivization, shown in (38). The transfer system used in sentence condensation orders the rules that apply. The four rules here need to be ordered in such a way that they correctly feed and bleed each other.

(38) a. Passive + oblique agent $\Longrightarrow$ active: rule (25)

b. Passive without oblique agent $\Longrightarrow$ active with *they* subject: rule (29)

c. Active $\Longrightarrow$ passive with oblique agent: rule (33)

d. Delete oblique agent: rule (36)

[9]The %% is a variable that matches any value. So, in (36) the rule states that it is unimportant what number the argument was in the predicate. This use of anonymous variables is also seen in rule 42 in which the feature COMP-FORM is deleted regardless of its value.

Feeding occurs when the application of one rule produces the structure needed for the application of another rule. For example, consider a sentence like (39).

(39) The enemy invaded the town.

Rule (38c) can apply to (39) to create a passive version. This creates (feeds) the environment for rule (38d) which deletes the oblique *by phrase*. This process is shown in (40).

(40) a. The enemy invaded the town.

b. The town was invaded by the enemy. (Rule 38c)

c. The town was invaded. (Rule 38d)

Bleeding occurs when the application of one rule destroys the environment for another. Consider the sentence in (40b). If rule (38a) applies creating an active sentence, then rule (38d) which deletes the oblique agent cannot apply.

In addition, each rule was written as an optional rule (?=>) and not an obligatory one (==>). Whether or not a rule applies will affect which further rules can apply to the f-structure. For example, suppose that the rules in (38) were in the opposite order. If rule (38d) applies to (40b) deleting the *by* agent, then rule (38b) can apply to create a *they* active. If the option is chosen where the rule does not apply and hence the *by* agent remains, then rule (38a) can apply to create a standard active sentence. As such, it is important to consider the ordering of the rules and which ones should be obligatory and which optional. Almost all the rules in the sentence condensation system are optional. In the case of the activization/passivization rules, this creates significant feeding and bleeding, even with the rule ordering. However, in applications like machine translation, most of the rules are obligatory, although feeding and bleeding issues still arise and can be exploited by the system.

3.2 Factive Verb Deletion

Next consider the condensation rules for factive verb deletion. Sentences with factive verbs can be condensed by keeping just the complement of the verb, as in (41a).

(41) a. They realized that Mary left yesterday. $\Longrightarrow$ Mary left yesterday.

b. They did not realize that Mary left yesterday. $\Longrightarrow$ Mary left yesterday.

The LFG f-structure analysis, shown in (43) for (41a), in conjunction with lexicalization of the condensation rules allows for the simple formulation of such rules, as in (42).

(42)
```
PRED(%Main,realize), COMP(%Main,%Comp), COMP-FORM(%Comp,%%)
?=> 0.
```

(43)
$$
\left[\begin{array}{ll}
\text{PRED} & \text{'realize} \langle \text{SUBJ,COMP} \rangle \text{'} \\
\text{SUBJ} & \left[\text{PRED}\quad \text{'pro'}\right] \\
\text{COMP} & \left[\begin{array}{ll} \text{PRED} & \text{'leave} \langle \text{SUBJ} \rangle \text{'} \\ \text{SUBJ} & \left[\text{PRED}\quad \text{'Mary'}\right] \\ \text{ADJUNCT} & \left\{\left[\text{PRED}\quad \text{'yesterday'}\right]\right\} \\ \text{TENSE} & \text{past} \\ \text{COMP-FORM} & \text{that}\end{array}\right]_{\%Comp} \\
\text{TENSE} & \text{past}
\end{array}\right]_{\%Main}
$$

The input facts in (42) match the f-structure in (43). The 0 after the rewrite symbol states that nothing is added. The desired output f-structure is that in (44) which corresponds to the sentence *Mary left*.

(44)
$$\left[\begin{array}{ll} \text{PRED} & \text{'leave<SUBJ>'} \\ \text{SUBJ} & \left[\text{PRED} \quad \text{'Mary'}\right] \\ \text{ADJUNCT} & \left\{\left[\text{PRED} \quad \text{'yesterday'}\right]\right\} \\ \text{TENSE} & \text{past} \end{array}\right]^{\%Comp}$$

3.2.1 Deleting F-structures

Looking more carefully at the rule in (42) there are a number of facts in the input f-structure in (43) that are not explicitly mentioned in the rule and hence will not be explicitly deleted. These facts from the main f-structure *%Main* are shown in (45).

(45)

SUBJ	$\Longleftrightarrow$	`SUBJ(%Main,%Subj)`
[PRED 'pro']	$\Longleftrightarrow$	`PRED(%Subj,pro)`
TENSE past	$\Longleftrightarrow$	`TENSE(%Main,past)`

These facts will be deleted by the transfer system because they are no longer connected to the top level f-structure. As such, it is unnecessary to mention every feature that might appear in an f-structure that is to be deleted or in the subsidiary f-structures of such an f-structure. This is essential because it is generally impossible to predict what additional information will occur in such structures. For example, the deleted verb *realize* might have had any number of adjunct modifiers, as in (46), all of which are to be deleted.

(46) Upon their arrival, they quickly realized that Mary left yesterday.

The rule in (42), however, also leaves the f-structure that was the value COMP (*%Comp*) disconnected from the top level f-structure. This is not what was intended. Instead, the intention was to have the f-structure of the COMP become the top level f-structure. This can be done by initially setting the original top level f-structure to a special fact called `root` and then redefining `root` to have the value of the COMP's f-structure.[10]

3.2.2 Templates for Lexicalized Rules

The factive verb deletion rule is lexicalized in that it only occurs with certain lexical items: not all verbs with *that* complements presuppose their complement. It would be possible to repeat the rule in (42) as many times are there are factive verbs, replacing the value of the verbal predicate in `PRED(%Main,realize)`. However, this misses a generalization and can result in maintenance difficulties. Instead, the rule in (42) can be defined as a template and each factive verb will call this template. The template version of (42) is shown in (47) with sample calls in (48). The @ indicates a call to a template.[11]

[10] The initial setting of `root` is done by placing the following call at the beginning of the transfer rules.

```
:- set_transfer_option(extra,[cf(1, root(root, var(0)))]).
```

[11] Templates must be defined before they are called, otherwise the transfer system will not correctly rewrite them as rule applications.

(47)
```
factive_verb_deletion(%Verb) ::
PRED(%Main,%Verb), COMP(%Main,%Comp), COMP-FORM(%Comp,%%)
?=> 0.
```

(48)
```
@factive_verb_deletion(realize).
@factive_verb_deletion(know).
```

The template in (47) takes one argument, the value of the PRED of the factive verb. This value is then substituted into the input facts of the template, resulting in a rule application similar to that in rule (42). For example, the two template calls in (48) will result in two versions of the rule, one for *realize* and one for *know*, as if the two rules in (49) had been included in the rule set. Large lists of verbs can be added by using templates in this way.

(49) a.
```
PRED(%Main,realize), COMP(%Main,%Comp), COMP-FORM(%Comp,%%)
?=> 0.
```

b.
```
PRED(%Main,know), COMP(%Main,%Comp), COMP-FORM(%Comp,%%)
?=> 0.
```

Using templates for rules that are triggered by particular lexical items can be very valuable. In the sentence condensation system, there are a number of these rules, including ones for deleting group terms (50a), keeping only the complements of certain adjectives (50b), and intransitivization (50c).

(50) a. A set of tools was found. $\Longrightarrow$ Tools were found.
```
@delete_group(set).
@delete_group(bunch).
@delete_group(group).
```

b. It is clear that they left. $\Longrightarrow$ They left.
```
@delete_copular_adjective(clear).
@delete_copular_adjective(obvious).
@delete_copular_adjective(evident).
```

c. They broke the glass. $\Longrightarrow$ The glass broke.
```
@intransitivization(break).
@intransitivization(decrease).
@intransitivization(increase).
```

4 Conclusions

In Riezler et al. 2003, we presented an application of ambiguity packing and stochastic disambiguation techniques for LFG to the domain of sentence condensation. The system incorporated a linguistic parser/generator for LFG, a transfer component for f-structure reduction using the rules described in this paper, and a maximum-entropy model for stochastic output selection. Overall summarization quality of the proposed system was tested on a small corpus and proved to be state-of-the-art, with guaranteed grammaticality of the system output due to the use of the LFG parser/generator.

In this paper, we described the types of sentence condensation rules used in the system in detail. We showed how the distinctions made in LFG f-structures as to grammatical functions and features make it possible to state simple but accurate rules to create smaller, well-formed f-structures from which the condensed sentence can be generated. In addition, we described the elements of the XLE system that make it possible to parse, transfer, and then generate the structures needed for accurate sentence condensation.

References

Bresnan, Joan, Ron Kaplan, Stanley Peters, and Annie Zaenen. 1982. Cross-serial dependencies in Dutch. *Linguistic Inquiry*, 13(4):613–35.

Butt, Miriam, Helge Dyvik, Tracy Holloway King, Hiroshi Masuichi, and Christian Rohrer. 2002. The Parallel Grammar Project. In *Proceedings of COLING-2002 Workshop on Grammar Engineering and Evaluation*. pp. 1-7.

Butt, Miriam, Rafiq Khader, and Tracy Holloway King. 2004. Deep CALL Grammars: The LFG-OT Experiment. Jahrestagung der Deutschen Gesellschaft dür Sprachwissenschaft, Mainz, Germany.

Butt, Miriam, Tracy Holloway King, Maria-Eugenia Nino, and Frederique Segond. 1999. *A Grammar Writer's Cookbook*. Stanford: CSLI Publications.

Frank, Anette. 1999. From Parallel Grammar Development towards Machine Translation. In *Proceedings of MT Summit VII*. pp. 134-142.

Frank, Anette, Tracy Holloway King, Jonas Kuhn, and John Maxwell. 2001. Optimality Theory style constraint ranking in large-scale LFG grammars. In Peter Sells, editor, *Formal and Empirical Issues in Optimality Theory*. Stanford: CSLI Publications. pp. 367-397.

Kaplan, Ron, John T. Maxwell III, Tracy Holloway King, and Richard Crouch. 2004. Integrating Finite-state Technology with Deep LFG Grammars. *Proceedings of the Workshop on Combining Shallow and Deep Processing for NLP (ESSLLI)*.

Kay, Martin. 1996. Chart Generation. In *Proceedings of the 34th conference on Association for Computational Linguistics*, pp. 200-204.

Knight, Kevin, and Daniel Marcu. 2000. Statistics-based summarization - step one: Sentence compression. In *Proceedings of the 17th National Conference on Artificial Intelligence (AAAI-2000)*.

Maxwell, John, and Ron Kaplan. 1991. A Method for Disjunctive Constraint Satisfaction. *Current Issues in Parsing Technologies*.

Maxwell, John, and Ron Kaplan. 1993. The Interface Between Phrasal and Functional Constraints. *Computational Linguistics* 19:4.

Maxwell, John, and Ron Kaplan. 1996. An Efficient Parser for LFG. In *Proceedings of the First LFG Conference*. CSLI On-line Publications.

Riezler, Stefan, Tracy Holloway King, Richard Crouch, and Annie Zaenen. 2003. Statistical sentence condensation using ambiguity packing and stochastic disambiguation methods for Lexical-Functional Grammar. In *Proceedings of the Human Language Technology Conference and the 3rd Meeting of the North A merican Chapter of the Association for Computational Linguistics (HLT-NAACL'03)*.

Riezler, Stefan, Tracy Holloway King, Ron Kaplan, Richard Crouch, John Maxwell, and Mark Johnson. 2002. Parsing the Wall Street Journal using a Lexical-Functional Grammar and Discriminative Estimation Techniques. *Proceedings of the Annual Meeting of the Association for Computational Linguistics*.

Witbrock, M. and V. Mittal. 1999. Ultra-summarization: A statistical approach to generating highly condensed non-extractive summaries. In *Proceedings of the 22nd ACM SIGIR Conference on Research and Development in Information Retrieval*.

COPULAR COMPLEMENTS: CLOSED OR OPEN?

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Abstract

In this paper, we present some preliminary observations on the syntactic analysis of copular constructions in LFG. We suggest several conclusions and directions for future research. First, the open analysis is appropriate for some copular constructions but not for others, even within the same language. Second, the same construction can be open in some languages and closed in others. Third, we can determine whether a particular copular construction is open or closed by examining phenomena like agreement and the obligatory presence of the copula. Fourth, we do not expect open postcopular complements always to be open in other environments.

1 Introduction

In this paper, we explore some questions in the syntactic analysis of copular constructions in LFG. Examples from English are shown in (1).

(1) a. They are books.

b. The books are flimsy.

c. The books are on the table.

d. The problem is that they appear.

e. The problem is their appearing.

f. The problem is to leave before 6:00.

We focus on the grammatical function of the post-copular element. In particular, is it an open complement (XCOMP, shown in (2a)) or a closed complement (PREDLINK, as proposed by Butt et al. 1999, shown in (2b))? Or is it open for some categories and closed for others? And how does this vary across languages? Do all languages have XCOMPs with copulas? Or PREDLINKs? Or do some have one and some the other?

(2) a. Open Complement

$$\begin{bmatrix} \text{PRED} & \text{`be} \langle \text{XCOMP} \rangle \text{SUBJ'} \\ \text{SUBJ} & [\ldots]1 \\ \text{XCOMP} & \begin{bmatrix} \text{PRED} & \text{`}\ldots \langle \text{SUBJ} \rangle \text{'} \\ \text{SUBJ} & [\ ]1 \end{bmatrix} \end{bmatrix}$$

b. Closed Complement

$$\begin{bmatrix} \text{PRED} & \text{`be} \langle \text{SUBJ, PREDLINK} \rangle \text{'} \\ \text{SUBJ} & [\ldots] \\ \text{PREDLINK} & \begin{bmatrix} \text{PRED} & \text{`}\ldots\text{'} \end{bmatrix} \end{bmatrix}$$

Although the difference between open and closed complements has semantic reflexes which have been examined extensively in the semantic literature, we focus here on syntactic issues. Positing a SUBJ in the f-structure should be supported by syntactic and not semantic criteria, since otherwise the proper distinction between grammatical functions and semantic arguments is not maintained.

In examining this issue, we first make our notion of ‘syntactic criteria’ more precise, before looking at constructions in which the copula may or must be absent. We then turn to constructions in which the post-copular constituent contains its own subject, separate from the subject in the matrix clause. Next, we look at control relations and agreement involving the subject and the post-copular constituent. Finally, we provide some discussion.

1.1 Subject Criteria

If f-structure analyses are to serve as a basis for typological comparison of languages, they must reflect grammatical rather than purely semantic properties of the expressions analyzed. Similarity in argument structure or semantic content shows only that the same content can be expressed in the languages compared, not that the syntactic expression of this content is parallel: however, the latter is necessary to justify a syntactic generalization. Therefore, the observation that a predicate takes a semantic argument is not sufficient to justify the conclusion that the lexeme expressing the predicate subcategorizes for a corresponding syntactic function. Such a conclusion needs further support from grammatical properties.

Here we restrict ourselves to presenting our basic assumptions about the definition of subject, which are the following. Universal characterizations of categories like 'subject' refer to prototypes. A language has subjects only if it has prototypical subjects, but then it may also have non-prototypical subjects. We take a prototypical subject to be a grammatically isolable nominal constituent which may carry the roles 'volitional' and 'agentive' with appropriate predicates, and which expresses wide scope in basic sentences with unmarked intonation.

A central point here is that a prototypical subject has a c-structure realization: prototypical subjects are overtly expressed. If we discard this criterion, i.e. envisage operating with the term 'subject' in cases where there is never any c-structure realization of this function, then 'subject' ceases to be a grammatical term and becomes a purely semantic term, denoting a subtype of semantic argument. On the other hand, this criterion does not forbid the occurrence of nonprototypical, (locally) non-overt subjects. We can argue for the presence of non-overt subjects in the following way: Predicates which appear with overt subjects must subcategorize for 'subject' in order to achieve the appropriate role assignment. This leads to the assumption of non-prototypical functional subjects when these forms occur as predicates in constructions where no (local) constituent bears this function. This motivates, for instance, the positing of controlled subjects in the case of infinitives, (3a), and of null subjects in pro-drop constructions, (3b), since these verbs also occur as the syntactic heads of predicates that combine with prototypical subjects.

(3) a. They want to leave.

b. Katalavéno ellinikά.
understand-1SG Greek
'I understand Greek.' (Modern Greek)

In order to investigate which lexical categories take subjects and hence may occur in open complements, we need to consider the motivation for assuming that a given expression E has a subject. We take the primary criterion to be E's status as syntactic head of a predicate phrase. Another potentially relevant property is agreement, if we (with, e.g., Keenan 1976) include among our prototypical subject criteria that the subject is always among the controllers of agreement in languages with agreement. Agreement would then be a possible basis for saying that the 'subject-of' relation obtains between the subject and the expression showing agreement.

1.2 Copular Occurrence Governed by Category

Some languages are unlike English in that the copula is not required, or not permitted, in certain constructions involving nonverbal predication (Rosén 1996). For example, Japanese adjectives do not require the copula, as seen in (4):

(4) a. hon wa akai
book red
'The book is red.' (Japanese)

b. $$\begin{bmatrix} \textsc{pred} & \text{`red}\langle\textsc{subj}\rangle\text{'} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`book'} \end{bmatrix} \end{bmatrix}$$

In these cases, it is plausible to assume that the adjective provides the main PRED for the clause. This is based on the reasoning in section 1.1: the adjective is the syntactic head of the predicate phrase. If this is not considered a sufficient criterion for assuming that it subcategorizes for the (prototypical) subject of the sentence, then even the assumption that ordinary verbs subcategorize for subjects may be called into question. Thus, in order to satisfy Coherence, the predicate must be open, subcategorizing for a SUBJ (Andrews 1982). In (4b), the adjective *akai* 'red' contributes the main PRED of the f-structure. It takes a SUBJ which licenses the occurrence of *hon* 'book'. Thus, in languages like Japanese, adjectives take overt SUBJs with which they combine directly in the syntax.

We propose that this analysis is also the correct one for cases in which Japanese adjectival predicates occur with an overt copula: a complement should be treated as open, subcategorizing for a SUBJ, if it can ever be used without a copula. Thus, in (5), the adjective is also an open function, and also subcategorizes for a SUBJ:

(5) sono hon wa akai desu
this book red is
'This book is red.' (Japanese)

In contrast to the examples above with adjectival complements, in Japanese copular sentences with nominal complements, the copula cannot be omitted, as in (6).

(6) a. sono hon wa syousetsu desu
this book novel is
'This book is a novel.' (Japanese)

b. *sono hon wa syousetsu

This suggests that Japanese nouns are not open complements and do not subcategorize for a SUBJ. We conclude that the category of the constituent – whether it is an adjective or a noun – can affect whether it can be a predicate on its own, licensing its own subject, or whether it must occur with a copula. Even within the same language, different constituents can behave differently in copular constructions. See Falk (2004) for a similar conclusion for Hebrew. Interestingly, Falk argues that some adjectival "copular" constructions in Hebrew take closed PREDLINK complements, while others are like the Japanese adjectives in (5) in which the adjective provides the main clausal predicate. The fact that different constituents can behave differently in copular constructions means that the full range of copular constructions must be examined within a language in order to analyze it completely. That is, the fact that one type of constituent requires a certain analysis of copular constructions does not guarantee that other, superficially similar constructions will be amenable to the same analysis.

1.3 Copula Occurrence Governed by Tense

In some languages, the copula is required in some situations but forbidden in others. One crosslinguistically common governing factor for this is tense. For example, in Russian (Chvany 1975) and Arabic (Shlonsky 1997), the copula is null in the present tense but overt in the past and future tenses. This is shown for Russian in (7).

(7) a. On student.
he student
'He is a student.' (Russian)

b. On byl student/studentom.
he was student
'He was a student.' (Russian)

c. On budet studentom.
he will.be student
'He will be a student.' (Russian)

For such languages, there does not appear to be any evidence that the copula-less constructions have different syntax (or semantics) from the ones with copulas.[1] As such, a unified analysis is desirable. However, a unified analysis is possible for all languages in which the occurrence of the copula is (partially) governed by tense; in particular, see Falk 2004 for a detailed discussion of the present tense "copula" in Hebrew.

For languages in which a unified analysis is possible, this unified analysis can take one of two forms. The first possibility is that the nominal complement is open, and contributes the main predicate of the sentence, as in the Japanese adjective examples discussed above. The copula under this analysis does not contribute a predicate to the f-structure, but instead only tense features. This is shown in (8) for (7b).

(8) $$\begin{bmatrix} \textsc{pred} & \text{`student}<\textsc{subj}>\text{'} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`he'} \end{bmatrix} \\ \textsc{tense} & \text{past} \end{bmatrix}$$

The second possibility is that the copula contributes the main predicate of the sentence. This means that a copular predicate must appear in the f-structure even for the present tense in which it is absent. Whether this copular predicate is open or closed depends on other patterns in the language in question. For the present tense case with no overt copula, the main predicate could be provided by annotations on the phrase structure rules. This approach can be thought of as constructional, in that a special copular construction provides the main PRED of the clause.

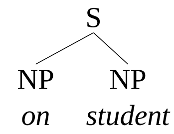
The annotated phrase structure rule in (9) accomplishes this for the closed complement (PREDLINK) analysis. (9) states that a sentence S can be composed of a subject noun phrase, then either a copular verb or nothing, and finally a complement: a noun phrase, an adjectival phrase, or a prepositional phrase, here bearing the closed grammatical function PREDLINK.[2] The resulting f-structure and c-structure for (7a) are shown in (10).

(9) $$\begin{array}{llllll} S \longrightarrow & NP & VCop & \vee & \epsilon & NP \vee AP \vee PP \\ & (\uparrow \textsc{subj}){=}\downarrow & \uparrow{=}\downarrow & & (\uparrow \textsc{pred}){=}\text{`be}<\textsc{subj},\textsc{predlink}>\text{'} & (\uparrow \textsc{predlink}){=}\downarrow \\ & & & & (\uparrow \textsc{tense}){=}\text{present} & \end{array}$$

[1]The choice between nominative (*student*) and instrumental (*studentom*) case on predicate nominals and adjectives in Russian copular sentences generally reflects aspectual semantic differences in interpretation (Ionin and Matushansky 2002), although on nominals the instrumental is almost obligatory in the future as is the nominative in the present.

[2]The XCOMP analysis f-structure would look like the one in (2), but with the PRED *be* for the SUBJ and *student* for the XCOMP. The agreement facts with Russian adjectives suggest that an open complement analysis might be warranted at least for the adjectival cases (section 4).

(10) a. $\begin{bmatrix} \text{PRED} & \text{‘be}\langle\text{SUBJ, PREDLINK}\rangle\text{’} \\ \text{SUBJ} & \begin{bmatrix}\text{PRED} & \text{‘he’}\end{bmatrix} \\ \text{PREDLINK} & \begin{bmatrix}\text{PRED} & \text{‘student’}\end{bmatrix} \\ \text{TENSE} & \text{present} \end{bmatrix}$

b. 

Given this rule, the f-structure in (10a) is identical to those associated with overt copular constructions, except that the value of tense is present instead of past or future. However, the predicate and tense information come from the annotated phrase structure rules instead of the overt copular form. This is due to the presence of the ϵ category in rule (9), which amounts to an instruction to introduce the associated equations if no VCop constituent is present. It is important to note that the ϵ in (10) is not an empty category; that is, no ϵ will appear in the c-structure in (10b). The only effect is on the f-structure: the associated equations will be introduced as if they were associated with the other categories in the rule (Kaplan and Maxwell 1996).

Here we do not argue for one or the other of these analyses for Russian because there are a number of other Russian copular constructions whose analysis may bear on the canonical constructions in this section. Note that certain impersonal adverbial predicates use the forms of *byt’* as tense markers with the same distribution as copular *byt’*. Regardless of the chosen analysis for the Russian data, the possibility of finding both analyses crosslinguistically remains. For example, the Arabic data, which was not presented here, would need to be considered in its own light.

1.4 The Copula as Grammatical Prothesis

In English, in contrast to languages like Japanese, an adjective cannot occur on its own as the syntactic head of a predicate; a copula is always required. This provides a functionally-motivated account of the existence of the copula: it is needed because the adjectives themselves are unable to combine directly with overt SUBJs, unlike Japanese adjectives.

Given this, the copula can be seen as giving to the adjective a needed grammatical prothesis: a SUBJ argument to which to link the adjective’s semantic role. This analysis entails that the syntactic head of the predicate is the copula, not the adjective; syntactically, the overt subject is SUBJ of the copula. For constructions where the copula is obligatory, then, the conclusion would be that adjectives in English do not take SUBJs, and hence that examples like (1b) take closed PREDLINKs rather than open XCOMPs. Corresponding arguments would lead to the same conclusions for PPs, as in (1c).

(1) b. The books are flimsy.

c. The books are on the table.

However, as we will see in section 3, there are control constructions involving English copular verbs which seem to require an open complement analysis. This once again suggests that copular constructions even within a single language may not have a uniform analysis.

2 Subjects in Post-Copular Constructions

The closed complement PREDLINK analysis is mandated when the post-copular element already has a subject, as with post-copular *that*-clauses, certain gerunds, and some modal uses of the copula with null pronominal subjects.[3] These are repeated in (11).

[3]Some modal uses of the copula do not pose a problem in this respect because the subject of the copula is the same as the subject of the post-copular verb. This is similar to the behavior of more prototypical modals such as *would* and *should*. An example is shown

(11) a. The problem is that they appear.

b. The problem is their appearing.

c. The problem is (for them) to leave before 6.

In all of these examples, the post-copular element contains a verb which has a subject distinct from the subject of the copula. In (11a) it is *they*, in (11b) it is the possessive *their*, and in (11c) it is either an arbitrary pronoun or the *them* in *for them*.

The XCOMP analysis of these constructions results in a clash of PRED values. The control equation (↑ SUBJ)=(↑ XCOMP SUBJ) equates the subject of the copula with the subject of the post-copular constituent. However, since these are distinct, the result is a failure in unification of the PREDs of the XCOMP's subject and an ungrammatical structure, as shown in (12) for (11a).

(12) Open Complement

$$\left[\begin{array}{ll} \textsc{pred} & \text{`be<}\textsc{xcomp}\text{>}\textsc{subj}\text{'} \\ \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{`problem'} \end{array}\right] \\ \textsc{xcomp} & \left[\begin{array}{ll} \textsc{pred} & \text{`appear<}\textsc{subj}\text{>'} \\ \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{*`they/problem'} \end{array}\right] \end{array}\right] \end{array}\right]$$

This problem is avoided if the copula takes a closed complement, as shown in (13).

(13) Closed Complement

$$\left[\begin{array}{ll} \textsc{pred} & \text{`be<}\textsc{predlink}\text{>}\textsc{subj}\text{'} \\ \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{`problem'} \end{array}\right] \\ \textsc{predlink} & \left[\begin{array}{ll} \textsc{pred} & \text{`appear<}\textsc{subj}\text{>'} \\ \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{`they'} \end{array}\right] \end{array}\right] \end{array}\right]$$

Under the closed PREDLINK analysis, there is no control equation to unify the two subjects and the result is a grammatical analysis. Thus, the PREDLINK analysis is the only one possible for constructions where the copular complement has its own subject, distinct from the matrix subject.

3 Control Relations

In sharp contrast to the examples in section 2 in which the subjects differed and hence required the closed PREDLINK analysis, there are constructions which are better treated uner an XCOMP analysis. The XCOMP analysis is excellent for capturing certain control relations, such as those in (14).

(14) a. It is likely/bound/certain to rain.

b. They are eager/foolish/loathe to leave.

---

in (i).

(i) They are to leave at six.

Whether these modal uses of the copula should be treated similarly to the more canonical uses is not explored here.

In these examples, the subject of the copula is also the subject of the verb embedded in the post-copular constituent.

If these adjectives have subjects, then the chain of control from the matrix subject through the adjective to its verbal complement is standardly described by the control equation ($\uparrow$SUBJ)=($\uparrow$XCOMP SUBJ). The f-structure for (14a) is shown in (15).

(15)
$$\left[\begin{array}{ll}
\textsc{pred} & \text{`be}\langle\textsc{xcomp}\rangle\textsc{subj'} \\
\textsc{subj} & \left[\begin{array}{ll}\textsc{pron-form} & \text{it}\end{array}\right]_1 \\
\textsc{xcomp} & \left[\begin{array}{ll}
\textsc{pred} & \text{`likely}\langle\textsc{xcomp}\rangle\textsc{subj'} \\
\textsc{subj} & [\;]_1 \\
\textsc{xcomp} & \left[\begin{array}{ll}
\textsc{pred} & \text{`rain}\langle\rangle\textsc{subj'} \\
\textsc{subj} & [\;]_1
\end{array}\right]
\end{array}\right]
\end{array}\right]$$

In contrast, if these constructions had a closed PREDLINK analysis, as in (16), then the control equation for adjectives like *likely* would have to be as in (17).

(16)
$$\left[\begin{array}{ll}
\textsc{pred} & \text{`be}\langle\textsc{predlink}\rangle\textsc{subj'} \\
\textsc{subj} & \left[\begin{array}{ll}\textsc{pron-form} & \text{it}\end{array}\right]_1 \\
\textsc{predlink} & \left[\begin{array}{ll}
\textsc{pred} & \text{`likely}\langle\textsc{comp}\rangle\text{'} \\
\textsc{comp} & \left[\begin{array}{ll}
\textsc{pred} & \text{`rain}\langle\rangle\textsc{subj'} \\
\textsc{subj} & [\;]_1
\end{array}\right]
\end{array}\right]
\end{array}\right]$$

(17) likely ($\uparrow$ PRED)=‘likely<COMP>’
($\uparrow$ COMP SUBJ)=((PREDLINK $\uparrow$) SUBJ)

Although it is possible to write equations to enforce the desired subject control, these equations are quite complicated and do not follow general patterns of control equations found crosslinguistically.

The contrast between the copular constructions in section 2 and the ones in this section, both from English, suggests once again that within languages, there is variation as to the grammatical function of the post-copular element: some copular complements are open, and some are closed.

4 Agreement

The XCOMP analysis also works well for languages like French and Norwegian, in which the postcopular complement shows agreement with the subject of the copula. A French example is shown in (18).

(18) a. Elle est petite.
she.F.SG is small.F.SG
‘She is small.’ (French)

b. Il est petit.
he.M.SG is small.M.SG
‘He is small.’ (French)

In the XCOMP analysis, the adjective simply agrees with its own SUBJ, in the same way as verbs do. Consider the structure in (19), which provides the open complement (XCOMP) analysis for the sentence in (18a).

(19)
$$\left[\begin{array}{ll}
\text{PRED} & \text{‘be}\langle\text{XCOMP}\rangle\text{SUBJ’} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{‘she’} \\ \text{NUM} & \text{sg} \\ \text{GEND} & \text{fem} \end{array}\right]1 \\
\text{XCOMP} & \left[\begin{array}{ll} \text{PRED} & \text{‘small}\langle\text{SUBJ}\rangle\text{’} \\ \text{SUBJ} & [\ ]1 \end{array}\right]
\end{array}\right]$$

Given a structure of this type, the adjective can have a basic lexical entry as in (20).

(20) petite $(\uparrow \text{PRED}) = \text{‘small}\langle\text{SUBJ}\rangle\text{’}$
$(\uparrow \text{SUBJ NUM}) =_c \text{sg}$
$(\uparrow \text{SUBJ GEND}) =_c \text{fem}$

In contrast, consider the structure in (21), which provides the closed complement (PREDLINK) analysis for the same sentence:

(21)
$$\left[\begin{array}{ll}
\text{PRED} & \text{‘be}\langle\text{SUBJ,PREDLINK}\rangle\text{’} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{‘she’} \\ \text{NUM} & \text{sg} \\ \text{GEND} & \text{fem} \end{array}\right] \\
\text{PREDLINK} & \left[\begin{array}{ll} \text{PRED} & \text{‘small’} \end{array}\right]
\end{array}\right]$$

If we assume that the adjective specifies the agreement features of the subject of the sentence, the adjective must have a lexical entry such as (22) under the closed-complement analysis, since the agreement specifications are not associated with a local argument of the adjective.

(22) petite $(\uparrow \text{PRED}) = \text{‘small’}$
$((\text{PREDLINK} \uparrow) \text{ SUBJ NUM}) =_c \text{sg}$
$((\text{PREDLINK} \uparrow) \text{ SUBJ GEND}) =_c \text{fem}$

Although it is possible to formulate equations so that agreement works in these copular constructions with a PREDLINK analysis, the XCOMP analysis allows for a much simpler analysis and one which is similar to that of other cases of subject-predicate agreement, such as subject-verb agreement.

In other languages, however, some considerations may weaken the status of agreement as an argument for assuming an XCOMP analysis. In languages like Norwegian, for example, there is no subject-verb agreement, so that subject-adjective agreement must be treated differently from subject-verb agreement in any case. Another issue is that predicative adjective agreement may be governed by semantic rather than syntactic features. Specifically, and unlike the case of agreement between attributive adjective and head noun, the form of the predicative adjective may be governed by properties of the intended referent rather than the grammatical properties of the subject, as in (23).

(23) a. Ekteparet er syke
the-married-couple.N.SG is ill.PL
‘The couple are ill.’ (Norwegian)

b. Postbudet er syk
the-mailman.N.SG is ill.M.SG
'The mailman is ill.' (Norwegian)

c. Bil er dyrt
car.M.SG is expensive.N.SG
'Having/buying/using/... a car is expensive.' (Norwegian)

This suggests that the agreement in predicative adjectives is not a strict grammatical rule, and hence less compelling as an argument for assuming that the predicative adjective takes its own SUBJ.

5 Discussion

We have laid out several issues in the syntactic analysis of copular constructions, and in particular the role of the postcopular complement. Much more work needs to be done to determine the range of copular constructions found crosslinguistically and how these should be analyzed in the overall LFG syntactic framework. This initial examination of copular constructions suggests several conclusions that we hope can guide future analyses.

First, the XCOMP analysis is appropriate for some copular constructions but not for others, even within the same language. That is, languages may have both closed and open postcopular constituents whose occurrence may be governed by different factors such as the c-structure category of the constituent.

Second, the same construction can be open in some languages and closed in others. For example, postcopular adjectives appear to be open categories in some languages and closed ones in others; this may hold of other categories as well.

Third, we can determine whether a particular copular construction is open or closed by examining phenomena like agreement and the obligatory presence of the copula. We hope that future work will identify other syntactic tests which can be used to determine the status of a postcopular constituent both within and across languages.

Assuming that postcopular complements can be open, requiring a subject argument for completeness, raises a number of questions that we have not addressed here. One of the most pressing is: to what extent does this status carry over to other environments? In particular, the subject requirement of words when they function predicatively may be different than when they have a non-predicative role. For example, if the adjectives in (14) and (18), partially repeated here as (24), are open in postcopular use, should it follow that they also open in attributive position, (25)?

(24) a. They are eager/foolish/loathe to leave.

b. Elle est petite.
she.F.SG is small.F.SG
'She is small.' (French)

(25) a. the foolish boy

b. la petite fille
the.F.SG little.F.SG girl
'the little girl' (French)

This does not seem implausible for adjectives, especially in languages such as French with adjectival agreement, but is less so for PPs and particularly for NPs. That is, it seems unlikely that every NP in a given language, regardless of the syntactic construction in which it appears, requires a subject. We thus speculate that open postcopular complements, which occur in a predicative environment, need not always be open in other, non-predicative environments. For example, postcopular noun phrases may be open in a language, but closed in other environments.

Finally, it is our hope that examining these constructions can illuminate the difference between a grammatical function and a semantic argument, and that untangling the two notions can lead to a better understanding of their interaction in LFG.

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Bibliography

Andrews, A. (1982). “The Representation of Case in Modern Icelandic”. In Joan Bresnan (ed.) *The Mental Representation of Grammatical Relations*, pp. 427-503. The MIT Press, Cambridge, MA.

Butt, M., King, T. H., Niño, M., and Segond, F. (1999). *A Grammar Writer’s Cookbook.* CSLI Publications, Stanford University.

Chvany, C. (1975). *On the Syntax of BE-sentences in Russian.* Slavica Publications.

Falk, Y. (2004). “The Hebrew Present-tense Copula as a Mixes Category”. In M. Butt and T. H. King (eds.) *Proceedings of the LFG04 Conference.* CSLI Publications, Stanford University. (This volume.)

Ionin, T., and R. Matushansky. (2002). “Elephants, times, and predicate case in the Russian copular”. Presented at *Existence*, Nancy, France. Handout available on-line.

Kaplan, R. and J. Maxwell. (1996). *LFG Grammar Writer’s Workbench.* Technical report, PARC. Available from: `ftp://ftp.parc.xerox.com/pub/lfg/lfgmanual.ps`.

Keenan, Edward L. (1976). “Towards a universal definition of subject”. In C. N. Li (editor), *Subject and Topic*. New York: Academic Press.

Rosén, V. (1996). “The LFG Architecture and ‘Verbless’ Syntactic Constructions”. In M. Butt and T. H. King (eds.) *Proceedings of the LFG96 Conference*. CSLI Publications, Stanford University.

Shlonsky, U. (1997). *Clause Structure and Word Order in Hebrew and Arabic: An Essay in Comparative Semitic Syntax.* Oxford University Press.

LINGUISTIC GENERALIZATIONS OVER DESCRIPTIONS

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Abstract[1]

LFG encodes linguistic generalizations not in terms of formal relations in a type hierarchy, but in terms of relations between *descriptions* of structures. An LFG functional description – a collection of equations – can be given a name, and this name can be used to stand for those equations in linguistic descriptions. In computational treatments, these named descriptions are generally referred to as *templates*. The use of templates allows for linguistic generalizations to be captured. Template definitions can refer to other templates; thus, a template hierarchy can be drawn to represent inclusion relations between these named LFG descriptions. Importantly, however, the relation depicted in such a diagram shows only how pieces of descriptions are factored into patterns that recur across the lexicon and does not indicate the formal mode of combination of those pieces.

1 Introduction

A primary goal of syntactic theory is to identify generalizations about classes and subclasses of linguistic items, and in doing so to explore and characterize linguistic structure. A word like *yawns* belongs to several classes: it is a third-person, singular, finite, present-tense, intransitive verb. It shares some of these properties with a verb like *coughed*, and others with a verb like *devours*.

Linguistic theories have adopted different views as to how such generalizations should be captured. Early theories viewed the lexicon as "a kind of appendix to the grammar, whose function is to list what is unpredictable and irregular about the words of a language" (Kiparsky, 1982). Such views were (and are) common among proponents of transformational approaches to syntax, since important linguistic generalizations were assumed to be best encoded transformationally, with the lexicon as a catchall for linguistic facts that could not be represented in general terms.

With the advent of constraint-based, nontransformational theories like LFG, this view of the lexicon changed. Bresnan (1978) observed that the effect of many transformations is better captured in terms of *lexical redundancy rules*: for example, the active and passive forms of a transitive verb, or the base and dative-shifted variants of a ditransitive verb, are related by lexical rules rather than by syntactic transformations. On this view, lexical information is no longer merely exceptional, idiosyncratic and therefore theoretically uninteresting. Instead, the lexicon and the rules relating lexical items become a prime locus of syntactic generalizations.

One of the first proposals for explicitly representing lexical generalizations was made by Flickinger (1987), who represents the lexicon as a hierarchy of word classes. Each class represents some piece of syntactic information: the word *yawns* belongs to the third-person singular present-tense class (like *devours*, *cooks*, and so on), the intransitive class (like *coughed*, *hiccup*, and so on), and to other classes as well. Classes may be subclasses of other classes, or may partition other classes along several dimensions: Flickinger analyzes VERB-TYPE and VERB-FORM as partitioning the class VERB, and FINITE as a subclass of VERB-FORM.

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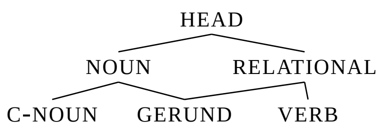
Subsequent work within HPSG has built on this view. Linguistic generalizations in HPSG are captured by a *type hierarchy*, with more specific types inheriting information from less specific but related types. Construction Grammar (Kay, 1998) assumes a similar hierarchy, the constructional hierarchy. On the HPSG view, lexical generalizations are statable as relations between elements in the type lattice, where different subtypes represent alternatives, and a type can belong to multiple supertypes. For example, Malouf (1998) provides the following depiction of a partial type hierarchy of HEAD values:

(1)



This diagram represents an AND/OR lattice: the alternative types NOUN and RELATIONAL are disjunctively specified as different subtypes of the type HEAD. The type GERUND inherits from two supertypes, NOUN and RELATIONAL, and the information inherited from all supertypes is conjoined.

Work within LFG, on the other hand, has not appealed to typed feature structures to encode linguistic generalizations. Instead, LFG encodes lexical generalizations not in terms of formal inheritance relations between types, but in terms of inclusion relations between *descriptions* of structures. An LFG functional description – a collection of equations – can be given a name, and this name can be used to stand for those equations in other linguistic descriptions. In computational treatments, these named descriptions are referred to as *templates*. A description containing a reference to a template is equivalent to that same description with the named equations, the template's definition, substituted for the template reference.

Template definitions can refer to other templates; thus, a template hierarchy similar to the type hierarchy of HPSG or Construction Grammar can be drawn to represent the inclusion relations between these named LFG descriptions. Importantly, however, the relation depicted in such a diagram shows only how pieces of descriptions are factored into patterns that recur across the lexicon and does not indicate the formal mode of combination of those pieces. The context of the template reference is what determines how the template definition combines with other parts of a larger description.

In the following, we will present several small template hierarchies and show how they can be used in the definition of linguistic constraints. For more discussion of computational issues related to the use of templates in grammatical description, see King et al. (2004).

2 Template definitions

We begin with a simple lexical entry for the verb *yawns*:

(2) *yawns* $(\uparrow \text{ PRED})=\text{`yawn}\langle\text{SUBJ}\rangle\text{'}$
$(\uparrow \text{ VFORM})=\text{FINITE}$
$(\uparrow \text{ TENSE})=\text{PRES}$
$(\uparrow \text{ SUBJ PERS})=3$
$(\uparrow \text{ SUBJ NUM})=\text{SG}$

This lexical entry contains information that is shared by other verbs. We can define the templates PRESENT and 3SG to encode this common information:

(3) PRESENT = (↑ VFORM)=FINITE
(↑ TENSE)=PRES

3SG = (↑ SUBJ PERS)=3
(↑ SUBJ NUM)=SG

The template name PRESENT names the functional description consisting of the two equations (↑ VFORM)=FINITE and (↑ TENSE)=PRES, and similarly for 3SG. With these definitions the entry for *yawns* can be rewritten as

(4) *yawns* (↑ PRED)='yawn⟨SUBJ⟩'
@PRESENT
@3SG

A template reference (or invocation) in a lexical entry or in the definition of another template, as in ((5) below), is marked by a preceding at-sign "@". The present-tense and third-singular templates will be invoked by all similarly inflected verbs, so that the details of these subdescriptions are specified in one place but effective in many.

We can further subdivide the functional description named by PRESENT into two more primitive template definitions:

(5) FINITE = (↑ VFORM)=FINITE

PRES-TENSE = (↑ TENSE)=PRES

PRESENT = @FINITE
@PRES-TENSE

These template definitions can be arranged in a simple hierarchy that indicates their interdependencies:

(6) PRES-TENSE FINITE
PRESENT

This diagram records the fact that the PRES-TENSE and FINITE templates are both referenced in (or inherited by) the definition of PRESENT. Similarly, we can also subdivide the 3SG template as follows:

(7) 3PersonSubj = (↑ SUBJ PERS)=3

SingSubj = (↑ SUBJ NUM)=SG

3Sg = @3PersonSubj
@SingSubj

This information can also be represented as a template hierarchy:

(8) 3PersonSubj SingSubj

3sg

Finally, we can define a template Pres3Sg that combines both tense and agreement features:

(9) Pres3Sg = @present
@3sg

Putting all these definitions together, our template hierarchy becomes

(10) pres-tense finite 3PersonSubj SingSubj

present 3sg

Pres3Sg

and the lexical entry for *yawns* further reduces to

(11) *yawns* (↑ pred)=‘yawn⟨subj⟩’
@Pres3Sg

Thus we see that a number of hierarchically arranged generalizations can be expressed through a simple set of template definitions. The use of parameterized templates allows for further generalizations to be captured by factoring out information provided as an argument to the template. These are discussed next.

3 Parameterized templates

All intransitive verbs in LFG carry a semantic form that indicates the relation denoted by the verb and also the fact that the verb must appear in f-structures containing the single governable grammatical function subj. The predicate, of course, differs from verb to verb, but the subj subcategorization frame is common to all intransitives. We can define intransitive as a parameterized template that expresses the common subcategorization. The predicate itself can be provided as an argument that is specified differently in different lexical entries. This template can be used with all intransitive verbs:

(12) intransitive(p) = (↑ pred)=‘p⟨subj⟩’

Whatever argument is provided in an invocation of this template will be substituted for the parameter to create the description that replaces the template reference. Thus the description in the original entry for the verb *yawns* can be equivalently specified as follows:

(13) *yawns* @intransitive(yawn)
@Pres3Sg

Arguments to parameterized templates can represent any part of an f-structure description: attributes as well as values and even whole subdescriptions can be parameterized. Templates can also take multiple arguments. For example, the template for a particle verb might take the verbal predicate as one argument and the form of the particle as another:

(14) VERB-PRT(P PRT) = ($\uparrow$ PRED)='P⟨SUBJ, OBJ⟩'
($\uparrow$ PRT-FORM)=c PRT

The few templates we have defined serve to demonstrate the point that templates interpreted only by simple substitution allow commonalities between lexical entries to be represented succinctly and for linguistic generalizations to be expressed in a theoretically motivated manner. The parameterized template INTRANSITIVE(P) is shared by verbs like *sneeze*, *arrive*, and many others. The PRES3SG template is shared by verbs like *appears*, *goes*, *cooks*, and many others. The template PRESENT, used in defining the PRES3SG template, is also used by verbs like *bake*, *are*, and many others.

4 Templates and Boolean operators

In LFG, complex descriptions can be conjoined, disjoined, or negated. Since templates are just names for descriptions, we can also use these operators with templates. For instance, we could define a template PRESNOT3SG by negating the 3SG template, as follows:

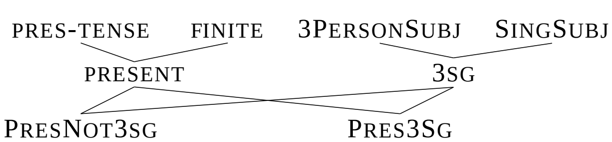
(15) PRESNOT3SG = @PRESENT
¬@3SG

The substitutions specified by these invocations produce the following description:

(16) ($\uparrow$ VFORM)=FINITE
($\uparrow$ TENSE)=PRES
¬{($\uparrow$ SUBJ PERS)=3
($\uparrow$ SUBJ NUM)=SG}

The first two lines are the result of expanding the PRESENT template, and the third and fourth lines are the negation of the expansion of the 3SG template. This template can be used in the lexical entry of verbs which are present tense but whose subject is not third person singular (*yawn*, *bake*, *appear*, etc.).

With this addition we have the following template hierarchy:

(17)


This indicates that PRESNOT3SG includes ("inherits") descriptions from both of its ancestors. However, unlike an HPSG type hierarchy, this does not entail that the inherited information is conjoined. For example, in (15) PRESNOT3SG invokes 3SG via negation. Template sharing is distinct from the mode of combination, which is determined by the context of the invocation.

For another illustration of this point, suppose that we have defined a parameterized TRANSITIVE template to be used for verbs like *devour*:

(18) TRANSITIVE(P) = (↑ PRED)=‘P⟨SUBJ, OBJ⟩’

This can be combined disjunctively with the INTRANSITIVE template to define a subcategorization template for verbs that can appear either with or without an object (*eat*, *cook*, *bake*, etc.):

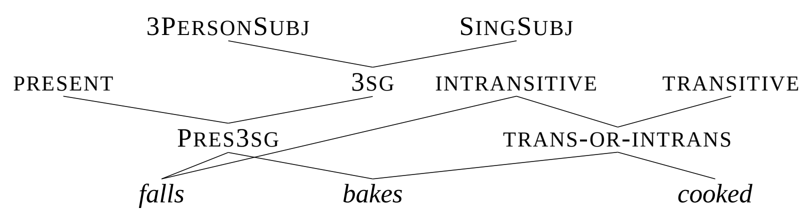
(19) TRANS-OR-INTRANS(P) = @TRANSITIVE(P) ∨ @INTRANSITIVE(P)

Notice that the parameter for TRANS-OR-INTRANS appears as an argument in the invocations of both INTRANSITIVE and TRANSITIVE. The reference @TRANS-OR-INTRANS(*eat*) thus expands ultimately to the disjunction

(20) (↑ PRED)=‘*eat*⟨SUBJ, OBJ⟩’ ∨ (↑ PRED)=‘*eat*⟨SUBJ⟩’

Finally, we can extend the hierarchical template inclusion diagram so that it bottoms out in particular lexical items, thus showing how generalizations are captured not only among the templates but also across the lexicon:

(21)



5 Expressing defaults

Default values can be expressed in LFG by means of existential constraints and disjunction. An *existential constraint* asserts that a feature must be present in an f-structure but it does not define the value that the feature must have. Thus the existential constraint in (22) is satisfied only if the f-structure denoted by ↑ has some value for the feature CASE:

(22) (↑ CASE)

This asserts that some (unspecified) value must be provided by a defining equation for the f-structure ↑. Otherwise, the existential constraint is not satisfied.

We can disjunctively combine this specification with a defining equation stating that the f-structure ↑ has the feature CASE with value NOM:

(23) (↑ CASE) ∨ (↑ CASE)=NOM

The first part of the disjunction is satisfied if $\uparrow$ has some value for CASE provided by a defining equation elsewhere in the functional description (the existential constraint in the left disjunct is satisfied). The second part of the disjunction is satisfied if $\uparrow$ has the value NOM for CASE (the defining equation in the right disjunct is satisfied). The effect is that NOM is the default value for CASE: if no other value is defined for that feature, the value NOM will be installed.

This technique for specifying a default value V for a designator D can be encapsulated in a parameterized template:

(24) DEFAULT(D V) = D $\vee$ D=V

and we can use this to make more obvious the fact that NOM is the default value of CASE:

(25) @DEFAULT(($\uparrow$ CASE) NOM)

An invocation of this default CASE assignment template could then be a part of the lexical description for a noun in a language with case clitics. If there is no case clitic to specify a particular case for the noun, the default NOM case will appear.

6 Templates and Phrase Structure Annotations

Since templates simply stand for pieces of functional descriptions, it is also possible to use templates in annotations on phrase structure rules, to capture recurring generalizations in the specification of the relation between c-structure configurations and f-structures. There is no difference in the way templates are defined or invoked when they are used in phrase structure rules; functional annotations in phrase structure rules can simply be replaced with a template reference.

To take an example, suppose that every adjunct in the grammar must be annotated with both its grammatical function and an ADJUNCT-TYPE feature, e.g., (26).

(26)
$$\begin{array}{llcc} \text{VP} & \longrightarrow & \text{V} & \text{ADVP*} \\ & & \uparrow=\downarrow & \downarrow \in (\uparrow \text{ ADJUNCT}) \\ & & & (\downarrow \text{ ADJUNCT-TYPE})=\text{VP-ADJ} \end{array}$$

This can be rewritten using a parameterized template:

(27)
$$\begin{array}{llcc} \text{VP} & \longrightarrow & \text{V} & \text{ADVP*} \\ & & \uparrow=\downarrow & @\text{ADJUNCT(VP-ADJ)} \end{array}$$

where the ADJUNCT template expands to:

(28) a. ADJUNCT(P) = $\downarrow \in (\uparrow$ ADJUNCT)
@ADJUNCT-TYPE(P)

b. ADJUNCT-TYPE(P) = ($\downarrow$ ADJUNCT-TYPE)=P

Coordination is another instance where templates are useful for capturing generalizations over phrase-structure annotations. In NP coordination, the conjuncts must be labelled not only for their relation to the f-structure of the coordination ($\downarrow\in\uparrow$) but also for information as to how the person and gender features of the conjuncts are resolved. Instead of repeating this set of equations for each conjunct, a template can be invoked which contains all of the relevant annotations.

(29) a. NP $\longrightarrow$

NP+	CONJ	NP
@NP-CONJUNCT	$\uparrow=\downarrow$	@NP-CONJUNCT

b. NP-CONJUNCT = $\downarrow\in\uparrow$
@CONJ-PERS
@CONJ-GEND

The templates CONJ-PERS and CONJ-GEND are then defined so as to impose the proper constraints on feature resolution in coordinate structure. Adopting the theory of feature indeterminacy and feature resolution proposed by (Dalrymple and Kaplan, 2000), the person and gender features are represented as sets of markers, and resolution is accomplished by the set-union implied by specifying subset relations on those marker sets:

(30) CONJ-PERS = $(\downarrow \text{PERS}) \subseteq (\uparrow \text{PERS})$
CONJ-GEND = $(\downarrow \text{GEND}) \subseteq (\uparrow \text{GEND})$

Thus, templates can be used to capture generalizations across functional descriptions not only within the lexicon but also within phrase structure annotations.

7 Conclusion

We have observed that templates can play the same role in capturing linguistic generalizations as hierarchical type systems in theories like HPSG. An important difference is that templates are simply a notational device for factoring descriptions, not part of a formal ontology. Template invocations are interpreted solely as instructions to substitute the named descriptions into other descriptions and do not require a more elaborate mathematical characterization. They are simply a means of collecting together and reusing linguistically significant collections of descriptions.

Templates differ from hierarchical type systems in two ways. First, parameterized templates allow for templates to be systematically specialized in particular ways. Second, since templates are just ways of naming descriptions, they can participate in Boolean combinations of descriptions involving disjunction, conjunction, and negation. These two differences may make it easier and more intuitive to express linguistic generalizations in comparison to hierarchical type systems.

References

Bresnan, Joan. 1978. A realistic transformational grammar. In Morris Halle, Joan Bresnan, and George A. Miller (editors), *Linguistic Theory and Psychological Reality*. Cambridge, MA: The MIT Press.

Dalrymple, Mary and Ronald M. Kaplan. 2000. Feature indeterminacy and feature resolution. *Language* 76(4), pp. 759–798.

Flickinger, Daniel P. 1987. *Lexical rules in the hierarchical lexicon*. Ph.D. thesis, Stanford University.

Kay, Paul. 1998. An informal sketch of a formal architecture for Construction Grammar. In *Proceedings of the Conference on Formal Grammar, HPSG and Categorial Grammar*. Saarbrücken. URL `www.icsi.berkeley.edu/ kay/cg.arch.ps`.

King, Tracy Holloway, Martin Forst, Jonas Kuhn, and Miriam Butt. 2004. The feature space in parallel grammar writing. *Research on Language and Computation*. In press.

Kiparsky, Paul. 1982. Word-formation and the lexicon. In F. Ingemann (editor), *Proceedings of the 1982 Mid-America Lingistics Conference*.

Malouf, Robert. 1998. Categories, prototypes, and default inheritance. In *Proceedings of the Joint Conference on Formal Grammar, Head-Driven Phrase Structure Grammar, and Categorial Grammar*, pp. 207–216. Saarbrücken.

ON THE SPECIAL STATUS OF INSTRUMENTALS

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Abstract:

In this paper we investigate the status of instrumental adjuncts in the clause. We present data from three Austronesian and three non-Austronesian (Papuan) languages and show that instrumental arguments are grammatically privileged compared to other non-terms, sharing grammatical properties with terms as well as non-terms. We also show that instruments that are not integral to the event do not have the same privileged status. We argue that this difference in behavior results from the fact that some instrumental arguments are integral to the event, and must thus be included in a verb's lexical conceptual structure, while others are truly adjuncts.

1. Introduction

Optional non-core arguments, or *adjuncts*, are admissable in a given clause by their semantic felicitousness (and the discourse requirements). These adjuncts are often described in terms of their semantic roles (or thematic/theta roles), such as recipient, instrumental, location. It is axiomatic that the grammatical constructions to which adjuncts have access are different to those which terms in general, and subjects in particular, control. For instance, relativization is often determined by grammatical function, with subjects being more privileged than non-subjects, and adjuncts the least privileged of all. In order to capture these ranked effects, different hierarchies have been proposed in which the thematic roles are listed in a total order. Some key assumptions about the meaning of hierarchical organisation, as opposed to simple lists, are outlined in (1).

(1) **A > B > C > D** implies (a) and/or (b), and that (c) is never the case:

a. $[_z [_y [_x \text{A}] > \text{B}] > \text{C}] > \text{D}$

There is a set of properties/constructions/behaviors, *x*, for which A shows more privileged behavior in terms of access; a second set of properties, *y*, are accessible to B, but they are still available to A; a third set of properties, *z*, are accessible to C; both A and B share these properties as well.

b. $\text{A} > [_z \text{B} > [_y \text{C} > [_x \text{D}]]]$

There is a set of properties/constructions/behaviors, *x*, for which only D is eligible; a second set of properties, *y*, are accessible to C, but they are also available to D; a third set of properties, *z*, are accessible to B; both D and C share these properties as well.

c. $[_x \text{A}] > [_y \text{B} > [_x \text{C}]] > [_z \text{D}]$

A 'central' element (C) shows greater syntactic privileges than the periphery; and in which the spread of properties is not contiguous (*x*).

The behavior in (1a) can be illustrated with the grammatical function hierarchy: access to relativization in different languages can be restricted to set *x* (subject only), or set *y* (subjects and objects), or set *z* (subjects, objects, and obliques), or simply unrestricted, but it does not ever show the sort of behavior shown in (1c), with obliques being more privileged than objects, for instance. The inverse hierarchy in (1b) is shown by the use of prepositions in English: prepositions are obligatory on all non-temporal adjuncts and obliques, and are found on some objects, but are never found with subjects. In a ground-breaking study of applicatives, Bresnan and Kanerva (1989) proposed the following ordering of thematic roles:

(2) agent > beneficiary > recipient/experiencer > instrument > theme/patient > locative

While there has been some disagreement about the relative ordering of some of the members in the hierarchy, this is indicative of what is now the assumed order of thematic roles. In Lexical Functional Grammar (Bresnan 2001, Dalrymple 2001) the agents and patient/theme arguments are mapped onto the SUBJ and OBJ grammatical functions by virtue of being featurally marked as [+r(estricted)] and [+o(bjective)]. Of the remaining thematic roles, instrumental is still roughly in the middle of the hierarchy. It is thus unexpected that instrumentals appear to have special grammatical status, sharing many properties with terms which are not shared with other arguments with different thematic roles.

In this paper, we present data from six languages of the Pacific – three Austronesian and three non-Austronesian (Papuan), illustrating the special grammatical status of instrumentals in terms of word order, case marking and access to syntactic constructions such as relativisation and voice alternations. We propose that instrumentals are singled out above other thematic roles for semantic reasons. As ‘intermediary agents’ (see, e.g., Marantz 1984), their role in an event is integral, even if it need not be overtly mentioned, whereas other thematic roles do not represent roles without which the predicate would not make sense. That is, a cutting event must have an implement which is responsible for the cutting, whereas a walking event need not imply a goal in order to be coherent. This suggests, we argue, that the instrumental is in the lexical conceptual structure (LCS) of the verb which results in its special grammatical status. This analysis implies that the thematic hierarchy has a limited application within the grammar, as other factors will determine involvement in grammatical constructions as well, such as the roles presence in the LCS.

2. Austronesian evidence

In this section, we examine evidence from three western Austronesian languages, each of which shows unusual properties associated with participants bearing instrumental roles. One of the crucial diagnostics of term/non-term status in these languages is word order: V O S OBL/ADJNT, and in Tukang Besi and Tagalog case marking also plays a role.

3.1 TUKANG BESI

Tukang Besi (Donohue 1999) uses the following nominal cases:

na nominative, for the grammatical subject;

nu genitive, for nominal modifiers;

i (irrealis) / *di* (realis) oblique, for non-terms where they are not marked with a more specialized preposition or serial verb construction; and

te, appearing in all other circumstances.

In this section we will look at the following grammatical constructions to show that instrumentals have special status: relativization, applicatives and case marking.

The most basic relativization strategy involves fronting the relativized nominal and affixing morphology, cognate with the well-known Philippine voice morphology, to the verb to indicate the syntactic status of the relative clause head as S or A (using *<um>*) or P (using *i-*/*di-*/*ni-*).[1] The following sentences show relative clauses as part of cleft constructions. While the verb shows prefixal agreement with the S/A argument when it is the head of a main clause, these prefixes are not found on verbs in relative clauses. A relative clause headed by an S or A shows fully verbal characteristics apart from the agreement prefixes, whereas a relative clause headed by a P is largely nominal in character, with genitive case rather than the core case *te* on all arguments.

Plain clause predicated with the verb 'fetch'[2]

(3)	a.	No-ala	te	uwe	(ako	te	embere / kene	embere).
		3R-fetch	CORE	water	INSTR	CORE	bucket INSTR	bucket

'They fetched water with a bucket.'

Relative clause with A as head

b.	Te	amai	na	[$_{RC}$ <**um**>ala	te	uwe	kene	embere].
	CORE	3PL	NOM	fetch.SI	CORE	water	INSTR	bucket

'It was them who fetched water with a bucket.'

Relative clause with P as head

c.	Te	uwe	na	[$_{RC}$ **i**-ala=no	kene	embere].
	CORE	water	NOM	PP-fetch=3GEN	INSTR	bucket

'It was water that they fetched with a bucket.'

Plain clause predicated with the verb 'go'

(4)	a.	No-wila	na	amai	kua	pante.
		3R-go	NOM	3PL	ALL	beach

'They went to the beach.'

Relative clause with S as head

b.	Te	amai	na	[$_{RC}$ w<**um**>ila	kua	pante].
	CORE	3PL	NOM	fetch.SI	ALL	beach

'It was them who went to the beach.'

Relativizing on non-terms is only possible if applicative morphology is present, making the original non-term the P, the object of the clause. In (5a) the applicative *=api* licenses the location as P, which can then be relativized with *i-*. In (5b) we can see that it is also possible for such an

[1] The terms A, P and S refer to the most agent-like in a transitive clause, most patient-like in a transitive clause and sole actant in an intransitive clause respectively. See Comrie (1978) for more explicit definitions.

[2] The following abbreviations have been used, in addition to 1, 2 and 3 representing person: ALL: allative, APPL: applicative, AV: S,A voice (± active), CAUS: causative, COM: comitative, CORE: core, DAT: dative, DET: determiner, F: feminine, FACT: factitive, GEN: genitive, INSTR: instrumental, M: masculine, NOM: nominative, OBL: oblique, P: P clitic, PASS: passive, PF: perfective, PL: plural, PV: P voice (± inverse), R: realis, SG: singular, SI: S,A infix.

applicative object to be further passivised with *to*-, and then to head an S/A relative clause with *<um>*.

Location as head of relative clause: verb affixed with locative applicative

(5) a. Te embere na [$_{RC}$ **i-**tau-**pi**=no nu uwe].
CORE water NOM PP-place-APPL=3GEN GEN water
'It was the bucket that they put the water in.'

Location as head of relative clause: verb affixed with locative applicative

b. Te embere na [$_{RC}$ t<um>o-tau-**pi** te uwe].
CORE water NOM PASS<SI>-place-APPL CORE water
'It was the bucket that the water was put in.'

Additional examples of applicative relative clauses are shown in (6) and (7), with beneficiary and instrumental arguments respectively.

Beneficiary as head of relative clause: verb affixed with general applicative

(6) Te amai na [$_{RC}$ **i-**ala-**ako**=no nu uwe].
CORE 3PL NOM PP-fetch-APPL=3GEN GEN water
'It was them who they fetched water for.'

Instrument as head of relative clause: verb affixed with general applicative

(7) Te embere na [$_{RC}$ **i-**ala-**ako**=no nu uwe].
CORE bucket NOM PP-fetch-APPL=3GEN GEN water
'It was a bucket that they fetched water with.'

In addition to the applicative construction shown in (5)–(7), there is another relativizing option which requires no relativizing morphology when an instrument is relativized, as shown in (8).

Instrument as head of bare relative clause: unaffixed verb root used

(8) Te embere na [$_{RC}$ ala te uwe].
CORE water NOM fetch CORE water
'It was the bucket that (they) fetched water with.'

An attempt to relativize on the locative or beneficiary adjuncts with the bare relative clause strategy is ungrammatical, as seen in (9). Similarly, this bare relativization strategy is not available for terms of any semantic role, unless they are instruments; some sample ungrammatical terms are shown in (10). The bare verbal construction seen in (8) is only available for instrumentals, regardless of their termhood.

Locative or Beneficiary ungrammatical as head of bare relative clause

(9) a. * te embere na [$_{RC}$ tau(-pi) te uwe].
CORE water NOM place-APPL CORE water
'It was the bucket that they put the water in.'

b. * te amai na [$_{RC}$ ala te uwe].
CORE water NOM fetch CORE water
'It was them who they fetched water for.'

Non-instrument term ungrammatical as head of bare relative clause: agent, theme, beneficiary, recipient, experiencer

(10) a. * te amai na [RC ala te uwe].
CORE 3PL NOM fetch CORE water
'It was them who fetched the water.' (compare with (3b))

b. * te uwe na [RC ala (te amai)].
CORE water NOM fetch CORE 3PL
'It was the water that they fetched.' (compare with (3c))

c. * te amai na [RC hoti (te ikita)].
CORE water NOM donate.items.charitably CORE 1PL
'It was them who (we) donated (food and clothing) to.'

d. * te amai na [RC hu'u te embere (te ikita)].
CORE 3PL NOM give CORE bucket CORE 1PL
'It was them who (we) gave the bucket to.'

e. * te amai na [RC po-ilu te ikita].
CORE 3PL NOM REC-lust CORE 1PL
'It was them who loved us.'

3.1.1 Passives

Further evidence that instruments have a special grammatical status can be found in passive constructions. Passives with *to-* do not permit agents to be overt in the clause; if the agent is instrumental, however, it may appear. In (11) and (12) we can see a 'normal' clause and its passive equivalent. In the passive version the A may not be expressed by any means.

(11) No-hoko-mate='e=mo te amai na mo'ane.
3R-FACT-die=3P=PF CORE 3PL NOM man
'They killed the man.'

(12) No-to-hoko-mate=mo na mo'ane (* te amai / * di amai).
3R-PASS-FACT-die=PF NOM man CORE 3PL OBL 3PL
'The man was killed (* by them).'

When the A of the clause is an instrument/effector, however, it may be mentioned in the passive clause.[3] It appears with the core case marker *te*, but does not have term status.

[3] In Tukang Besi instruments and effectors are treated identically as members of the same morphosyntactic 'class'. For instance, sentences are constrained to allow only one of each distinct 'class' of semantic roles in a clause: one location, one goal, one beneficiary, for instance. A possible maximal clause might be something like that seen in (i). (The sentence is unlikely, but grammatical. This would preferentially be coded with a pair of clauses, and a couple of applicatives on the verbs.)

(13)	No-pa-motiti=‘e=mo	te	‘oloo	na	wurai.	
	3R-CAUS-dry=3P=PF	CORE	sun	NOM	sarong	
	‘The sun dried the sarong.’					

(14)	No-to-pa-motiti=mo	na	wurai	**te**	**‘oloo**.
	3R-PASS-CAUS-dry=PF	NOM	sarong	CORE	sun
	‘The sarong was dried by the sun.’				

This is not simply a function of the verb chosen, or of *pa-* causatives rather than *hoko-* causatives. If (13) were rephrased with a shaman as the causer of the event, the active clause is essentially identical, but the passive clause does not allow for an A by-phrase, since that A would bear the agent semantic role, not the (macro-)instrument.

(15)	No-pa-motiti=‘e=mo	te	mia	pande	na	wurai.
	3R-CAUS-dry=3P=PF	CORE	person	clever	NOM	sarong
	‘The shaman dried the sarong.’					

(16)	No-to-pa-motiti=mo	na	wurai	(*	te / *	di	mia	pande).
	3R-PASS-CAUS-dry=PF	NOM	sarong		CORE/	OBL	person	clever
	‘The sarong was dried (* by the shaman).’							

3.1.2 Case marking

As previously noted, case marking in Tukang Besi works as follows: one term is selected on pragmatic grounds to receive the nominative case *na*, the syntactic role of this argument being made clear from the verbal agreement configuration selected. Other terms are marked with *te*, the ‘core case’ marker.

A non-term must be morphologically marked with an applicative, an oblique case, a preposition or a serial verb in the clause. An instrumental, however, may appear with a core case marker rather than any other of these strategies, and may participate in voice alternations (being marked by the use of nominative, rather than simply core, case) without requiring applicatives. In (17) we can see that the instrument may appear in a clause simply marked by a core case, in addition to the options shown in (18) which are more typical for a non-term: instrumental prepositions and applicative constructions. (19) shows that the instrument may be the nominative argument of the clause, even in the absence of an applicative morpheme.

(i)	No-ala	te	kaujawa	kene	kene=no	ako	te	ama=no
	3R-fetch	CORE	cassava	COM	friend=3GEN	BEN	CORE	father=3GEN
	kene	embere	kua	kampo	di	hawu’a.		
	INSTR	bucket	ALL	village	OBL	field		
	‘They fetched cassava to the village with their friends for their father with buckets in the field.’							

On the other hand, effectors and instruments may not co-occur. Compare (16) with (ii).

(ii) *	no-pa-motiti=‘e	te	‘oloo	na	wurai	ako	te	mena /	kene	mena)
	3R-CAUS-dry=3P	CORE	sun	NOM	sarong	INSTR	CORE	hot	INSTR	hot
	‘The sun dried the sarong with heat.’									

(17) No-koho te kau **te** **baliu**.
3R-chop CORE wood CORE axe
'He chopped the wood with an axe.'

(18) a. No-koho te kau **kene** baliu.
INSTR

b. No-koho te kau **ako** **te** baliu.
INSTR CORE

c. No-koho=**ako** te baliu te kau.
3R-chop=APPL
'He chopped the wood with an axe.'

(19) a. No-koho=**'e** **na** **kau** te baliu.
3R-chop=3P NOM wood CORE axe
'He chopped the wood with an axe.'

b. No-koho(=ako)=**'e** te kau **na** **baliu**.
3R-chop(=APPL)=3P CORE wood NOM axe
'He chopped the wood with the axe.'

This behavior is not possible with accompaniers, beneficiaries, or locations, as in (20).

Accompanier/Beneficiary/Location with core case

(20) a. * no-koho te kau **te** (ina=no / koranga)
3R-chop CORE wood CORE mother=3GEN garden
"They$_i$ chopped the wood the mother$_j$ / the garden$_k$"

Accompanier/Beneficiary/Location with nominative case in the absence of an applicative

b. no-koho * (-ngkene$_i$/-api$_j$/=ako$_k$)='e te kau na (ina=no$_{i,k}$ /
3R-chop (-APPL)=3P CORE wood NOM mother=3GEN

na koranga$_j$).
NOM garden
'He chopped the wood (for/with his mother / in the garden).'

Accompanier/Beneficiary/Location with non-term marking strategies

c. no-koho='e na kau ((ako te / kene) ina=no
3R-chop=3P NOM wood BEN CORE COM mother=3GEN

/ i koranga).
OBL garden
'He chopped the wood (for/with his mother / in the garden).'

In this section we have seen that instrumentals in Tukang Besi appear to be distinct from other thematic roles in their syntactic behavior:

- like terms, they can appear in unmarked relative clauses (regardless of syntactic role as A, P or adjunct);

- unlike terms, they may appear as *by*-phrases in passive clauses;
- unlike non-terms, they may bear core structural case markers and participate in main clause voice alternations without applicatives.

3.2 TAGALOG

There are three marked nominal cases in Tagalog, and case marking is obligatory in most environments (Schacter and Otanes 1972, Kroeger 1993). The case markers are as follows:

ang marks the grammatical subject of the clause; the semantic role of the *ang*-phrase controls 'agreement' marking on the verb ('voice marking'), and all non-a-structure subject properties.

sa is multifunctional: it appears with non-terms; with terms which are neither the highest nor the lowest role in their predicate; and with highly individuated Ps which are not subject.

ng is used with terms which are neither subject nor eligible for *sa*.

Examples of adjunct participants marked with the dative *sa*, or a preposition that governs *sa*, are shown in (21) and (22).

(21)	Lulutu-in=niya	ang	adobo	(**para**	**sa**	kanila).
	will.cook-PV=3SG.GEN	NOM	adobo	for	DAT	3PL.DAT
	'She will cook the adobo for them.'					

(22)	Lulutu-in=niya	ang	adobo	**sa**	bahay	niya.
	will.cook-PV=3SG.GEN	NOM	adobo	DAT	house	3SG.GEN
	'She will cook the adobo at her house.'					

Adjuncts may be expressed using the appropriate voice on the verb to code them as the subject of the clause, as in (26), in which the 'dative voice' *-an* licenses the beneficiary *sila* 'them' to appear as the subject, in nominative case.

(23)	Lulutu-an=niya=**sila**	ng	adobo.
	will.cook-DV=3SG.GEN=3PL.NOM	GEN	adobo
	'She will cook them some adobo.'		

There are several way to express instrumental nominals in addition to the instrumental voice option. Instrumentals may appear in a complex oblique phrase, marked with *sa*, involving the nominal *pamamagitan (ng)* 'the use (of)', as in (24). There can be a complex predicate using the verb *gamit* 'use', shown in (25); or the instrument may simply be marked as a (non-subject) term with the general term case *ng*, as in (26).

(24)	Lulutu-in=niya	ang	adobo	**sa**	pamamagitan	ng	kutsara.
	will.cook-PV=3SG.GEN	NOM	adobo	DAT	use(n.)	GEN	spoon
	'She will cook the adobo with a spoon.'						

(25)	Lulutu-in=niya	ang	adobo	at	gamit-in=niya	ang	kutsara.
	will.cook-PV=3SG.GEN	NOM	adobo	CONJ	use-PV=3SG.GEN	NOM	spoon
	'She will cook the adobo with a spoon.'						

(26)	Lulutu-in=niya	**ng**	**kutsara**	ang	adobo.
	will.cook-PV=3SG.GEN	GEN	spoon	NOM	adobo

‘She will cook the adobo with a spoon.’

(27)	Sundut-in=mo	**ng**	**karayom**	ang	lobo.
	poke-PV=2SG.GEN	GEN	needle	NOM	balloon

‘Poke the balloon with a needle.’

The data in this section also suggests that for some grammatical constructions instrumentals have a special status:

- instrumentals can appear with core structural case marking;
- when marked with *ng*, instrumentals appear preceding the subject which is not an option for other non-terms.

3.3 BILAAN

In Bilaan (Abrams 1961, Rhea 1972) the voice marker *(a)m* on the verb marks the S or A of the clause as the subject, and *an* marks the P as subject. The following examples illustrate these voices (note that the pronouns in the following examples are clitics, and do not follow the regular word order described at the beginning of section 3).

(28)	K<**am**>lang	**agu**	kayu	di	bulul.
	cut.AV	1SG.NOM	tree(s)	OBL	hill

‘I cut trees on the hill.’

(29)	**M**-anwe	**agu**	dini.
	live.AV	1SG.NOM	here

‘I live here.’

(30)	K<**an**>lang=gu	**kayu**	di	bulul.
	cut.PV=1SG.GEN	tree(s)	OBL	hill

‘I cut trees on the hill.’

In addition to predicates with verbs overtly marked for voice some predicates allow a verb to be unmarked with any voice morphology. In these clauses the subject can can be, depending on the verb, the S, P or *instrumental* participant. Examples of each are shown in (31)–(33).

(31)	Kel	**agu**	malfábi.
	arrive	1SG.NOM	yesterday

‘I arrived yesterday.’

(32)	Dsù=gu	**i**	**anok**	di	tulus.
	sacrifice=1SG.GEN	DET	chicken	OBL	spirit

‘I sacrifice a chicken to the spirit.’

(33)	Klang=gu	kayu	**falakol**.
	cut=1SG.GEN	tree(s)	hatchet

‘I cut trees with a hatchet.’

It is not possible for an A to be the subject of an unmarked verb form, nor for other adjuncts (goals, locations, beneficiaries) to appear as subject with no overt voice morphology.

3.4 AUSTRONESIAN SUMMARY

The evidence we have seen in these Austronesian languages for the special syntactic status of instruments is that the instrumental argument is the only adjunct to be able to assume privileged (term-like) status without overt marking, as evidenced through case-marking and verbal agreement.

It is not true that all instruments show uniformly privileged status, however. The instrument must be an intermediate agent in those predicates that allow it special behavior. That is, in order to show term-like privileges, the instrument must exist for the event to take place. If it is not integral in the LCS of the predicate, these privileges do not exist. The following examples show that *wila* 'go' does not afford special privileges to an instrument. The instrumental may appear in the clause marked either by the instrumental preposition, in (35a), or the general applicative, in (36b). However the instruments in these clauses are not eligible to appear in core case, or to show agreement on the verb; they are fundamentally different from instrumentals that effect the action in an event.

Tukang Besi

(34) No-wila kua togo
3R-go ALL town
'They went to town.'

(35) a. No-wila **kene** honda kua togo
3R-go INSTR motorbike ALL town
'They went to town by motorbike.'

b. * no-wila **te** honda kua togo
3R-go CORE motorbike ALL town
'They went to town by motorbike.'

(36) a. * no-wila=**'e** **na** honda kua togo.
3R-go=3P NOM motorbike ALL town

b. No-wila=ako te honda kua togo.
3R-go=APPL CORE motorbike ALL town
'They went to town by motorbike.'

4. Papuan evidence

This section presents data from three languages of New Guinea, the first two are related to each other in the Skou family, the last is a member of the Torricelli family. The first two non-Austronesian languages discussed have S O V OBL/ADJNT word order; the third (One) is S V O OBL/ADJNT (non-terms, OBL or ADJNT, show near identical behavior in many Papuan languages).

4.1 SKOU

Skou distinguishes grammatical functions as follows:

SUBJECT	agreement prefix on verb; initial position in clause; coordination with switch reference marker =*pa*; raising to object in control structures.
OBJECT	(agreement by umlaut on verb); preverbal sister of V' inside VP; raising to object in control structures.
OBL/ADJNT	postverbal positions; reassigned to OBJ in negated clauses (obliques and adjuncts show very similar behavior in the grammar; see Donohue 2002).

Non-patient objects may appear postverbally (in the position of an adjunct), but show the syntactic behavior of OBJ.[4]

		OBJ	V		V	OBJ
(37)	a.	**Mè**	nì=fí.	b.	Nì=fí	**mè**.
		2SG	1SG=meet		1SG=meet	2SG
		'I met you.'			'I (physically) bumped into you.'	

Instrumentals show unique behavior. Unlike the regular non-terms (shown in (39)–(40) with a location and a beneficiary, respectively), instrumentals are case marked by =*pa* and have a very flexible word order, as shown in (41). Here the instrument *ní=pa* may appear either pre- or post-verbally, and may be VP internal or VP external. This freedom of position is not possible with other adjuncts.

(38) Pe hòe pe=tue e tue.
3SG.F sago 3SG.F=3SG.F.do 3SG.F.be 3SG.F.do
'She's cooking sago.'

(39) a. Pe hòe pe=tue e tue **bàme**.
3SG.F sago 3SG.F=3SG.F.do 3SG.F.be 3SG.F.do village
'She's cooking sago in the village.'

b. * pe hòe pe=tue **bàme** e tue
3SG.F sago 3SG.F=3SG.F.do village 3SG.F.be 3SG.F.do

c. * pe **bàme** hòe pe=tue e tue
3SG.F village sago 3SG.F=3SG.F.do 3SG.F.be 3SG.F.do

(40) a. Pe hòe pe=tue **te=te** e tue.
3SG.F sago 3SG.F=3SG.F.do 3PL=3PL.DAT 3SG.F.be 3SG.F.do
'She's cooking sago for them.'

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[4] This split is similar to English prepositional object predicates, such as *listen to*, or Bantu or Austronesian applicative objects: Indonesian *men-dengar-**kan*** 'listen to', Tukang Besi *ma'aw=**ako*** 'forgive'.

b. * pe **te=te** hòe pe=tue e tue
3SG.F 3PL=3PL.DAT sago 3SG.F=3SG.F.do 3SG.F.be 3SG.F.do

(41) Pe (**ní=pa**) hòe (**ní=pa**) pe=tue (**ní=pa**) e tue.
3SG.F spoon=INSTR sago 3SG.F=3SG.F.do 3SG.F.be 3SG.F.do
‘She’s cooking sago with a stirring spoon.’

4.2 BARUPU

Barupu (Donohue 2003) identifies its grammatical functions both morphologically and positionally:

SUBJECT: agreement on verb, preverbal, not in a close constituent with the verb

OBJECT: agreement on verb, (preverbal)

OBL/ADJNCT: postverbal, no agreement

As in Skou, instrumental arguments appear to share properties of both terms and non-terms. Like terms, they appear before the verb, though their position is not fixed, but like adjuncts, they are not cross-referenced on the verb.

A basic clause is shown in (42). (43) shows the variable positioning of a low-affect object, either preverbally or postverbally (just as in the Skou examples in the previous section). In (44) and (45) we can see that the object of an applicative construction can only appear postverbally.

(42) Nena **ru’u** k-ana-peri-**re**.
1SG.M bird R-1SG.M-stare.at-3PL.F
‘I$_{\text{male}}$ stared at the birds$_{\text{female}}$.’

(43) a. Nena **ru’u** k-ana-yara-**re**.
1SG.M bird R-1SG.M-see-3PL.F
‘I$_{\text{male}}$ saw the birds$_{\text{female}}$.’

b. Nena k-ana-yara-**re** **ru’u**.
1SG.M R-1SG.M-see-3PL.F bird

(44) K-ana-peri-a-n-**i-re** **bom**.
R-1SG.M-stare.at-3SG.M-1SG-WITH-3PL.F woman
‘I$_{\text{male}}$ stared at him with the women.’

(45) * **bom** k-ana-peri-a-n-**i-re**

The position and coding of an instrument is shown in (46). Here the instrument appears preverbally, in the position normally accorded to subjects or objects, yet is not indexed on the verb with any agreement morphology. In (46) we can also see the use of the discourse-function marking case *-a*, which may appear on any, but only, preverbal nominals, including the instrument.

(46) (Nena) **kawai** oi-a k-ana-raivi(*-re) **mo**.
1SG.M coconut.scraper sago-CASE R-1SG.M-cook house
‘I cooked the sago pancakes with coconut scraper(s) in the house.’

4.3 ONE

One (Donohue 2000, Sikale et al 2002) exhibits a very strict phrase structure, with grammatical relations primarily encoded by position (although subject is also prefixed on the verb). Each grammatical function can only be instantiated once per predicate: the restriction to one subject is not surprising. The restriction that there cannot be more than one object means that there are no ditransitive verbs and that applicatives are allowed only on intransitive verbs. Moreover there can be only one non-term (one oblique *OR* adjunct). These restrictions result in a highly constrained set of phrase structure possibilities at the clause level.

There is exactly one position in which some variability, and some coincident overt case marking, is allowed. Instruments can appear following the verb and object, in the oblique/adjunct position, as seen in (47). In this position they are obligatorily case marked, in contrast to locations or goals which occur as bare NPs.

(47)	No	tere	aila	**eko=ne**.	
	3PL	chop	tree	axe=INSTR	
	'They cut the trees down with axes.'				

(48)	No	tere	aila	**ninkleli**.
	3PL	chop	tree	garden
	'They cut the trees down in the garden.'			

(49)	No	panteri	ala	nala.
	3PL	PL.ascend	sun	tooth
	'They went to the mountain.'			

As stated above, multiple obliques/adjuncts are ungrammatical in a single verbal clause.[5] If required to code more than one non-term, a speaker will resort to a serial verb construction that codes the otherwise non-term as an object or oblique, seen in the codings given to *eko* in (51a) and *ninkleli* in (51b) respectively. Note that this can result in the same verb appearing twice in the clause, as in (52b) and the textual (53). In (52b) it is the wide semantic sense of *pari* (3PL form *panteri*) that licenses the two appearances, one as 'board, travel by means of', and one as 'ascend, go up, climb'. In (53), on the other hand, the first occurrence of *palo* simply marks the source as its oblique, and the second indicates the goal. There is no conventionalized means of indicating a source for inanimate subjects.

(50)	* no	tere	aila	**eko=ne**	**ninkleli**.
	3PL	chop	tree	axe=INSTR	garden
	'They cut the trees down with axes in the garden.'				

(51) a.	No	n-em	**eko**	tere	aila	**ninkleli**.
	3PL	3PL-get	axe	chop	tree	garden
	'They took axes and cut the trees down in the garden.'					

[5] Obliques or adjuncts are not permitted at all in non-verbal clauses.

b.

No	panteri	**ninkleli**	tere	aila	**eko=ne**.
3PL	PL.ascend	garden	chop	tree	axe=INSTR

'They went to the garden and cut the trees down with axes.'

(52)

* no	panteri	**ala**	**nala**	,	(**pleni** /	**tolla**	**moa=ne**)
3PL	PL.ascend	sun	tooth		path	bird	mother=INSTR

'They went to the mountain by road/plane.'

(53) a.

No	n-upane	**pleni**	panteri	**ala**	**nala**.
3PL	3PL-follow	path	PL.ascend	sun	tooth

'They went to the mountain by road.'

b.

No	panteri	**tolla**	**moa**	panteri	**ala**	**nala**.
3PL	PL.ascend	bird	mother	PL.ascend	sun	tooth

'They went to the mountain by road/plane.'

c.

Yine	mamplo	au	puno	sa	ese	w-ae	e	asu
2SG	rinse	sago	pith	TOP	IRR	2/3SG-sit	SG.be	sago.strainer

pente	au	ani	sa	ese	fanta	palo	**tiroa**	palo
with	sago	milk	TOP	IRR	fall	go.down	sago.trough	go.down

nal	**mairop**.
sago	catcher

'When you rinse sago, the scrapings stop at the strainer, and the milk goes down from the trough to the sago catcher.'

While still bound by the one-oblique/adjunct-per-clause constraint, instruments show behavior that is quite distinct from the other non-terms: in addition to being case marked, as in (47), they have variable position, as seen by comparing (54) with (47). In addition to the position following the nominal object, instruments may also precede it. This is not possible for locations, as shown in (55).

(54)

No	tere	**eko=ne**	aila.
3PL	chop	axe=INSTR	tree

'They cut the trees down with axes.'

(55)

* no	tere	**ninkleli**	aila
3PL	chop	garden	tree

Instruments in One are non-terms: they cannot appear in a clause with another non-term (e.g. a locative argument). However, they also show object-like behavior quite distinct from other non-terms in their positional freedom and overt case marking.

4.4 New Guinea summary

The Papuan evidence, from two unrelated language families, shows that instruments are privileged non-terms. In the languages examined instruments show positional freedom of a kind not associated with other non-terms, or with terms. Despite this, instruments are not coded as terms: they do not show agreement on the verb, and in Skou and One require specific case marking

5. Conclusion

We have examined data from six different languages of the Pacific. In each of these languages instrumentals *that are integral to the event* may exhibit term-like properties in the clause. This distinguishes them from other non-terms and is perhaps an unexpected observation given their position in the (standardly assumed) thematic hierarchies.

This exceptional behavior is, we believe, due to the semantic status of the instrumental. When the instrument is necessary for the event to take place, then it is part of the Lexical Conceptual Structure (LCS) of the verb. It is not a term, and need not be overtly expressed. However, it is this inclusion in the LCS which enables it to participate in a broader range of grammatical constructions resulting in properties that are shared with both terms and non-terms. This has been demonstrated for Tukang Besi and for Bilaan. Support for this in the grammar of Tagalog is found in many works on Tagalog verbal structures, all of which emphasize the idiosyncratic and unpredictable nature of the non-term voices that allow, for instance, an instrument to appear as subject. The reason for the non-uniformity of voice alternations is that only those instruments which are present in LCS allow promotion to subject (on this topic see, for example, De Guzman 1978, Himmelmann 1991, McFarland 1976 and Ramos 1974, as well as the references cited earlier).

The non-subcategorized status of beneficiaries in turn implies and explains the frequent appearance of a beneficiary applicative before other applicatives: instruments are lexically advantaged, and so do not so commonly require the overt and dedicated morphosyntactic coding options that approximate term status, in the form of applicatives. Instruments do not so immediately require a dedicated applicative, since they are already part of the Lexical Conceptual Structure, while beneficiaries (and, commonly, locations) are not an integral part of the event structure of the predicate.

This study predicts a broader distinction between ‘adjuncts’ that appear in the LCS and (true) adjuncts that are part of the LCS, in terms of their grammatical properties. We leave the investigation of the full extent of these distinctions, in a wider range of languages, for future work.

References

Abrams, Norman. 1961. Word base classes in Bilaan. *Lingua* 10: 391-402.

Alsina, Alex and Sam Mchombo. 1990. The syntax of applicatives in Chichewa: problems for a theta theoretic asymmetry. *Natural language and linguistic theory* 8 (4): 493-506.

Bresnan, Joan and Jonni Kanerva. 1989. Locative inversion in Chichewa: a case study of factorization in grammar. *Linguistic Inquiry* 20(1): 1-50.

Comrie, Bernard. 1978. Ergativity. In Winifred P. Lehmann, ed., *Syntactic typology: studies in the phenomenology of language*: 329-394. Sussex: The Harvester Press.

Dalrymple, Mary. 2001. Lexical Functional Grammar. Syntax and Semantics vol. 34. Academic Press: London.

Davis, Tony. 1997. Lexical semantics and linking in the hierarchical lexicon. PhD thesis, Stanford University.

De Guzman, Videa P., 1975. Syntactic derivation of Tagalog verbs. Oceanic Linguistics Special publications 16. Honolulu: The University Press of Hawaii.

Donohue, Mark. 1999. *A grammar of Tukang Besi*. Berlin: Mouton de Gruyter.

2000. One phrase structure. In Keith Allan & John Henderson, eds., *Proceedings of ALS2k, the 2000 Conference of the Australian Linguistic Society*. University of Melbourne. Published online at http://www.arts.monash.edu.au/ling/als/als2kproceedings.shtml.

2002. Negation and Grammatical functions in Skou. In Peter Collins & Mengistu Amberber, eds., *Proceedings of ALS2002, the 2002 Conference of the Australian Linguistic Society*. University of New South Wales. Published online at http://www.arts.unsw.edu.au/als2002/.

2003. Morphological templates, headedness, and applicatives in Barupu. *Oceanic Linguistics* 42 (1): 111-143.

Foley, William A. and Robert D. Van Valin. 1984. *Functional Syntax and Universal grammar*. Cambridge: Cambridge University Press.

Himmelmann, Nikolaus P. 1991. The Philippine challenge to universal grammar. Arbeitspapier Nr. 15 (Neue Folge), Universität zu Köln.

Kroeger, Paul. 1993. *Phrase structure and Grammatical relations in Tagalog*. Stanford: CSLI publications.

Marantz, Alec P. 1984. On the nature of grammatical relations. Cambridge: MIT Press.

McFarland, Curtis D. 1976. A provisional classification of Tagalog verbs. Study of languages & cultures of Asia & Africa monograph series No.8. Tokyo: Toyo Shuppan and Tokyo Gaikokugo Daigaku: Institute for the study of languages and cultures of Asia and Africa.

Ramos, Teresita V. 1974. The case system of Tagalog verbs. Canberra: Pacific Linguistics B-27.

Rhea, Mary. 1972. Prefocus and verbal orientation in Sarangani Bilaan. *Philippine Journal of Linguistics* 2: 35-42.

Schachter, Paul, and Fe T. Otanes. 1972. Tagalog reference grammar. Los Angeles: University of California Press.

Sikale, John Weiyo, Melissa Crowther and Mark Donohue. 2002. One dictionary. Available online at http://www.molmo.com.

The Hebrew Present-Tense Copula as a Mixed Category

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Abstract

Hebrew has several ways to express the present tense equivalent of the copular verb *haya* 'to be'. None of these forms is verbal in nature; Aside from the Ø realization, they are nominal. It is argued that the functional verbal nature and categorial nominal nature of these forms combine to make the present-tense copular forms mixed-category constructions, and that this accounts for the peculiar syntactic properties displayed by present tense copulas.

1. Overview

Hebrew present tense copular constructions display an interesting set of properties. The claim to be made here[1] is that they are profitably analyzed as mixed-category constructions. This, in turn, has theoretical repercussions.

We start with the basic data:

(1) a. Pnina {nora xamuda / tinoket / b- a- bayit}.
Pnina {awfully cute.F / baby.F / in- the- house}
'Pnina is {awfully cute / a baby / in the house}.'

b. Pnina hayta {nora xamuda / tinoket / b- a- bayit}.
Pnina be.PST.3FSG {awfully cute.F / baby.F / in- the- house}
'Pnina was {awfully cute / a baby / in the house}.'

(2) a. Pnina hi {nora xamuda / ha- tinoket / …}.
Pnina PRON.FSG {awfully cute.F / the- baby.F / …}
'Pnina is {awfully cute / the baby / …}.'

b. Pnina hayta {nora xamuda / ha- tinoket / …}.
Pnina be.PST.3FSG {awfully cute.F / the- baby.F / …}
'Pnina was {awfully cute / the baby / …}.'

(3) a. Pnina yešna (b- a- bayit).
Pnina YEŠ.3FSG (in- the- house)
'Pnina is (t)here / is (exists) in the house.'

b. Pnina hayta (b- a- bayit).
Pnina be.PST.3FSG (in- the- house)
'Pnina was (t)here / was (existed) in the house.'

(4) a. Pnina eynena (b- a- bayit).
Pnina EYN.3FSG (in- the- house)
'Pnina isn't (t)here / isn't (in existence) in the house.'

b. Pnina lo hayta (b- a- bayit).
Pnina not be.PST.3FSG (in- the- house)
'Pnina wasn't (t)here/ wasn't in the house.'

[1]Thanks to Ash Asudeh, Joan Bresnan, Itamar Francez, Tracy King, and Irit Meir for comments.

(5) a. Yeš tinok- et b- a- bayit.
YEŠ baby- F in- the- house
'There is a girl baby in the house.'

b. Hayta tinok- et b- a- bayit.
be.PST.3FSG baby- F in- the- house
'There was a girl baby in the house.'

(6) a. Eyn tinok- et b- a- bayit.
EYN baby- F in- the- house
'There isn't a girl baby in the house.'

b. Lo hayta tinok- et b- a- bayit.
not be.PST.3FSG baby- F in- the- house
'There wasn't a girl baby in the house.'

(7) a. Yeš le- Pnina caacuim meacbenim.
YEŠ DAT- Pnina toys annoying.MPL
'Pnina has annoying toys.'

b. Hayu le- Pnina caacuim meacbenim.
be.PST.3PL DAT- Pnina toys annoying.MPL
'Pnina had annoying toys.'

(8) a. Eyn le- Pnina caacuim meacbenim.
EYN DAT- Pnina toys annoying.MPL
'Pnina doesn't have annoying toys.'

b. Lo hayu le- Pnina caacuim meacbenim.
not be.PST.3PL DAT- Pnina toys annoying.MPL
'Pnina didn't have annoying toys.'

As can be seen by perusing the examples, all of the past (and future) tense sentences use a form of the verb *haya* 'be'; it is this that makes them all copular. However, in the present tense, four different forms are used: Ø (1), the pronominal forms which we will call

Pron[2] (2), *yeš* (3, 5, 7), and *eyn* (4, 6, 8). (Not all the forms are equally natural; as shown in the examples, an indefinite predicate nominal prefers Ø and a definite one prefers Pron. Not unsurprisingly, Ø is generally unmarked if the sentence is sufficiently easy to parse. The preference for Pron with definite nominals may be a result of the possible parse as an appositive 'Pnina, the baby'.) Previous analyses have run into problems with the analysis of these present tense forms.

Despite the evidence of paradigmatic contrast in (2), it has become standard in transformational analyses of Pron to deny that it is the present tense of the verb *haya*. Instead, it is usually taken to be a realization of agreement features (Berman 1978, Doron 1983, Shlonsky 1997). The arguments for denying Pron the status of the present tense of *haya* are not inconsiderable. In the first place, the forms are pronouns, not verbs. This is shown in (9), where we contrast the forms of Pron with the theoretical dictionary present tense of *haya*, forms which are not actually used, but demonstrate what a present tense verbal paradigm for *haya* would look like.[3] Particularly interesting is the non-standard but not infrequent use of the demonstrative as a neuter form, since, unlike the personal pronouns, it does not even share an initial /h/ with *haya*.

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[2]Appearances (and history) notwithstanding, there is near-universal agreement (although a dissenting view is expressed by Chayen and Dror 1976) that the construction with Pron is not a variety of topicalization or left-dislocation. Such a construction is possible, but has distinctly different properties from the Pron construction. For example, there is an intonational break between the dislocated element and the subject pronoun (i).

(i) Pnina, hi nora xamuda.
Pnina, she awfully cute.F
'Pnina, she is awfully cute.'

In contrast to the Pron construction, the left-dislocation construction can be used in conjunction with 'be' in other tenses (ii) or other verbs in the present tense (iii).

(ii) a. Pnina, hi hayta nora xamuda.
Pnina, she be.PST.3FSG awfully cute.F
'Pnina, she was awfully cute.'

b. *Pnina hi hayta nora xamuda.
Pnina PRON.FSG be.PST.3FSG awfully cute.F
'Pnina was awfully cute.'

(iii) a Pnina, hi ohevet ledaber.
Pnina, she love.PRES.FSG talk.INF
'Pnina, she loves to talk.'

b. *Pnina hi ohevet ledaber.
Pnina PRON.FSG love.PRES.FSG talk.INF
'Pnina loves to talk.'

Some of the properties of the Pron construction to be discussed below, particularly the contrast with the Ø construction, also show that a left-dislocation analysis is incorrect. Most importantly, sentences with Pron do not exhibit the pragmatic effects one would expect from topicalization or left dislocation.

[3]Morphologically, *haya* belongs to the class of verbs ending in orthographic *h* (historically, and perhaps underlyingly, /y/). This manifests itself in two ways: the masculine singular ends in the present-tense template vowel /e/ which is deleted in the other forms (in more regular verbs this /e/ is followed by the final root consonant), and the suffix for the feminine singular is *-a* rather than the more common *-et*. One interesting feature of the theoretical present tense of *haya* is the replacement of the stem /y/ with /v/ (historically /w/).

(9)

Form	Use as pronoun	Use as copula	Comparable verb form
hu	personal pronoun: 3rd pers masc sg 'he'	masculine singular	hove
hi	personal pronoun: 3rd pers fem sg 'she'	feminine singular	hov-a
ze	demonstrative: 'this'	non-standard neuter singular	
hem	personal pronoun: 3rd pers masc pl 'they.M'	masculine plural	hov-im
hen	personal pronoun: 3rd pers fem pl 'they.F'	feminine plural	hov-ot

Pron thus appears to be (pro)nominal rather than verbal, and therefore not plausibly the present tense of *haya*. Other facts also militate against analyzing Pron as the present tense of *haya*. An often noted point is the position of *lo* 'not', which precedes tensed verbs, including verbs in the present tense, but not Pron. Instead, sentences with Pron are negated by placing *lo* before Pron's complement.

(10) a. Gabi lo haya ayef.
Gabi not be.PST.3MSG tired.M
'Gabi wasn't tired.'

b. Gabi lo nire ayef.
Gabi not seem.PRES.MSG tired.M
'Gabi doesn't seem tired.'

c. *Gabi lo hu ayef.
Gabi not PRON.MSG tired.M
'Gabi isn't tired.'

d. Gabi hu lo ayef.
Gabi PRON.MSG not tired.M
'Gabi isn't tired.'

There is thus good reason to deny that Pron is the present tense of *haya*. Nevertheless, it is clear that Pron functions as the present tense of *haya*, and an analysis of Pron ought to reflect this.

On the other hand *yeš* is often analyzed as if it were a verb, either the present of *haya* or something essentially equivalent (Chayen and Dror 1976, Berman 1978, Doron 1983, Shlonsky 1997). While the motivation is clear (the paradigmatic relation between *haya* and *yeš*), it is also obviously the case that *yeš* is not a verb. It appears to be a noun, as does its negative *eyn*. The subject agreement paradigms for *yeš* and *eyn* resemble the possessor agreement paradigm for nouns:[4]

(11)

no agreement	yeš	eyn	gan 'garden'
1st pers. sing.	(yeš- n- i)	(eyn- en- i)	gan-i
2nd pers. sing. masc.	(yeš- xa)	(eyn- xa)	gan-xa
2nd pers. sing. fem.	(yeš- n- ex)	(eyn- ex)	gan-ex
3rd pers. sing. masc.	yeš- n- o	eyn- en- o	gan-o
3rd pers. sing. fem.	yeš- n- a	eyn- en- a	gan-a
1st pers. plural	(yeš- n- enu)	(eyn- enu)	gan-enu
2nd pers. plural masc.	(yeš- xem)	(eyn- xem)	gan-xem
2nd pers. plural fem.	(yeš- xen)	(eyn- xen)	gan-xen
3rd pers. plural masc.	yeš- n- am	eyn- am	gan-am
3rd pers. plural fem.	yeš- n- an	eyn- an	gan-an

Aside from the unique *(e)n* "infix" in some of the forms, the suffixes on *yeš* and *eyn* are clearly identical to the nominal suffixes. On the other hand, the non-third-person forms are very rare, especially for *yeš* (Schwarzwald 1982); it is striking that they are all listed in the prescriptively oriented dictionary Even-Shoshan (1985), but the non-third-person forms of *yeš* are not included in the descriptively oriented dictionary Choueka (1997).[5] Speakers of Hebrew typically use circumlocutions to avoid these forms, but occasionally the third person forms are used with non-third-person subjects. (Examples a–c are spoken examples reported by Schwarzwald 1982, and d is a song lyric.)

(12) a. Todi'i le- baalex lakaxat et ha- oto hayom,
inform.IMP DAT- husband.2FSGposs take.INF ACC the- car today
ki maxar ani eyneno.
because tomorrow I EYN.3MSG
'Tell your husband to take the car today, because tomorrow I'm not in.'

[4]The dictionary form for the third person masculine singular of *eyn* is *eynenu*, not *eyneno*, and it is often transcribed as *eynenu* in linguistic examples. However, it is usually pronounced *eyneno* in spoken Hebrew. This is presumably a regularization of the paradigm.

[5]There is also a clausal-negation *eyn*, used prescriptively in place of *lo* in present-tense clauses. While there is clearly a relation between the two *eyn*'s, since both are negative, they are not the same lexical item. They are associated with different registers, and there are some differences in the agreement morphology. However, dictionaries (and many analyses) do not distinguish between the two *eyn*'s. Since the clausal-negation *eyn* has all the agreement forms, Choueka lists them under the one entry for *eyn*.

b. Im ata yešno b- a- bayit, ani af paam lo
if you.MSG YEŠ.3MSG in- the- house I never not
mit'oreret b- a- layla kše ha- yeladim boxim.
wake.up.PRES.FSG in- the- night when the- children cry.PRES.MPL
'If you're in the house, I never wake at night when the children cry.'

c. A: Kše at yešna, ani lo nogea b- a- tinok.
when you.FSG YEŠ.3FSG I not touch.PRES.MSG in- the- baby
'When you're present, I don't touch the baby.'
B: Ve kše ani eynena ?
and when I EYN.3FSG
'And when I'm not present?'

d. Ani pašut yešno.
I simply YEŠ.3MSG
'I just am.'

Schwarzwald suggests, plausibly, that the non-use of the non-third-person forms may be a result of the present-tense function of *yeš*, since present tense verbs in Hebrew do not exhibit person agreement. Nevertheless, the forms are clearly nominal forms. In fact, the existence of a non-agreeing form is also a nominal property rather than a verbal one: in verbs, an unsuffixed form is (third person) masculine singular. Distributional properties, such as the impossibility of appearing with the negative *lo*, also appear to point to a non-verb analysis for *yeš*.

The upshot of these observations is that Pron, *yeš*, and *eyn* display a strange array of properties. On the one hand, they function as the present tense of the verb *haya*; on the other hand, they are categorially nominal forms. The correct analysis of present tense copular constructions in Hebrew will simultaneously express both aspects of these elements:

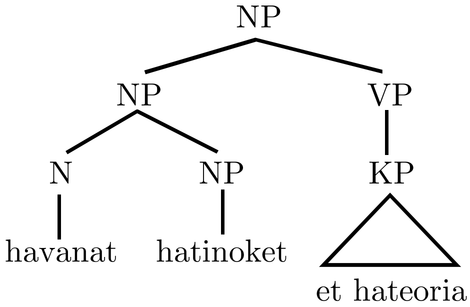
- Hebrew present-tense copulas are **functionally** verbal (present tense of 'be')
- Hebrew present-tense copulas are **categorially** nominal

Structurally, the Hebrew present-tense copulas have a mixed status. Being categorially nominal, they have a structural nominal nature. But they also have a structural verbal nature. This can be seen in the nature of the arguments they take: predicative complements, accusative objects, and the like. These arguments are realized structurally within a VP. Furthermore, the copulas head constituents with clausal distribution. Unlike the structural nominal nature of the present tense copulas, which appears to be a stipulated property of category, these verbal properties are a consequence of their functional nature as verbal elements.

This informal characterization of the present-tense copulas bears some similarity to the concept of mixed categories, in the sense of Bresnan (1997). Such mixed categories are widely attested; one in-depth analysis (in Kikuyu) is given by Mugane (2003). An example of a mixed category in Hebrew is the action nominal. It is a mixed category in that, although it is a noun, it takes verb-type arguments which are part of a VP embedded in the NP that the action nominal heads (Hazout 1995, Falk 2001). (In the case of the Hebrew action nominal, the taking of verb-type arguments is optional.)

(13) a. havanat ha- tinoket et ha- teoria
understanding the- baby(F) ACC the- theory
'the baby's understanding of the theory'

b.



Lexically, it is the result of a derivational process in which a verb, an element with a verbal argument structure, becomes incompletely nominalized; the resulting form is categorially nominal, but the argument structure retains a verbal nature. Informally, we can represent the argument structure of *havana* as follows:

(14) 'understanding $\langle_{\mathrm{n}} \langle_{\mathrm{v}}\, x,\, y\rangle\rangle$'

Although *havana* itself is a noun, the verbal part of the argument structure results in a lexical requirement of a VP in the extended projection; formally:

(15) VP $\in$ CAT $(\uparrow)$

An action nominal in Hebrew is thus functionally a mixed verbal/nominal entity. Categorially, it is a noun (this point is made very strongly by Siloni 1997, who denies the verbal element), but the functional verbal properties give rise to structural verbal properties within its extended projection.

Hebrew present-tense copulas differ in one important detail from action nominals: the copula is functionally completely verbal, while action nominals have a mixed nominal/ verbal nature at the functional level. The mixed-category status of present-tense copulas is thus a purely stipulated property. Nevertheless, the similarities between the copular forms and mixed categories are suggestive. If the analysis is correct, the basic properties of Pron and *yeš/eyn* will follow from the theory of mixed cartegories, while the differences between them will follow from individual lexical properties, such as argument structure. We will argue that this is, in fact, the case.

2. Pron

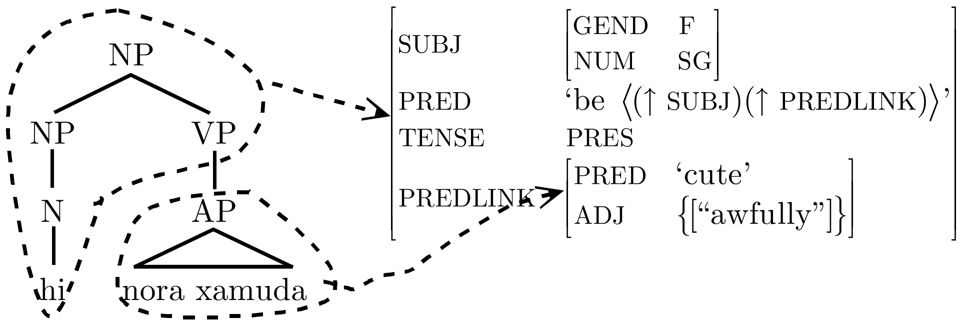
2.1. Analysis

Let us consider (2a). The Pron element will have the following in its lexical entry:[6]

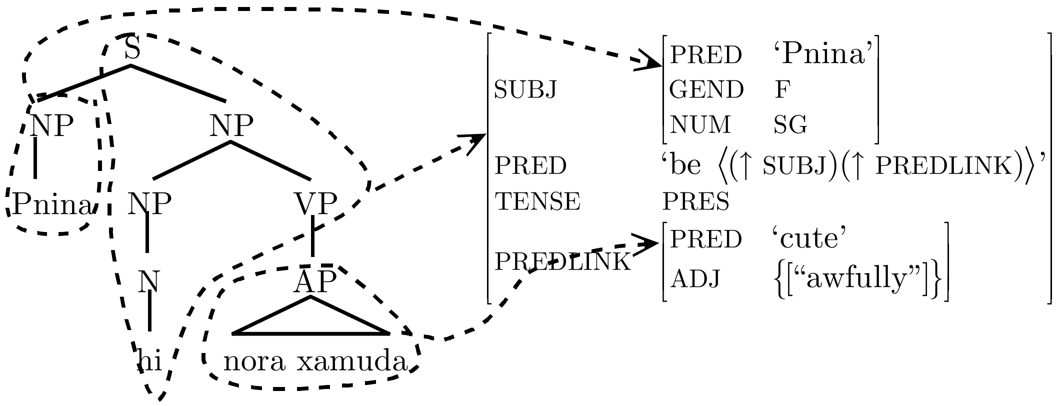
[6]For convenience, we are assuming the analysis of predicative complements proposed in Butt, King, Niño, and Segonde (1999), under which the complement of 'be' bears a closed function called PREDLINK, rather than the more traditional analysis in which it bears the open complement function XCOMP. As pointed out by Butt et al., not all copular complements can be analyzed as XCOMP; this is particularly true when the complement is a full clause. The overall relationship between "PREDLINK" and "XCOMP" needs to be worked out, but this lies beyond the scope of the present paper; for some thoughts on the subject, see Dalrymple, Dyvik, and King (2004). 'Be' predicates may take both types of argument structure.

(16) *hi*: N $(\uparrow \text{PRED}) = \text{`be} \langle(\uparrow \text{SUBJ})(\uparrow \text{PREDLINK})\rangle\text{'}$
$(\uparrow \text{TENSE}) = \text{PRES}$
$(\uparrow \text{SUBJ GEND}) = \text{F}$
$(\uparrow \text{SUBJ NUM}) = \text{SG}$
$\text{VP} \in \text{CAT}\ (\uparrow)$

Pron has a verbal argument structure, but, idiosyncratically, is categorized as a noun. As in action nominals, the verbal argument structure has, as a consequence, the requirement that its extended projection include the category VP. Pron's PREDLINK argument is a daughter of the VP node. The VP itself shares a head with the NP in which it is embedded, the N serving as its extended head.

(17)


But this f-structure is incomplete, since the SUBJ has no content. By embedding the NP under an S, we can provide it with a SUBJ.

(18)


This analysis embodies most of the properties of Pron (and of other copular constructions as well). First of all, our analysis correctly expresses the fact that present tense copulas are morphologically nominal elements and that they have verbal argument structure. The mixed c-structures are a consequence of the mixed nature of the copulas. The argument types are ones that are typical of VP constituents because they *are* VP constituents. The fact that the distribution of present-tense copula constructions is that of S/IP also follows from this analysis, since the NP headed by the present tense copula must be embedded under S.

The inability of Pron to be preceded by *lo* ((10) above) also follows from the present analysis. We analyze *lo* as being left-adjoined to verbal elements; this is essentially the (surface) analysis of Shlonsky (1997), who refers to *lo* as affixal. Since Pron is not (categorially) a verbal element, it cannot combine with *lo*. Instead, sentences with Pron are negated by placing the *lo* before the predicative complement of Pron; we hypothesize that this is structurally constituent negation rather than clausal negation: i.e. that the use of *lo* in cases like (10)is similar to the following:

(19) Mati kibel haftaa lo neima.
Mati received surprise not pleasant
'Mati got an unpleasant surprise.'

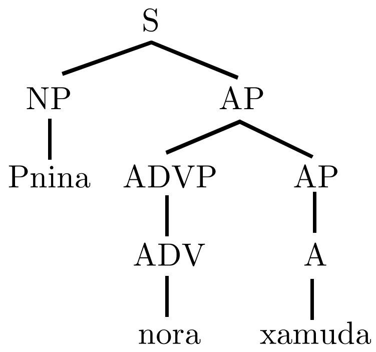
Another interesting property of Pron which follows from the proposed analysis is its inability to occur in the Triggered Inversion construction. Triggered Inversion is discussed in the appendix.

Pron has other, more idiosyncratic properties. The fact that it cannot take contrastive stress, for example, is not derivable from any other property, and presumably must be marked lexically. The usual ungrammaticality of Pron in a sentence with a pronominal subject may be a morphological effect, disallowing two adjacent pronominal forms under most circumstances. However, the majority of Pron's properties follow without additional stipulation from the mixed-category analysis proposed here.

2.2. Pron vs. Ø

Our analysis provides us with an account of the distinction between Pron and Ø. In sentences with the Ø realization of the present tense copula, traditionally called nominal sentences, there is no reason to hypothesize any copular element. Instead, such sentences are most naturally analyzed as involving an exocentric S, with direct predication by the non-verbal element.

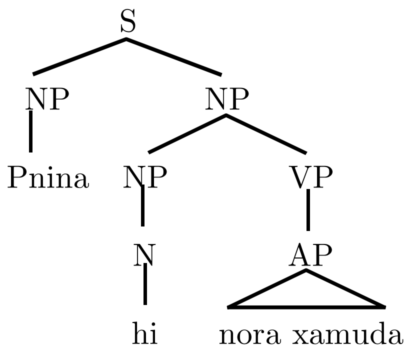
(20)



$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'Pnina'} \\ \text{NUM} & \text{SG} \\ \text{GEND} & \text{F} \end{bmatrix} \\ \text{PRED} & \text{'cute } \langle(\uparrow \text{SUBJ})\rangle\text{'} \\ \text{TENSE} & \text{PRES} \\ \text{ADJ} & \left\{\begin{bmatrix} \text{PRED} & \text{'awfully'} \end{bmatrix}\right\} \end{bmatrix}$$

This contrasts with sentences with Pron, which have a 'be' predicate:

(21)



$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'Pnina'} \\ \text{GEND} & \text{F} \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{PRED} & \text{'be } \langle(\uparrow \text{SUBJ})(\uparrow \text{PREDLINK})\rangle\text{'} \\ \text{TENSE} & \text{PRES} \\ \text{PREDLINK} & \begin{bmatrix} \text{PRED} & \text{'cute'} \\ \text{ADJ} & \left\{[\text{"awfully"}]\right\} \end{bmatrix} \end{bmatrix}$$

Both are possible because most non-predicational elements can be lexically extended to be used predicationally (Bresnan 2001). So the difference between (1) and (2) is analogous to the following in English:

(22) a. Pnina seems very cute.
b. Pnina seems to be very cute.

The only difference between Hebrew and English is that the latter does not allow 'be'-less sentences in tensed clauses.

Most of the time, clauses with 'be' and those without are essentially synonymous. However, as noted by Doron (1983), there are situations where, in both English and Hebrew, the 'be' predicate is necessary. Her example involves a case where the complement is referential, and thus not predicative.

(23) a. Pnina considers her favorite brother to be Yoni.
b. *Pnina considers her favorite brother Yoni.

(24) a. Ha- student hu Eli.
the- student PRON.MSG Eli
b. *Ha- student Eli.
the- student Eli
'The student is Eli.'

Another such case is when the complement is itself a sentence. As a closed element with its own SUBJ, it cannot be used predicatively. Here again, Hebrew and English act the same way.

(25) a. The danger seems to be that the hamster will eat the cat.
b. *The danger seems that the hamster will eat the cat.

(26) a. Ha- sakana hi še ha- oger yoxal
the- danger PRON.FSG that the- hamster eat.FUT.3MSG
et ha- xatul.
ACC the- cat
b. *Ha- sakana še ha- oger yoxal et ha- xatul.
the- danger that the- hamster eat.FUT.3MSG ACC the- cat
'The danger is that the hamster will eat the cat.'

In both of these situations, a copula+PREDLINK construction is possible, since PREDLINK is not a predicative (open) function.

A case which is different from English is noted by Shlonsky (1997): Pron is used with individual-level predicates and Ø with stage-level predicates.

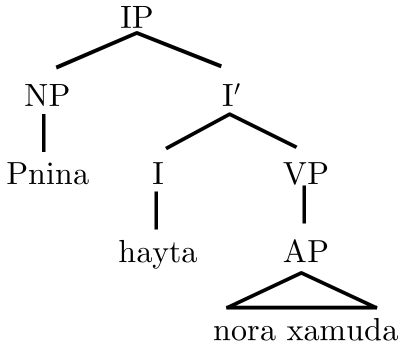
(27) a. Ha- dinozaur hu šikor.
the- dinosaur PRON.MSG drunk.MSG
'The dinosaur is a drunkard.'

b. Ha- dinozaur šikor.
the- dinosaur drunk.MSG
'The dinosaur is drunk.'

This indicates that Pron has aspectual content, not unusual for a 'be'-type predicate.

We thus disagree with analyses that see Pron and Ø as essentially stylistic variants, and consider *haya* to always be a mere carrier of tense information (Blau 1968, Rubinstein 1969, Berman 1978). On the other hand, we do conjecture that the predicative content of *haya* is optional, thus making it functionally equivalent to both Pron and Ø. The use of *haya* as an auxiliary suggests that it is sometimes devoid of content. Sentences (1b) and (2b), although c-structurally identical, differ functionally.

(28) a. c-structure for both



b. f-structure for (1b)

$$\begin{bmatrix} \text{SUBJ} & [\text{“Pnina”}] \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{‘cute } \langle(\uparrow \text{SUBJ})\rangle\text{’} \\ \text{ADJ} & \{[\text{“awfully”}]\} \end{bmatrix}$$

c. f-structure for (2b)

$$\begin{bmatrix} \text{SUBJ} & [\text{“Pnina”}] \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{‘be } \langle(\uparrow \text{SUBJ})(\uparrow \text{PREDLINK})\rangle\text{’} \\ \text{PREDLINK} & \begin{bmatrix} \text{PRED} & \text{‘cute’} \\ \text{ADJ} & \{[\text{“awfully”}]\} \end{bmatrix} \end{bmatrix}$$

3. *Yeš* and *Eyn*

We turn now to the other realization of present tense copula in Hebrew: *yeš* (and its negative *eyn*). *Yeš* is used in locative, existential, and possessive constructions. We will discuss these in order.

Primarily on the basis of analysis of the locative inversion construction (Bresnan 1994), Bresnan (2001) proposes that, unlike other complements of *be*, locatives in English are not predicative complements (XCOMP in Bresnan's implementation, PREDLINK in ours), but rather obliques.[7] Thus, despite the c-structure similarities, (28a) and (29a) have very different f-structures. (We henceforth refer to the PREDLINK-taking 'be' as 'be_1', and the non-PREDLINK-taking variety as 'be_2'.)

[7]Since in Hebrew, locative PPs can occur in Ø and Pron constructions, the PREDLINK and predicational analyses must be open to them as well.

(29) a. Pnina is very cute.

b.
$$\left[\begin{array}{ll} \textsc{subj} & [\text{“Pnina”}] \\ \textsc{tense} & \textsc{pres} \\ \textsc{pred} & \text{‘be}_1\ \langle(\uparrow \textsc{subj})(\uparrow \textsc{predlink})\rangle\text{’} \\ \textsc{predlink} & \left[\begin{array}{ll} \textsc{pred} & \text{‘cute’} \\ \textsc{adj} & \{[\text{“very”}]\} \end{array}\right] \end{array}\right]$$

(30) a. Pnina is in the house.

b.
$$\left[\begin{array}{ll} \textsc{subj} & [\text{“Pnina”}] \\ \textsc{tense} & \textsc{pres} \\ \textsc{pred} & \text{‘be}_2\ \langle(\uparrow \textsc{subj})(\uparrow \textsc{obl}_{\text{Loc}})\rangle\text{’} \\ \textsc{obl}_{\text{Loc}} & \left[\begin{array}{ll} \textsc{pred} & \text{‘in}\ \langle(\uparrow \textsc{obj})\rangle\text{’} \\ \textsc{obj} & [\text{“the house”}] \end{array}\right] \end{array}\right]$$

We propose that while the Hebrew verb *haya* exhibits the same ambiguity as the English *be*, expressing both ‘be_1’ and ‘be_2’, the two are distinguished in the present tense. While both are realized idiosyncratically as nouns in the present tense, ‘be_1’ is realized as Pron while ‘be_2’ is realized as *yeš*. The differences between Pron and *yeš* should be a consequence of the different arguments selected by the two.

One of the keys to understanding *yeš* is that, as observed by Shlonsky (1997), ‘be_2’ is an unaccusative predicate: its sole core argument is non-Agentive. Hebrew allows the sole core argument of an unaccusative to be realized as either SUBJ or OBJ.

(31) a. Ha- orxim higiu.
the- guests arrive.PST.3PL
‘The guests arrived.’

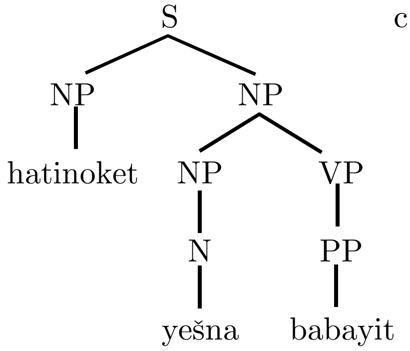
b. Higiu orxim.
arrive.PST.3PL guests
‘Guests arrived.’

As reflected in these examples, there is a preference for definite arguments to be expressed as SUBJ and indefinite arguments as OBJ, mirroring the universal preference for definite topical SUBJs, although the strength of this preference appears to differ between speakers, and may even be based on the verb.[8] Whether SUBJ or OBJ, the unaccusative argument triggers verb agreement. All things being equal, we expect *yeš* to exhibit the same behavior; and it does.

(32) a. Ha- tinok- et yešna b- a- bayit.
the- baby- F YEŠ.3FSG in- the- house
‘The baby is in the house.’

[8] Shlonsky (1997) claims that there is a clear Definiteness Effect at work, with no definite OBJs allowed. This does not match the judgments of my informants.

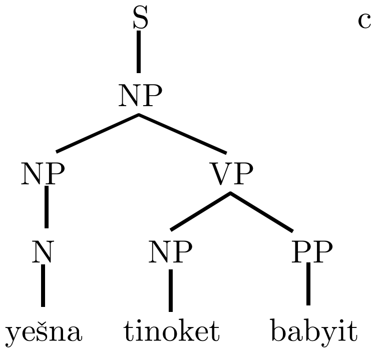
b.



c. $\begin{bmatrix} \textsc{pred} & \text{‘be}_2\ \langle(\uparrow \textsc{subj})(\uparrow \textsc{obl}_{\text{Loc}})\rangle\text{’} \\ \textsc{tense} & \textsc{pres} \\ \textsc{subj} & [\text{“the baby”}] \\ \textsc{obl}_{\text{Loc}} & [\text{“in the house”}] \end{bmatrix}$

(33) a. Yešna tinok- et b- a- bayit.
YEŠ.3FSG baby- F in- the- house
‘A baby is in the house.’

b.



c. $\begin{bmatrix} \textsc{pred} & \text{‘be}_2\ \langle(\uparrow \textsc{obj})(\uparrow \textsc{obl}_{\text{Loc}})\rangle\text{’} \\ \textsc{tense} & \textsc{pres} \\ \textsc{obj} & [\text{“a baby”}] \\ \textsc{obl}_{\text{Loc}} & [\text{“in the house”}] \end{bmatrix}$

When the Theme argument of ‘be$_2$’ is realized as SUBJ (31), the structure is exactly the same as in sentences with Pron. When it is realized as OBJ, it is naturally different; a structure with OBJ is not available for ‘be$_1$’. Note, however, that the structure in (32) is still an S, even though it is not needed to make the clause functionally complete. We conjecture that, like the VP constituent, this is a consequence of the functional status of *yeš* as verb-like. Since the present-tense copulas are functionally completely verbal, the c-structural expression must be a clausal constituent, unlike the nominal constituent headed by action nominals.

(34) *yešna*: N $(\uparrow \textsc{pred}) = \text{‘be}_2\ \langle(\uparrow \textsc{subj}|\textsc{obj})\boldsymbol{(}(\uparrow \textsc{obl}_{\text{Loc}})\boldsymbol{)}\rangle\text{’}$
$(\uparrow \textsc{tense}) = \textsc{pres}$
$(\uparrow \textsc{subj}|\textsc{obj gend}) = \textsc{f}$
$(\uparrow \textsc{subj}|\textsc{obj num}) = \textsc{sg}$
$\boldsymbol{(}\text{VP} \in \text{CAT}\ (\uparrow)\boldsymbol{)}$
$\text{S} \in \text{CAT}\ (\uparrow)$

Unlike *yeš*, *eyn* idiosyncratically requires its core argument to be realized as SUBJ.

(35) a. Ha- tinok- et eynena b- a- bayit.
the- baby- F EYN.3FS in- the- house
‘The baby is not in the house.’

b. *Eynena tinok- et b- a- bayit.
EYN.3FSG baby- F in- the- house
'A baby is not in the house.'

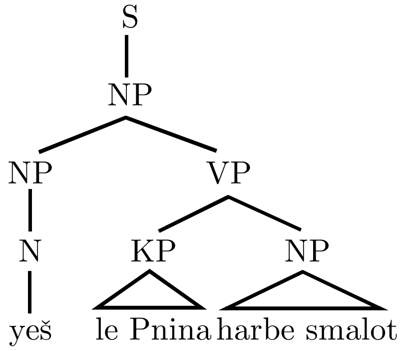
As in many other languages, 'be$_2$' also has an existential use—in Hebrew, a much more common use of 'be$_2$'. In the existential construction, the Theme has a discourse status (roughly speaking) of new information, a discourse status which generally precludes subjecthood. In English, where subjects are required in all clauses, the result is an expletive *there* as SUBJ, and the realization of the Theme as OBJ. In Hebrew, an expletive SUBJ is not required, and the Theme is simply realized as OBJ; with the existential construction, this is even true for *eyn*, which does not allow its Theme to be realized as OBJ in its locative version. The Theme is not a true unaccusative argument, since it cannot be realized as SUBJ, but simply as OBJ. The existential Theme therefore does not control agreement with *yeš* and *eyn*. If it is definite, it can even be marked with accusative Case in colloquial Hebrew, a usage frowned upon by prescriptivists.

(36) a. Yeš tinok- et.
YEŠ baby- F
'There is a baby.'
b. Eyn tinok- et.
EYN baby- F
'There is no baby.'
c. Yeš et ha- caacua ha- ze b- a- xanut šelanu.
YEŠ ACC the- toy the- this in- the- store ours
'This toy exists in our store.' / 'We have this toy in our store.'
d. Eyn et ha- caacua ha- ze b- a- xanut ha- mitxara
EYN ACC the- toy the- this in- the- store the- competing
'This toy does not exist in the competing store.' / 'The competition doesn't have this toy in their store.'

As in many other languages, the possessive construction in Hebrew is derived historically from the existential, and thus shares many properties with it (Berman 1978). Like the existential, the possessive is a subjectless construction: the possessed element is an OBJ, colloquially marked accusative when definite, and the possessor is a dative-marked element which we hypothesize is a restricted object (OBJ$_{\mathrm{Dat}}$).

(37) a. Yeš le Pnina harbe smalot.
YEŠ DAT Pnina many dresses
'Pnina has many dresses.'

b.



$$\begin{bmatrix} \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{`have } \langle(\uparrow \text{OBJ}_{\text{Dat}})(\uparrow \text{OBJ})\rangle\text{'} \\ \text{OBJ}_{\text{Dat}} & [\text{`Pnina'}] \\ \text{OBJ} & [\text{``many dresses''}] \end{bmatrix}$$

c. Eyn le Pnina et ha- simla ha- zot.
EYN DAT Pnina ACC the- dress the- this
'Pnina doesn't have this dress.'

In all of their uses, *yeš* and *eyn* conform to our claim that they are categorially nouns but functionally verb-like. They cannot be negated by *lo*; instead, *yeš* is negated by being replaced by *eyn*. The existence (and frequent use of) nonagreeing forms is also a nominal property. And, as discussed in the appendix, they do not participate in the Triggered Inversion construction. On the other hand, their functional properties (f-structural and f-structure–based c-structural properties) are verbal: they carry tense information, they take verbal arguments, and they head clausal constituents.

As one would expect, *yeš* and *eyn* share their verb-like properties with their present and future equivalents, forms of the verb *haya*, in all three uses. Even the realization of the arguments is identical. The nominal properties, on the other hand, are not shared. For example, *haya* is negated by a left-adjoined *lo*.

(38) a. Ha- tinoket lo hayta b- a- bayit.
the- baby not be.PST.3FSG in- the- house.
'The baby wasn't in the house.'

b. Lo hayta tinok- et.
not be.PST.3FSG baby- F
'There was no baby.'

c. Lo haya le Mati et ha- sefer ha- naxon.
not be.PST.3MSG DAT Mati ACC the- book the- right
'Mati didn't have the right book.'

The agreement facts for *haya* in the subjectless existential and possessive constructions are relevant in this context. Recall that *yeš* and *eyn* do not agree with the Theme in these constructions. As a verb, *haya* lacks non-agreeing forms; the unmarked form, though, is the masculine third person singular: past tense *haya* and future tense *yihye*. Prescriptively, in the subjectless constructions *haya* agrees with the OBJ; this is markedly different from the nominal present tense forms. Colloquially, the situation is a little more complex. Both the prescriptively correct agreeing forms[9] and the neutral third person masculine singular forms are possible. The preference, however, is for the use of agreement to be correlated with the absence of Case marking, i.e. for the non-accusative object to agree and for the accusative object not to agree. This is shown in the following data from Ziv (1976).

[9]But it should be noted that the accusative Case forms are not prescriptively correct.

(39) a. Hayta li mexonit kazot.
be.PST.3FSG DAT.1SG car(F) such
b. ?Haya li mexonit kazot.
be.PST.3MSG DAT.1SG car(F) such
'I had such a car.'

(40) a. ?Hayta lanu et ha- mexonit ha- zot od kše
be.PST.3FSG DAT.1PL ACC the- car(F) the- this still when
garnu be Tel Aviv.
live.PST.1PL in Tel Aviv
b. Haya lanu et ha- mexonit ha- zot od kše
be.PST.3MSG DAT.1PL ACC the- car(F) the- this still when
garnu be Tel Aviv.
live.PST.1PL in Tel Aviv
'We had this car when we were living in Tel Aviv.'

This type of pattern is attested for verbs in other languages; one striking example is Hindi, where both SUBJ and OBJ can be either Case marked or not Case marked. If the SUBJ is not Case marked, the verb agrees with it; if the SUBJ is Case marked but the OBJ is not, the verb agrees with the OBJ; if both are Case marked, the verb does not agree (Mohanan 1994). The preferred colloquial pattern of agreement is thus clearly a verbal pattern, contrasting sharply with the nominal pattern of (non)agreement found with *yeš* and *eyn*.

4. Conclusion

The analysis of Hebrew present tense copulas as mixed categories provides an understanding of their peculiar properties, and is a result of their peculiar lexical status as functionally verbal but categorially nominal. The theory of mixed categories needs to be extended to allow such elements.

5. Appendix: Triggered Inversion

Another construction in which present-tense copulas have special properties is the Triggered Inversion construction. This appendix describes the construction, proposes an analysis, and shows how the construction interacts with present-tense copulas.

We begin by noting that an element with discourse prominence can be placed at the beginning of a Hebrew clause. The most common way to do this involves setting this fronted element off from the clause intonationally; the clause itself has a normal structure.

(41) Be yaldut- o , Eli patar targil- ey matematika
in childhood- his , Eli solve.PST.3MSG exercise- PL mathematics
be kalut.
in ease
'In his childhood, Eli solved math exercises easily.'

In this construction, the fronted element is presumably adjoined to the clausal node —IP for a verbal sentence (as discussed in Doron 2000 and references cited there, Hebrew is a V-to-I language, in which the tensed verb is Infl) or S for a nominal sentence. However, there is another, stylistically marked, implementation in which there need not be an intonational break after the fronted element. In this version, the Triggered Inversion construction, the verb (or auxiliary) precedes the subject.

(42) a. Be yaldut- o patar Eli targil- ey matematika
in childhood- his solve.PST.3MSG Eli exercise- PL mathematics
be kalut.
in ease
'In his childhood, Eli solved math exercises easily.'

b. Be yaldut- o haya Eli poter targil- ey
in childhood- his AUX.PST.3MSG Eli solve.PART.MSG exercise- PL
matematika be kalut.
mathematics in ease
'In his childhood, Eli would solve math exercises easily.'

In the transformational literature, two analyses have been proposed for the Triggered Inversion construction. In one (e.g. Borer 1995) the topicalized element occupies the position of [SPEC, IP] and the SUBJ is VP internal; the verb is in Infl. In the other (e.g. Shlonsky and Doron 1992, Shlonsky 1998) the topicalized element is in [SPEC, CP] and the SUBJ is outside the VP (in [SPEC, IP]); the verb is in the complementizer position. The distributional evidence suggests that both analyses are partially correct. In subordinate clauses (i.e. clauses with an overt complementizer) the fronted element intervenes between the complementizer and the remainder of the clause, suggesting a [SPEC, IP] position for the fronted element (and the usual Infl position for the tensed verb).

(43) Sipru li še be yaldut- o patar Eli
tell.PST.3PL me.DAT that in childhood- his solve.PST.3MSG Eli
targil- ey matematika be kalut.
exercise- PL mathematics in ease
'I have been told that in his childhood, Eli solved math exercises easily.'

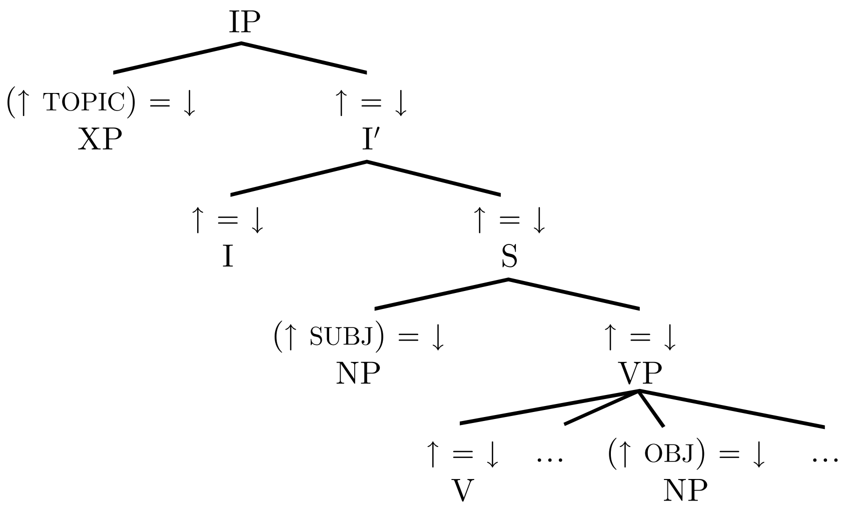
On the other hand, VP-adjuncts cannot intervene between the verb in Infl and the SUBJ, but must follow the SUBJ, suggesting that the SUBJ is not internal to VP.

(44) a. Be yaldut- o patar Eli be kalut targil- ey
in childhood- his solve.PST.MSG Eli in ease exercise- PL
matematika.
mathematics

b. *Be yaldut- o patar be kalut Eli targil- ey
in childhood- his solve.PST.MSG in ease Eli exercise- PL
matematika.
mathematics
'In his childhood, Eli solved math exercises easily.'

The standard LFG analysis of "VP-internal subjects", under which the constituent which contains the SUBJ is S rather than VP, provides a way to capture what is essentially correct in both of these analyses. Under this analysis, Triggered Inversion has the following structure in Hebrew.

(45)



This structure correctly places the topicalized element in [SPEC, IP], the verb in Infl, and the SUBJ outside the VP.

Triggered Inversion is not available for Pron sentences.

(46) a Yoni haya nora xamud.
Yoni be.PST.3MSG awfully cute.MSG
'Yoni was awfully cute.'

b. *Haya Yoni nora xamud.
be.PST.3MSG Yoni awfully cute.MSG
'Yoni was awfully cute.'

c. Lifney harbe šanim, Yoni haya nora xamud.
before many years Yoni be.PST.3MSG awfully cute.MSG
'Many years ago, Yoni was awfully cute.'

d. Lifney harbe šanim haya Yoni nora xamud.
before many years be.PST.3MSG Yoni awfully cute.MSG
'Many years ago, Yoni was awfully cute.'

(47) a. Kše hi mexayexet, Pnina hi nora xamuda.
when she smile.PRES.FSG Pnina is.FSG awfully cute.FSG
'When she smiles, Pnina is awfully cute.'

b. *Kše hi mexayexet hi Pnina nora xamuda.
when she smile.PRES.FSG is.FSG Pnina awfully cute.FSG
'When she smiles, Pnina is awfully cute.'

The inability of present tense copulas to occur in the Triggered Inversion construction is a consequence of the analysis. Under the analysis proposed here, the present tense copula is not an Infl, so it cannot take an S complement. Nothing licenses an S instead of the XP in predicate position, nor would we expect an S to be licensed there, since S is not a predicative category (Bresnan 1982); there is therefore no available post-Pron position for the subject.[10]

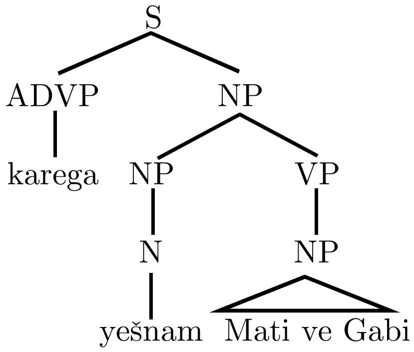
It has been claimed by Doron (1983) that, while *eyn* is ungrammatical in Trigered Inversion sentences, *yeš* is possible.

(48) a. Karega yešnam Mati ve Gabi.
now YEŠ.3MPL Mati and Gabi
'Right now, Mati and Gabi are here.'

b. *Karega eynam Mati ve Gabi.
now EYN.3MPL Mati and Gabi
'Right now, Mati and Gabi are not here.'

Under our analysis, however, there is an analysis available for the *yeš* sentence which does not involve Triggered Inversion: *Mati ve Gabi* could be an OBJ.

(49)



$$\left[\begin{array}{ll} \text{TOPIC} & [\text{“now”}] \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{‘be}_2 \left\langle (\uparrow \text{SUBJ} \mid \text{OBJ})((\uparrow \text{OBL}_{\text{Loc}})) \right\rangle\text{’} \\ \text{OBJ} & [\text{“Mati and Gabi”}] \\ \text{ADJ} & \end{array}\right]$$

This analysis is confirmed by the ungrammaticality of such a construction with *eyn*, since locative *eyn* does not allow the expression of its Theme argument as an OBJ. Contrary to appearances, then, *yeš* is not a counterexample to our claim that Triggered Inversion is impossible with Hebrew present tense copulas.

References

Berman, Ruth (1978) *Modern Hebrew Structure.* Tel Aviv: University Publishing Projects.

Blau, Yehoshua (1968) *The Foundations of Syntax (Yesodot ha-taxbir).* Jerusalem: Hebrew Institute for Education.

Borer, Hagit (1995) "The Ups and Downs of Hebrew Verb Movement." *Natural Language and Linguistic Theory* 13: 527–606.

Bresnan, Joan (1982) "Control and Complementation." in Joan Bresnan, ed., *The Mental Representation of Grammatical Relations* Cambridge, Mass.: MIT Press. 282–390.

Bresnan, Joan (1994) "Locative Inversion and the Architecture of Universal Grammar." *Language* 70: 72–131.

Bresnan, Joan (1997) "Mixed Categories as Head-Sharing Constructions." in Miriam Butt and Tracy Holloway King, eds., *Proceedings of the LFG97 Conference, University of California, San Diego.* On-line: CSLI Publications. `http://cslipublications.stanford.edu/LFG/2/lfg97.html`.

Bresnan, Joan (2001) *Lexical-Functional Syntax.* Oxford: Blackwell.

Butt, Miriam, Tracy Holloway King, María-Eugenia Niño, and Frédérique Segonde (1999)

[10]This explanation of the ungrammaticality of Triggered Inversion would not be possible if we treated the constituent that hosts the subject as a VP.

A Grammar-Writer's Cookbook. Stanford, Calif.: CSLI Publications.

Chayen, M. J., and Z. Dror (1976) *Introduction to Hebrew Transformational Grammar (Mavo le-dikduk ticruni ivri).* Tel Aviv: University Publishing Projects.

Choueka, Yaacov (1997) *Rav-Milim: A Comprehensive Dictionary of Modern Hebrew (Rav-Milim: Ha-milon ha-šalem la-ivrit ha-xadaša).* Tel Aviv: Center for Educational Technology.

Dalrymple, Mary, Helge Dyvik, and Tracy Holloway King (2004) "Copular Complements: Closed or Open?", this volume.

Doron, Edit (1983) *Verbless Predicates in Hebrew.* Doctoral dissertation, University of Texas, Austin

Doron, Edit (2000) "VSO and Left-Conjunct Agreement: Biblical Hebrew vs. Modern Hebrew." in Andrew Carnie and Eithne Guilfoyle, eds., *The Syntax of Verb Initial Languages*. New York: Oxford University Press. 75–95.

Even-Shoshan, Avraham (1985) *The New Dictionary (Ha-milon he-xadaš).* Jerusalem: Kiryat Sefer.

Falk, Yehuda N. (2001) "Constituent Structure and Grammatical Functions in the Hebrew Action Nominal." in Miriam Butt and Tracy Holloway King, eds., *Proceedings of the LFG01 Conference, University of Hong Kong, Hong Kong* On-line: CSLI Publications. 83–103.
`http://cslipublications.stanford.edu/LFG/6/lfg01.html`
Also in Yehuda N. Falk, ed. (2002) *Proceedings of Israel Association for Theoretical Linguistics 17, The Hebrew University of Jerusalem.* On-line: The Hebrew University of Jerusalem English Department.
`http://atar.mscc.huji.ac.il/~english/IATL/17/`

Hazout, Ilan (1995) "Action Nominalizations and the Lexicalist Hypothesis." *Natural Language and Linguistic Theory* 13: 355–404.

Mohanan, Tara (1994) *Argument Structure In Hindi.* Stanford, California: CSLI Publications.

Mugane, John M. (2003) "Hybrid Constructions in Gĩkũyũ: Agentive Nominalizations and Infinitive-Gerund Constructions." in Miriam Butt and Tracy Holloway King, ed., *Nominals: Inside and Out.* Stanford, Calif: CSLI Publications. 235–265.

Rubinstein, Eliezer (1969) *The Nominal Sentence: A Study in the Syntax of Contemporary Hebrew (Ha-mišpat ha-šemani: Iyunim be-taxbir yameynu).* Tel Aviv: Hakibbutz Hameuhad Publishing House.

Schwarzwald, Ora (1982) "Comments on the Inflection of Existential *Yeš* And *Eyn* in Colloquial Modern Hebrew (He'arot axadot al netiyot 'yeš' ve-'eyn' kiyumiyot ba-ivrit ha-meduberet)." *Hebrew Computational Linguistics* 19: 59–70.

Shlonsky, Ur (1997) *Clause Structure and Word Order in Hebrew and Arabic: An Essay in Comparative Semitic Syntax.* Oxford: Oxford University Press.

Shlonsky, Ur, and Edit Doron (1992) "Verb Second in Hebrew." in Dawn Bates, ed., *Proceedings of the Tenth West Coast Conference on Formal Linguistics*. Stanford, Calif.: Stanford Linguistics Association. 431–445.

Siloni, Tal (1997) *Noun Phrases and Nominalizations: The Syntax of DPs.* Dordrecht: Kluwer.

Ziv, Yael (1976) "On the Reanalysis of Grammatical Terms in Hebrew Possessive Constructions." in Peter Cole, ed., *Studies in Modern Hebrew Syntax and Semantics: The Transformational-Generative Approach* Amsterdam: North Holland.

LEXICAL INTEGRITY, HEAD SHARING, AND CASE MARKING IN JAPANESE TEMPORAL AFFIX CONSTRUCTIONS

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1. Introduction[1]

Case-marking in Japanese is, in general, correlated to the category of the case assigner and its projection. Verbal cases (VCs) such as Nominative and Accusative seem to be assigned by a verbal head such as V/I under the projection such as VP/IP, as in (1a). Nominal cases (NCs) such as Genitive appear to be assigned by a nominal head such as N under the projection such as NP, as in (1b). In contrast, NCs and VCs cannot appear under a VP/IP and a NP, respectively.

(1)a. [$_{IP}$ John-ga/*-no [$_{VP}$ ainugo-o/*-no [$_{V}$ kenkyuu-si]]-ta]
John-NOM/*-GEN Ainu-ACC/*-GEN research-do-PAST
'John studied Ainu.'
b. [$_{NP}$ John-no/*-ga ainugo-no/*-o kenkyuu](-ga itiban sugureteita).
John-GEN/*-NOM Ainu-GEN/*-ACC research(-NOM most was.excellent)
'John's research on Ainu (was most excellent).'

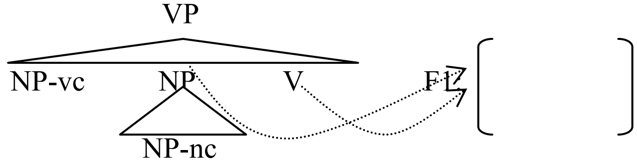
However, the Temporal Affix Construction (TAC), which is headed by a temporal affix that immediately follows an argument-taking noun, allows either NC (*no*) or VC (*o*) marking as in (2a, b)[2]. It also allows a mixture of both VC- and NC-marking (i.e. mixed case: MC) under the same projection, as in (2c).

(2)a. [John-no ainugo-no kenkyuu tyuu] <NC>
John-GEN Ainu-GEN research mid
'during John's research on Ainu'
b. [John-ga ainugo-o kenkyuu-tyuu] <VC>
John-NOM Ainu-ACC research-mid
c. [John-ga ainugo-no kenkyuu-tyuu] <MC>
John-NOM Ainu-GEN research-mid

The NC- and VC-marking in (2a, b) do not pose a serious problem for the general case-marking pattern as in (1), if we assume that the head (or the case assigner) of these TACs can assign either NCs as a noun or VCs as a verb. However, the serious problem is that we cannot handle the MC-marking in (2c), because it suggests that, whatever the category is, the single head assigns both a VC and a NC in the same domain, against the general case-marking pattern.

The goal of this paper is to solve the problem of MC-marking and explain all of the case-marking patterns in TAC as in (2) as well as the general case-marking pattern as in (1) within a LFG framework. In particular, to solve the problem of MC-marking, we will defend Bresnan (1997)'s head sharing analysis, which allows the case-assigning verbal head and its NC-marked (i.e. genitive-marked) sister NP to map to the same f-structure, as in (3).

(3)



[1] My special thanks are due to Stephen Wechsler for suggesting a LFG implementation of the head sharing analysis and for valuable comments on my linguistic argumentation. My thanks are due to Peter Sells, Jonas Kuhn, Chiyo Nishida, and Junko Shimoyama for helpful comments on my earlier draft of this paper. I also wish to thank the audience in LFG04, anonymous reviewers, two editors (Tracy Holloway King and Miriam Butt), and Canterbury students in Linguistics, especially, Aaron Nolan, who helped me stay in Christchurch. Eric McCready helped me in proofreading the draft for this paper.

[2] Following the literature (Sells 1990, Hoshi 1997, Sato 1998) I will use the name, temporal affix construction, for convenience. However, the name is misleading, since the affix-like element does not always behave like an affix but can behave like a full-fledged word, as we discuss later.

Assigning a VC under its projection, the case-assigning verbal head can share the headness with its sister NP, so that it is an extended head. Since the verbal head can serve as an extended head of the sister NP at f-structure, it can license a NC in the sister NP under the verbal projection.

We examine every type of TAC in Japanese. They can be classified into subclasses, according to the kind of argument-taking noun and the kind of temporal affix. The argument-taking noun includes Sino-Japanese verbal nouns (e.g. *kenkyuu* 'research'), nominalized V-V compounds (e.g. *uke-tori* 'receipt'), western loanwords (e.g. *doraibu* 'drive'), etc. As for the temporal affix, we include not only typical affixes which are directly concatenated with a preceding argument-taking noun (e.g. *–tyuu* 'during') but also periphrastic types of affixes which require an intervening morpheme *no* between the affix itself and the preceding argument-taking noun (e.g. *–no-sai/ori* 'on the occasion of'). In spite of the superficial difference in TAC types, our goal is to give a unified account for case-marking in every type of TAC[3].

Our discussion is organized in the following order: properties of mixed case marking in TAC [Section 2], our proposals and head sharing analysis [Section 3], empirical preferences for the head sharing analysis [Section 4], residual issues [Section 5], and conclusion [Section 6].

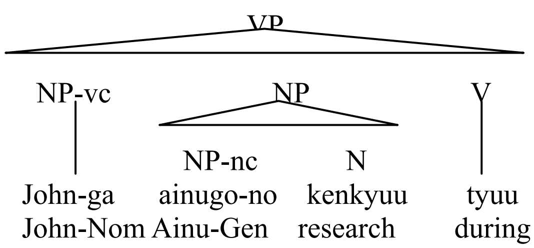
2. Properties of Mixed Case Marking in Temporal Affix Constructions

In this section, we discuss some structural properties associated with TACs which allow MC-marking (hereafter, MC-TAC). A theory that can handle MC-marking should capture the properties.

2.1 Wordhood of a Case-assigning Head

In (1), we observed a general case-marking pattern such that a verbal head or its cohead assigns VCs under VP/IP and a nominal head assigns NCs under NP. Those who assume such a general case-marking pattern might wonder if a MC-TAC involves two heads, each of which licenses VC- or NC-marking. That is, they might assume the following bi-clausal structure for a MC-TAC such as (2c).

(4)



In (4), two heads, N and V, can assign a NC and a VC, respectively, in each domain of case assignment, conforming to the general case-marking pattern. If (4) is a correct analysis, then we do not have the problem of MC-marking any longer. But, in fact, it is not a correct analysis. There is evidence that a MC-TAC involves only a single word as a head. The evidence is given on the basis of criteria for lexical integrity (Bresnan and Mchombo 1995), as follows. It suggests that a head is one word if a TAC allows VC-marking (hereafter, VC-TAC), while it is formed by two words if a TAC allows NC-marking (hereafter, NC-TAC). The MC-TAC behaves in the same way as the VC-TAC does, so that we can conclude that the MC-TAC has a single word as a head.

[3] Our treatment of a temporal affix seems to be controversial, since it has, traditionally, been limited to the typical type of affix such as *–tyuu* 'during' (Sells 1990, Kageyama 1993). Nevertheless, our uniform treatment of the two types of temporal affix is supported by their similar behavior with respect to wordhood (cf. Section 2.1) as well as their parallel case-marking patterns, although they differ in phonological wordhood (cf. Appendix). We will discuss our treatment of the intervening morpheme *no* preceding a periphrastic temporal affix in Section 5.1, in spite of the fact that the morpheme is superficially identical to a genitive case-marker, which suggests a nominal property of the subsequent element (Peter Sells, p.c.).

2.1.1 Inbound Anaphoric Island

This criterion is used to show that part of a word does not allow an anaphoric use (e.g. *McCarthyism*, **himism*). NC-TACs as in (5a, 6a) allow an argument-taking noun to be replaced by a pronoun which is co-referential with the antecedent argument-taking noun, while VC-/MC-TACs as in (5b, c) and (6b, c) do not[4]. This suggests that an argument-taking noun in a NC-TAC behaves like a full-fledged word, while the one in a VC- or MC-TAC does not.

(5) Mary-wa iroirona gengo-no kenkyuu$_i$-o sita.
Mary-TOP various language-GEN research-ACC did
'Mary studied various languages.'
a. (?)John-wa [kanojo-no ainugo-no sore$_i$ tyuu/izen(-ni)], ronbun-o happyoo-sita. <NC>
John-TOP her-GEN Ainu-GEN it mid/before(-at)] paper-ACC presentation-did
'During/Before her research (lit. it) of Ainu, John presented his paper.'
b. *John-wa [kanojo-ga ainugo-o sore$_i$-tyuu/izen(-ni)], ronbun-o happyoo-sita <VC>
John-TOP she-NOM Ainu-ACC it-mid/before(-at) paper-ACC presentation-did
c. *John-wa [kanojo-ga ainugo-no sore$_i$-tyuu/izen(-ni)], ronbun-o happyoo-sita <MC>
John-TOP she-NOM Ainu-GEN it-mid/before(-at) paper-ACC presentation-did

(6) Mary-wa iroirona gengo-no kenkyuu$_i$-o sita.
Mary-TOP various language-GEN research-ACC did
'Mary studied various languages.'
a. (?)John-wa [kanojo-no ainugo-no sore$_i$ no-ori/-sai(-ni)], ronbun-o happyoo-sita. <NC>
John-TOP her-GEN Ainu-GEN it on.the.occasion.of (-at)] paper-ACC presentation-did
'On the occasion of her research (lit. it) of Ainu, John presented his paper.'
b. *John-wa [kanojo-ga ainugo-o sore$_i$-no-ori/-sai(-ni)], ronbun-o happyoo-sita <VC>
John-TOP she-NOM Ainu-ACC it-on.the.occasion.of(-at) paper-ACC presentation-did
c. *John-wa [kanojo-ga ainugo-no sore$_i$-no-ori/-sai(-ni)], ronbun-o happyoo-sita <MC>
John-TOP she-NOM Ainu-GEN it-on.the.occasion.of(-at) paper-ACC presentation-did

Moreover, the parallel between (5a) and (6a) and between (5b, c) and (6b, c) suggests the similarity of the two types of temporal affixes.

2.1.2 Phrasal Recursivity

This criterion is used to show that word-internal constituents disallow the arbitrarily deep embedding of syntactic phrasal modifiers (e.g. **quite happiness*, **more happy than sadness*). An adjective can modify only an argument-taking noun in NC-TACs as in (7a, b), while it cannot in VC-/MC-TACs as in (8a, b) and (9a, b).

(7)a. John-no sono ronbun-no kibisii hihan go(-ni),
John-GEN the paper-GEN severe criticism after(-at),
Mary-ga syohyoo-o kaita. [NC]
Mary-NOM review-ACC wrote
'Mary wrote a review after John's severe criticism of the paper.'

[4] There are informants who do not allow (5a). It seems to me that the unacceptability comes from a reason other than the wordhood of the head element. For example, one informant does not allow a replacement of an argument-taking noun by a pronoun even in an NP headed by an argument-taking noun which takes NC-marked arguments (i.e. *John-no ainugo-no sore* '*John's that of Ainu (lit.)'), which sounds good to me. Another informant is suspicious when only a verb is replaced by a pro-form, but it is important to notice that the head in (5a) is a noun, which can be replaced by a pro-form (i.e. John's one on anaphora = John's article on anaphora).

b. John-no sono ronbun-no kibisii hihan no sai,
John-GEN the paper-GEN severe criticism NO occasion,
Mary-ga syohyoo-o kaita. [NC]
Mary-NOM review-ACC wrote
'Mary wrote a review on the occasion of John's severe criticism of the paper.'

(8)a. *John-ga sono ronbun-o kibisii hihan-go(-ni),
John-NOM the paper-ACC severe criticism-after(-at),
Mary-ga syohyoo-o kaita. [VC]
Mary-NOM review-ACC wrote

b. *John-ga sono ronbun-no kibisii hihan-go(-ni),
John-NOM the paper-GEN severe criticism-after(-at),
Mary-ga syohyoo-o kaita. [MC]
Mary-NOM review-ACC wrote
'Mary wrote a review after John's severe criticism of the paper.'

(9)a. *John-ga sono ronbun-o kibishii hihan-no-sai,
John-NOM the paper-ACC severe criticism-NO-occasion,
Mary-ga syohyoo-o kaita. [VC]
Mary-NOM review-ACC wrote

b. ?John-ga sono ronbun-no kibishii hihan-no-sai,
John-NOM the paper-GEN severe criticism-NO-occasion,
Mary-ga syohyoo-o kaita. [MC]
Mary-NOM review-ACC wrote
'Mary wrote a review on the occasion of John's severe criticism of the paper.'

Moreover, the parallel between (7a) and (7b), between (8a) and (9a), and between (8b) and (9b) suggests the similarity of the two types of temporal affixes.

2.1.3 Other Criteria

Other criteria such as extraction, conjoinability, and gapping are irrelevant to our discussion, due to other factors than wordhood. In general, extraction does not apply to predicative elements in Japanese. Instead, some researchers use a test of intervention by focus particle to a predicate (Kageyama 1999, Sells 1995). Generally, verbs allow a focus particle to occur between their nominal form and the tense-conveying pro-verb *suru* 'do', as in (10). In contrast, intervention by a focus particle is disallowed in TACs as in (11).

(10) kenkyuu-wa/-mo/-sae suru
study-TOP/also/even do
'(to) study'

(11)a. *kenkyuu-wa/-mo/-sae tyuu
study-TOP/also/even mid
'during a study'

b. *kenkyuu-wa/-mo/-sae (-no) sai/ori
study-TOP/also/even -NO occasion
'on the occasion of a study'

The following argument can explain the impossibility of the focus particle in (11). In NC-TACs, since focus particles behave like VC-particles, they do not appear in a nominal environment such as a head element which consists of two nouns. As for VC/MC-TACs, their head element, an argument-taking noun followed by a temporal affix, forms a single verb, so that it has no room to allow an intervening particle. In contrast, the VN-*suru* form as in (10) allows an intervening particle, since the VN behaves like a full-fledged word which serves as a complement of the verb *suru* 'do' (Sells 2003)[5].

The other two criteria, conjoinability and gapping, are sensitive to phonological wordhood, as Bresnan and Mchombo pointed out, so that the result of applying them to TAC suggests that a periphrastic temporal affix is a phonological word, while a typical temporal affix is not. Since the phonological wordhood is not relevant to our discussion, we do not take this result as important. For reference, the data are shown in the Appendix.

2.2 Categorical Consistency: Verbal Head and Projection
2.2.1 Distribution of MC-TAC

A MC-TAC shows distributional properties associated with verbal projections. In general, verbs and their projections cannot appear in pre-particle positions (e.g., *(*John-ga*) *aruku-ga/o/ni…* '*(John) walks-NOM/ACC/DAT…'), but nouns and their projections can (e.g., (sono) *gakusei-ga/o/ni…* '(the) student-NOM/ACC/DAT…'). Likewise, a MC- or VC-TAC cannot appear in pre-particle positions as in (12b, c), but a NC-TAC can as in (12a). Thus, a MC-TAC is a verbal projection rather than a nominal projection[6].

(12)a. Mary-wa [$_{NP}$ John-no ainugo-no kenkyuu tyuu]-o omoidasita.
Mary-TOP John-GEN Ainu-GEN research mid-ACC remembered
'Mary remembered the middle of John's study of Ainu.'
b. *Mary-wa [$_{VP}$ John-ga ainugo-no kenkyuu-tyuu]-o omoidasita.
Mary-TOP John-NOM Ainu-GEN research-mid-ACC remembered
c. *Mary-wa [$_{VP}$ John-ga ainugo-o kenkyuu-tyuu]-o omoidasita.
Mary-TOP John-NOM Ainu-ACC research-mid-ACC remembered

2.2.2 Nominative-licensing property

A MC-TAC must have a head which licenses a Nominative case to its external argument similar to a VC-TAC or other verbal projections in general, so that (13a) is well-formed. The Nominative-licensing property can generally be associated with a verbal head and its cohead, while it cannot be associated with a nominal head[7]. The same property is commonly taken as a subject-taking/licensing property (cf. Extended Projection Principle in GB, Subject Condition in LFG, and Baker (2003)'s definition of verbs), but we do not take it as unique to verbs, since we will assume both verbs and nouns subcategorize for a subject (cf. Section 3). Moreover, because of the Nominative-licensing property, a verbal head in (13b) does not allow a mixed case pattern such that an external argument is NC-marked and an internal argument is VC-marked. Such a mixed case pattern is allowed in some types of nominalization constructions (e.g. *Pat's watching television*) cross-linguistically (Malouf 2000), because a head is nominal and lacks the Nominative-licensing property.

[5] VN stands for verbal noun (Martin 1975).
[6] As to the distribution of TAC, Sells (1990) claims that the head elements of TAC are nouns, based on his examples showing that even a VC-TAC appears in pre-particle positions. Horiuchi (2004) argues against his claim, pointing out that his examples involve a syntactic environment which allows a non-nominal element.
[7] Nominal projections which allow Nominative-Genitive conversion are exceptions. If it is true that the Nominative-marking property is limited to a verbal head, the head of such nominal projections should be taken as a mixed category which inherits both verbal and nominal properties (Malouf 2000). See Kikuta (2000) for the mixed category analysis of Nominative-Genitive conversion constructions.

(13)a. John-ga ainugo-no kenkyuu-tyuu (=2c)
John-NOM Ainu-GEN research-mid
'during John's research on Ainu'
b. *John-no ainugo-o kenkyuu-tyuu
John-GEN Ainu-ACC research-mid

2.2.3 Modification by Adjectives and Adverbs

Modification by adjectives and adverbs also supports our argument that a MC-TAC has a verbal head. We have already seen that an adjective can modify (part of) the head of NC-TAC but cannot modify (part of) the head of VC- or MC-TAC as in (7, 8, 9), partially repeated in (14). In contrast, adverbs can modify the head of MC-TAC as well as VC-TAC but cannot modify the head of NC-TAC, so that we can argue that a MC-TAC has a verbal head, again. The datum (15c) appears to be an exception, since the adverb *kinoo* 'yesterday' does not modify the head *hihan-go* 'after criticism'. However, adverbs can modify a head of MC-TAC in a position other than the one immediately preceding the head, as in (17a, b). Moreover, adjectives cannot modify the head of MC-TAC, regardless of where they occur, as in (14c) and (16a, b). We have no definite answer to explain the exception (15c), but it might suggest a structural difference between VC-TAC and MC-TAC or be related to an extra-linguistic factor such as psychological processability. We leave this matter open.

(14) a. John-no sono ronbun-no kibisii hihan go(-ni), <NC> (=7a)
John-GEN the paper-GEN severe criticism after(-at),
b. *John-ga sono ronbun-o kibisii hihan-go(-ni), <VC> (=8a)
John-NOM the paper-ACC severe criticism-after(-at),
c. *John-ga sono ronbun-no kibisii hihan-go(-ni), <MC> (=8b)
John-NOM the paper-GEN severe criticism-after(-at),
'after John's severe criticism of the paper'
(15) a. *John-no sono ronbun-no kinoo hihan go(-ni), <NC>
John-GEN the paper-GEN yesterday criticism after(-at),
b. John-ga sono ronbun-o kinoo hihan-go(-ni), <VC>
John-NOM the paper-ACC yesterday criticism-after(-at),
c. *John-ga sono ronbun-no kinoo hihan-go(-ni), <MC>
John-NOM the paper-GEN yesterday criticism-after(-at),
'after John criticized the paper yesterday'
(16) a. #John-ga kibisii sono ronbun-no hihan-go(-ni), <MC>
John-NOM severe the paper-GEN criticism after(-at),
b. #kibisii John-ga sono ronbun-no hihan-go(-ni), <MC>
severe John-NOM the paper-ACC criticism-after(-at),
(17) a. John-ga kinoo sono ronbun-no hihan-go(-ni), <MC>
John-NOM yesterday the paper-GEN criticism after(-at),
b. Kinoo John-ga sono ronbun-no hihan-go(-ni), <MC>
Yesterday John-NOM the paper-ACC criticism-after(-at),

2.3 Summary

In sum, the properties associated with a MC-TAC include 1) the wordhood of the head element and 2) the categorical consistency as a verbal head and projection. These properties of MC-TAC can be captured by Bresnan (1997)'s head sharing analysis. The basic idea is that a single head and its sister XP can be mapped to the same f-structure. In a MC-TAC, a verbal head and its sister (i.e. a Genitive-marked

NP) are mapped to the same f-structure, so that the verbal head can license a NC for the sister NP as an extended head at f-structure. The resultant TAC is a verbal projection headed by the verbal head at c-structure.

3. A Head Sharing Analysis

In this section, we present our proposals, explaining not only MC-marking but also NC- and VC-marking in TAC. Our proposals are based on the following assumption about case assignment. We do not assume that a head assigns a case. The correlation between category and case marking, which we observed in (1), is brought about by phrase structure. Case morphology associated with a particular kind of case such as Nom and Acc carries information about a grammatical function such as SUBJ and OBJ, which is unified with a grammatical function that a head subcategorizes for. The alleged MC-marking in TAC is a consequence of a variation in phrase structure, which is allowed by the head sharing analysis.

The structural relevance of case to category is reflected in the following assumption.

(18) **Structural Case Licensing**: A NP is licensed to have a VC (e.g. Nom(inative), Acc(usative)) under a VP/IP, while a NP is licensed to have a NC (e.g. Gen(itive)) under a NP/DP.

The result of our study on lexical integrity of the head element of TAC is reflected as the following lexical entries for an argument-taking noun, *kenkyuu* ‘research’, in (19a), temporal affixes, *-tyuu* ‘during’, and *–nosai* ‘occasion-of’, in (19b) and (19d), respectively, and their combinations, *kenkyuu-tyuu* ‘during research’ and *kenkyuu-nosai* ‘occasion of research’, in (19c) and (19e), respectively[8].

(19)a. kenkyuu: N, (↑PRED) = ‘research <SUBJ, OBJ>’
b. –tyuu: Af, (↑PRED) = ‘during<PRED>’
c. kenkyuu-tyuu: V, (↑PRED) = ‘during<research <SUBJ, OBJ>>’
d. –nosai: Af, (↑PRED) = ‘occasion-of<PRED>’
e. kenkyuu-nosai: V, (↑PRED) = ‘occasion-of<research <SUBJ, OBJ>>’

The lexical entries for a noun, *tyuu* ‘mid’ or *sai* ‘occasion’, are shown later.

Among case-markings, MC-marking is largely explained by the Extended Head Theory, which is defined as follows.

(20) **Extended Head Theory** (Bresnan 1997: 11).
(i) A functional category F0 and its sister correspond to the same f-structure.
(ii) Every lexical category has a(n extended) head.
(X is an extended head of Y if X corresponds to the same f-structure as Y, X is of the same/nondistinct category type as Y, and every node other than Y that dominates X also dominates Y.)

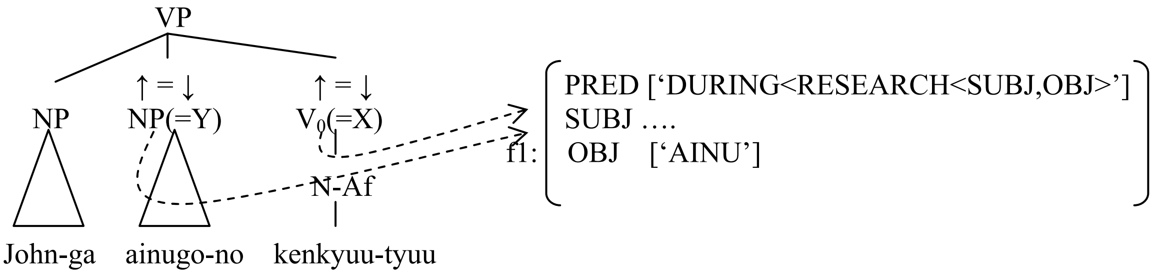
We need the following modifications, which are indicated by underlining, to define an extended head which appears in mixed category constructions (Morimoto 1996, Bresnan 1997, 2001).

(i’) A functional/<u>lexical</u> category F0/<u>L0</u> and its sister correspond to the same f-structure.
(ii’) Every lexical category has a(n extended) head.
(X is an extended head of Y if X corresponds to the same f-structure as Y, X is of the same/nondistinct category type as Y, <u>or X is a morphological derivative of a category identical/nondistinct from the phrase Y</u>, and every node other than Y that dominates X also dominates Y.)

[8] Here, the morphological structure of the affix *–nosai* is not analyzed as *–no-sai*. We will consider the morphology in Section 5.

For instance, the modified Extended Head Theory (20i',ii') applies to a MC-TAC (2c) as in (21). In (21), by (20i'), a lexical category V_0 and its sister NP correspond to the same f-structure f1. By (20ii'), the V_0 is an extended head of the sister NP because the V_0 corresponds to the same f-structure as the sister NP, the V_0 is a morphological derivative of a category identical/nondistinct from the sister NP, and every node other than the sister NP that dominates the V_0 also dominates the sister NP.

(21)



The Structural Case Licensing (18) and the modified Extended Head Theory (20i', ii') can be implemented by the following PS rules[9].

(22) **PS-rules**

a. VP →	NP*	(NP)	V
	(↑GF) =↓	↑=↓	↑=↓
	(↓CASE) = V-CASE		
b. NP →	NP*	(N)	
	(↑GF) =↓	↑=↓	
	(↓CASE) = GEN		

The general case-marking pattern as in (1) can be captured by the PS rules (22a, b) in the following manner: by the VP rule (22a), a VC (i.e. V-CASE) is licensed under a VP, while by the NP rule (22b), a NC (i.e. GEN) is licensed under a NP. Given the assumption that a head element of NC-TAC is formed by a sequence of two nouns and that of VC-TAC is a verb, the PS rules (22a, b) can also explain NC- and VC-marking in TAC as in (2a, b), because each TAC is generated by a different PS rule, (22b) or (22a), which serves to generate either a nominal or verbal projection.

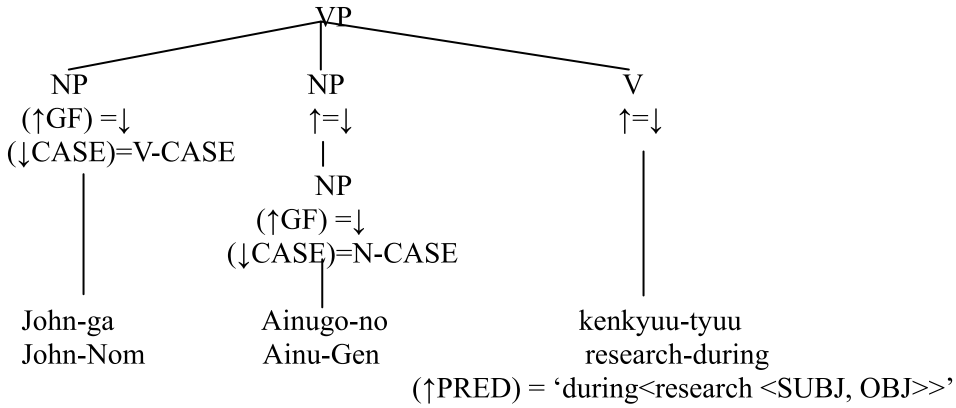
The PS-rules (22a, b) can handle even the MC-marking observed in (2c) in the same way as they handle the general case-marking pattern. A MC-TAC can be generated by plugging the NP rule (22b) into the second NP in the VP rule (22a). The functional annotation, ↑=↓, under the second NP in the VP rule (22a) suggests that the NP is mapped to the same f-structure as a head verb, so that it reflects the modified Extended Head Theory. For example, the phrase structure for (2c) can be represented in (23). Here, a NC and a VC are licensed by PS-rules (22b, a) under a nominal and a verbal projection, respectively. MC-marking in (23) is different from NC- or VC-marking in that there appears no superficial NC-licensing head in (23). The lack of c-structure head does not matter in the LFG framework, and we assume that a verbal head licenses a NC-marking on the sister NP as an extended head.

Incidentally, the PS-rules (22a, b) predict the Nominative-licensing property of MC-TAC (cf. 2.2.2). That is, they allow (13a = 2c), *John-ga ainugo-no kenkyuu-tyuu* [John-NOM Ainu-GEN research-mid], but do not allow (13b), **John-no ainugo-o kenkyuu-tyuu* [John-GEN Ainu-ACC research-mid]. A NC-marked NP, which is generated by the NP rule (22b), cannot be plugged into the first NP in the VP rule (22a), since two conflicting CASE values are attributed to the first NP.

---

[9] In (22), GF is an abbreviation of SUBJ/OBJ etc. Likewise, V-CASE in (22a) is an abbreviation of NOM/ACC/DAT. Thus, the V-CASE does not conflict with a particular CASE such as NOM, ACC, or DAT, which is introduced by constructive case specifications (cf. (24)).

(23) c-structure for (2c) without lexical insertion of argument NPs



The PS-rules (22a, b) serve to license a VC and a GEN, but they do not specify a particular kind of VC such as Nom, Acc, or Dat. The specification of individual cases is made by the **Constructive Case Theory** (Nordlinger 1997)[10], which is an application of inside-out function application to lexical entries for case particles in order “to enable case markers to carry information about the larger syntactic context in which they appear, especially information about grammatical relations (Nordlinger 1997: 6)”. For example, the major VC particles have the following lexical entries.

(24)a. –ga: (↑ CASE) = NOM
(SUBJ ↑)
b. –o: (↑ CASE) = ACC
(OBJ ↑)
c. –ni: (↑ CASE) = DAT
(OBJ_θ ↑)
d. –ni: (↑ CASE) = DAT
(OBLgoal ↑)

The inside-out function application makes it possible that an inner f-structure carrying information about a CASE value also carries information about a GF value. This technology reflects an insight in which case morphology in Japanese serves to determine a GF for the host noun.

Then, how about NC-particles? Do they also carry information about GFs? Yes, they do. Here, we follow the so-called **Functional Consistency Hypothesis** advocated by Saiki (1987), which predicts that argument-taking nouns share not only thematic structure but also functional structure of the corresponding verbs[11]. Accordingly, we assume that, even in a nominal domain, case morphology carries information about GFs. In particular, genitive *–no* carries information about SUBJ and OBJ as in (25b). Each GF is carried by a nominative *–ga* and an accusative *–o*, respectively, under a VP/IP, as in (25a). Another genitive *–eno* carries information about OBJ_θ and OBL_{goal} as in (26b) and (27b)[12]. Each GF is carried by a dative *–ni* (or a directional *–e*), under a VP/IP, as in (26a) and (27a). Though the information carried by a genitive morpheme is not specific enough to determine a particular GF, it is specific enough to distinguish a **semantically unrestricted** GF (i.e. SUBJ or OBJ) from a **semantically restricted** GF (i.e. OBJ_θ or

[10] Ohara (2000) also applies the Constructive Case Theory to her studies of light verb constructions or other constructions related to verbal nouns, including TACs.
[11] Functional Consistency is proposed to argue against Rappaport (1983)’s Thematic Consistency, which claims that a derived noun and its corresponding verb share thematic structure but do not share grammatical function. In this article, we will take a position similar to Morimoto (1999)’s OT analysis such that the facts supporting the Functional Consistency in Japanese and the facts supporting the Thematic Consistency in English emerge through a difference in constraint ranking, so that each hypothesis is valid for each language.
[12] We do not analyze *–eno* as *–e-no* until the analysis is required.

OBL_{θ}).

(25)a. John-ga ainugo-o kenkyuu-suru.
John-NOM Ainu-ACC research-do
‘John studies Ainu.’

b. John-no ainugo-no kenkyuu
John-GEN Ainu-GEN research
‘John’s research on Ainu’

(26)a. John-ga gakkoo-ni/e hon-o kihu-suru.
John-NOM school-DAT/DIR book-ACC donation-do
‘John donates his book to a school’

b. John-no gakkoo-eno hon-no kihu
John-GEN school-GEN book-GEN donation
‘John’s donation of his book to a school’

(27)a. John-ga pari-ni/e syuttyoo-suru
John-NOM Paris-DAT/DIR business.trip-do
‘John goes on business to Paris’

b. John-no pari-eno syuttyoo
John-GEN Paris-GEN business.trip
‘John’s business trip to Paris’

Another property associated with genitive morphemes is their obligatory occurrences. As the phenomena of case-drop suggests, GFs like SUBJ or OBJ can be associated with a NP which lacks a Nominative or an Accusative case particle, but cannot be associated with a NP which lacks a Genitive case particle.

(25)a’. John-(ga) ainugo-(o) kenkyuu-suru.
John-NOM Ainu-ACC research-do
‘John studies Ainu’

b’. John-*(no) ainugo-*(no) kenkyuu
John-GEN Ainu-GEN research
‘John’s research on Ainu’

(26)a’. John-(ga) gakkoo-*(ni/e) hon-(o) kihu-suru.
John-NOM school-DAT/DIR book-ACC donation-do
‘John donates his book to a school’

b’. John-*(no) gakkoo-*(eno) hon-*(no) kihu
John-GEN school-GEN book-GEN donation
‘John’s donation of his book to a school’

The contrast between the obligatory and optional occurrence of case particles can be captured by a constraining and defining equation for their morphological forms, respectively. Here, we assume that the major NC-particles have the following lexical entries.

(28)a. –no: (↑ CASE) = GEN
(GF_{unres} ↑)
(↑ CASE CASEFORM) =c NO
b.–eno: (↑ CASE) = GEN
(GF_{res} ↑)
(↑ CASE CASEFORM) =c ENO

Now, let us go back to a MC-TAC such as (2c). In the MC-TAC, a genitive-marked NP, *ainugo-no* ‘of Ainu’, carries information about a GF_{unres}, which can be unified with either SUBJ or OBJ associated with a verb, *kenkyuu-tyuu* ‘during research’[13]. The c-structure (23) can be fully represented as (29a) after lexical insertion of their arguments. The corresponding f-structure is shown in (29b).

[13] The genitive-marked NP, *ainugo-no*, can serve as an OBJ as well as a SUBJ. Only pragmatics can determine which is selected.

(29)a. c-structure for (2c) with lexical insertion

VP

NP	NP	V
(↑GF) = ↓	↑ = ↓	↑ = ↓
(↓CASE) = V-CASE	NP	
	(↑GF) = ↓	
	(↓CASE) = GEN	
John-ga	Ainugo-no	kenkyuu-tyuu
(↑PRED) = ‘John’	(↑PRED) = ‘Ainu’	(↑PRED) = ‘during<research<SUBJ, OBJ>>’
(↑CASE) = NOM	(↑CASE) =c GEN	
(SUBJ ↑)	(GF_{unres} ↑)	
	(↑ CASE CASEFORM) =c NO	

b. f-structure for (2c)

$$\left[\begin{array}{ll} \text{PRED} & [\text{‘DURING<RESEARCH<SUBJ, OBJ>>’}] \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{‘John’} \\ \text{CASE} & \text{NOM} \end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{‘Ainu’} \\ \text{CASE} & \text{GEN} \end{array}\right] \end{array}\right]$$

Lastly, let us move on to our account for NC- and VC-TACs. Our analysis of NC-TAC should reflect our morphological analysis of the head element, which consists of two nouns. We assume that a noun that has a corresponding temporal affix takes an argument-taking noun as its argument. However, the problem is that the argument NP has no case morphology if a noun like *tyuu* ‘during’ follows it (i.e. *kenkyuu tyuu* vs **kenkyuu-no tyuu* ‘during research’), while it has a genitive *–no* if a noun like *–sai* ‘occasion’ follows it (i.e. *kenkyuu-no sai* vs **kenkyuu sai* ‘on the occasion of research’). Here, we assume that a noun like *tyuu* ‘during’ does not require the complement NP to have case morphology, while a noun like *–sai* requires the complement NP to have a genitive morpheme *–no*. To capture the selectional restriction on case morphology of argument NPs, we adopt a constraining equation and a negative existential constraint for the entries of *sai* and *tyuu*. The lexical entries for items relevant to NC-TAC are shown below[14].

(30)a. kenkyuu: N, (↑ PRED) = 'research<SUBJ, OBJ>'
(↑ STEMFORM) = KENKYUU

b. -no: Af, (↑ CASE) = GEN
(GF_{unres} ↑)
(↑ CASE CASEFORM) =c NO

c. kenkyuu-no: N, (↑ PRED) = 'research<SUBJ, OBJ>'
(↑ STEMFORM) = KENKYUU
(↑ CASE) = GEN
(GF_{unres} ↑)
(↑ CASE CASEFORM) =c NO

d. tyuu: N, (↑ PRED) = 'during<OBJ>'
¬(↑ OBJ CASE CASEFORM)

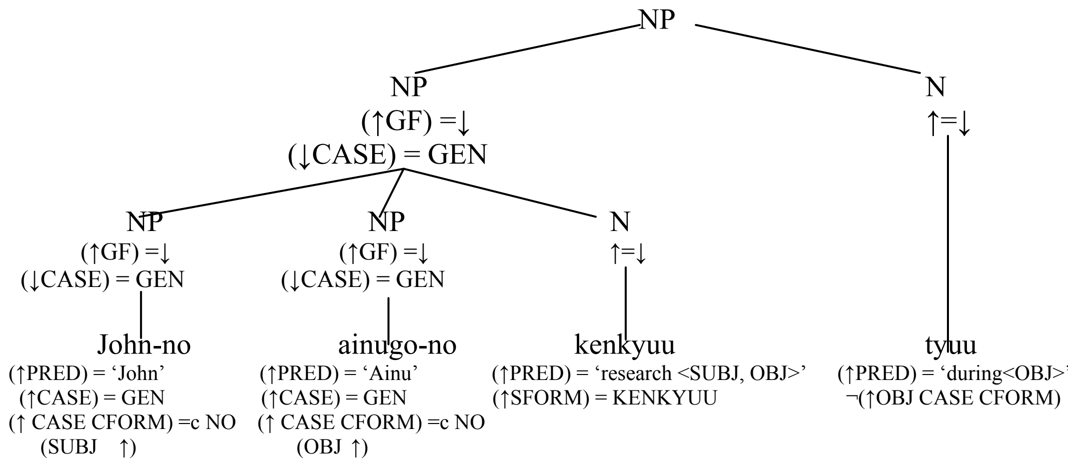
e. sai: N, (↑ PRED) = 'occasion<OBJ>'

[14] We will use SFORM or CFORM to stand for STEMFORM or CASEFORM for saving a space.

(↑ OBJ CASE CASEFORM) =c NO

Our c-structure analysis for NC-TAC as in (2a) can be represented as in (31). A NC-TAC is a nominal projection whose head consists of two nouns. An outer noun *tyuu* ‘during’ takes an argument NP headed by an inner noun *kenkyuu* ‘research’, which in turn takes its arguments. The Functional Consistency allows the inner noun to have arguments associated with a GF. The argument NPs receive a NC such as GEN(itive), because they are generated by the NP-rule (22b), which serves to license a NC for a complement NP. The Constructive Case Theory allows a genitive-marked NP to carry information about a GF, which can be unified with information about a GF associated with a head noun. As for the inner noun, it has no case morphology, though Functional Consistency allows the outer noun to have its argument associated with a GF. We assume that the inner noun itself cannot take case morphology due to the selectional restriction of the outer noun, so that it cannot carry information about a GF. Nevertheless, (31a) is legitimate since the defining equation for GEN in the NP-rule (22b) does not require but just allows an argument NP to have a GEN. The c-structure for NC-TAC (31a) can be mapped to the f-structure (31b).

(31)a. c-structure for (2a)

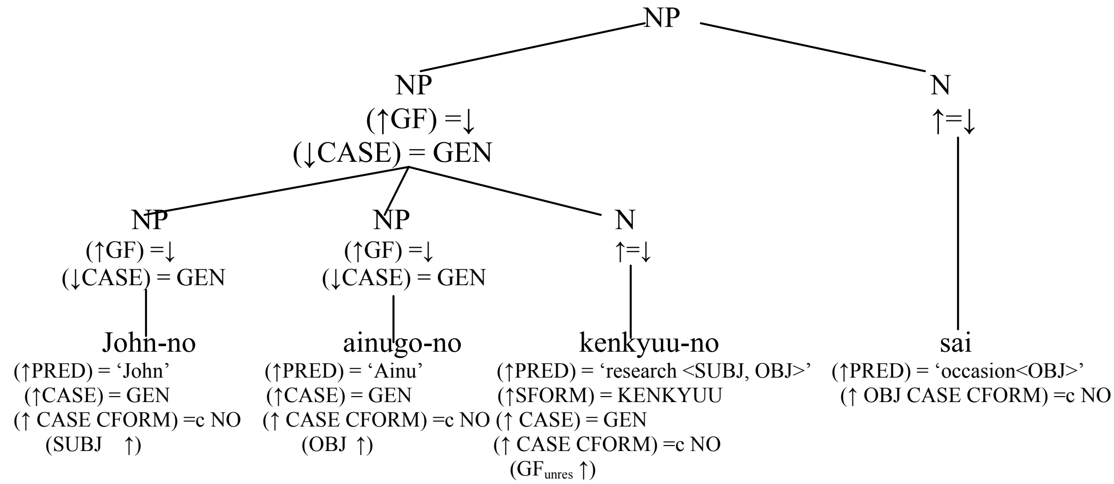


(31)b. f-structure for (2a)

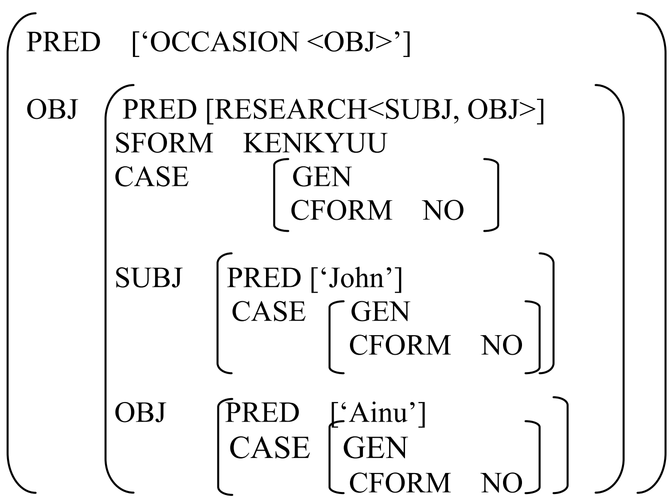
$$\begin{bmatrix} \text{PRED} & [\text{‘DURING <OBJ>’}] \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & [\text{‘RESEARCH<SUBJ, OBJ>’}] \\ \text{SFORM} & \text{KENKYUU} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & [\text{‘John’}] \\ \text{CASE} & \begin{bmatrix} \text{GEN} & \\ \text{CFORM} & \text{NO} \end{bmatrix} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & [\text{‘Ainu’}] \\ \text{CASE} & \begin{bmatrix} \text{GEN} & \\ \text{CFORM} & \text{NO} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Similarly, the c- and f-structure for a NC-TAC, *John-no ainugo-no kenkyuu-no sai* ‘on the occasion of John’s research on Ainu’ can be represented as in (32a, b). Unlike (31a, b), the inner noun *kenkyuu* ‘research’ has a genitive case particle. Functional Consistency allows the outer noun *sai* ‘occasion’ to have its argument associated with a GF. We assume that the inner noun itself must take case morphology due to the selectional restriction of the outer noun, so that it must carry information about a GF.

(32)a. c-structure for *John-no ainugo-no kenkyuu-no sai* ‘on the occasion of John’s research on Ainu’

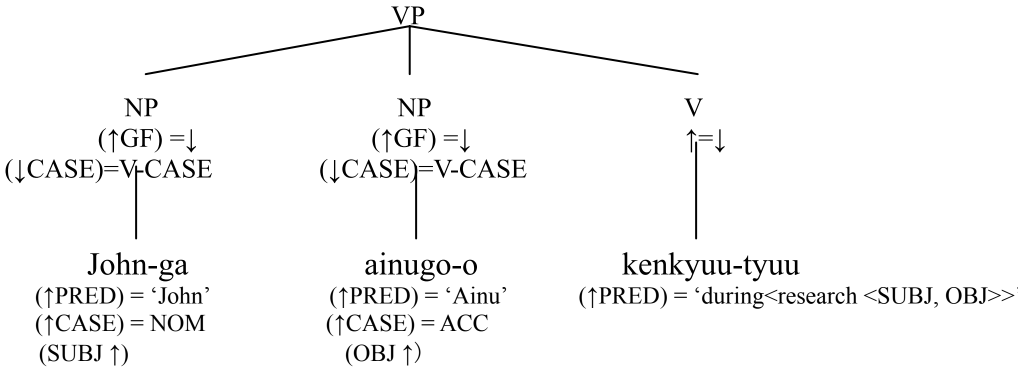


(32)b. f-structure for *John-no ainugo-no kenkyuu-no sai* ‘on the occasion of John’s research on Ainu’



Next, let us move on to our c-structure analysis for VC-TAC as in (2b). A VC-TAC is a verbal projection whose head is a verb, which inherits arguments from an argument-taking noun. The arguments are syntactically realized as VC-marked NPs, since they are generated by the VP-rule (22a), which serves to license a VC for a complement NP. The Constructive Case Theory allows a VC-marked NP to carry information about a GF, which can be unified with information about the GF associated with a head verb. The c-structure for VC-TAC (2b) can be represented in (33a). It can be mapped to the f-structure in (33b).

(33)a. c-structure for (2b)



(33)b. f-structure for (2b)

$$\left(\begin{array}{ll} \text{PRED} & [\text{‘DURING}\langle\text{RESEARCH}\langle\text{SUBJ, OBJ}\rangle\rangle\text{’}] \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{‘John’} \\ \text{CASE} & \text{NOM} \end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{‘Ainu’} \\ \text{CASE} & \text{ACC} \end{array}\right] \end{array}\right)$$

4. On the Theoretical Preference for Head Sharing Analysis

In Section 2, we saw that Bresnan (1997)’s head sharing analysis can capture the following properties of MC-TAC.

(34)a. wordhood of the head
b. categorical consistency: a verbal projection and a verbal head

In this section, we will see that other approaches cannot capture both of the properties.

4.1 Head Movement Approaches

Miyagawa (1991) claims that a temporal affix is a functional category such as ASP(ect) and an argument-taking noun moves to the position of ASP to derive a syntactically derived word. VCs such as Nom and Acc are assigned on the basis of a government-based case theory (cf. Chomsky 1981: 12), but as for a NC such as Gen, it “must be licensed by an N lexical head, so that if there is a genitive Case, the nominal head cannot raise”. This stipulation suggests that a head element of TAC cannot form a syntactically derived word in a MC-TAC. Thus, Miyagawa’s head movement approach explains MC-marking at the cost of the property (34a) at every level of grammar[15].

4.2 Lexical Approaches

So-called lexical approaches can share the view that head nouns can share a semantic property with verbs and the semantic property is responsible for VC-marking at the cost of the property (34b), following the lead of Iida (1987). She claims that a semantic feature [+aspect] associated with a temporal affix is

[15] Hoshi (1997)’s LF incorporation analysis can also be taken as a kind of head movement analysis. Like Miyagawa’s account, it assumes that a head element does not form a syntactically derived word in a MC-TAC.

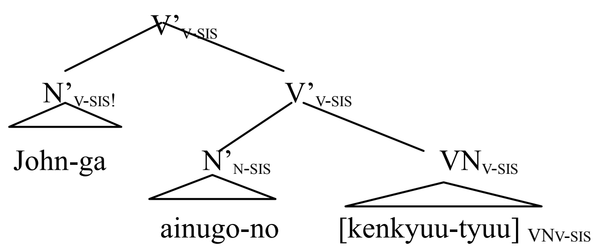
inherited by an entire head noun, which can consequently have a verbal argument structure, the source of VC-marking.

Sells (1990) explains MC-marking in TACs by distinguishing subcategorization from thematic structure (cf. Rappaport 1983). A head nominal (e.g. *kenkyuu-tyuu* 'during research') itself is associated with a thematic structure such as <Agent, Theme> and four possibilities for subcategorization (i.e. a lexical specification of syntactic realizations of arguments eligible to receive VCs: <VC, VC>, <NC, NC>, <VC, NC>, <NC, VC>). Mixed case marking is made possible if only the first argument in the thematic structure is subcategorized for as a syntactically realized (verbal) argument (i.e., <VC, NC>). For Sells, the head element of TAC is a noun and the entire TAC is a nominal projection. This view is incompatible with the property (34b).

Manning (1993)'s lexical underspecification (cf. Malouf (2000)'s type hierarchy) can serve to explain MC-marking in a TAC as well as the distinction of categorial from combinatoric information and of selection from subcategorization. As shown in (35), a lexically underspecified category such as VN (e.g., *kenkyuu-tyuu* 'during research') heads a verbal projection, based on their combinatoric information, V-SIS. Nevertheless, the VN can take a NC-marked argument *ainugo-no* 'of Ainu', since it is a lexically underspecified category which is sort-compatible with N and V and its argument phrase only selects for an N sister. The resultant phrase *ainugo-no kenkyuu-tyuu* 'during research on Ainu' can take a VC-marked subject argument *John-ga*, since it is a verbal projection and the subject phrase must specify a V sister.

Manning's account is apparently compatible with the property (34b) in that it assumes a verbal projection for a MC-TAC. Nevertheless, the head VN in (35) must be sort-compatible with nouns, so that the account wrongly predicts that the head VN can be modified by adjectives. Thus, Manning's account cannot capture the verbal property of the head of MC-TAC and does not reflect the property (34b).

(35)



4.3 Phrasal Coherence Approaches

Sells (1996) explains MC-marking in a TAC on the basis of the Dual Lexical Category Theory (cf. Lapointe 1993). A head element is taken as $<V|N>^0$ which heads an external verbal projection and an internal nominal projection. This account can capture the so-called phrasal coherence (Malouf 2000) in that there appears to be an articulating point between categorically distinct projections in mixed category constructions across languages. However, since this account tries to capture phrasal coherence at c-structure, it is also incompatible with the property (34b), since it assumes that both verbal and nominal projections are involved in a MC-TAC. Also, as for modification by adjuncts, the account wrongly predicts that the head element is modified by adjectives due to the internal nominal projection. Although our head sharing analysis is also taken as a phrasal coherence approach, but it tries to capture the phrasal coherence at f-structure. Our head sharing analysis does not involve an inner nominal projection headed by the element that heads an external verbal projection at c-structure.

5. On the Morphology and Sub-Lexical Semantics of Head Elements in TACs

Our primary goal in this paper (i.e. an account for case markings in TAC) has been achieved thus far. In this section, we discuss some problems brought about by our head sharing analysis.

A problem for our analysis is the morphology of head elements in TACs, since we deal with different types of temporal affixes identically, and since we assume that an element that has been called a (temporal) affix can serve as a full-fledged word. Typical temporal affixes (e.g. *–tyuu* 'during') must be directly concatenated with their preceding nouns, while periphrastic affixes need an intervening morpheme *–no* between themselves and the preceding nouns. Since the morpheme *–no* is superficially identical to a genitive case-marker, it raises the following questions related to case marking. The first question is whether some nouns can do without receiving or assigning NCs. This question is raised when we consider the morphology of the head element in NC-TACs, as shown below.

(35)a. $[_{NP}$ $[_{NP}$ $[_{N}$ kenkyuu]][$_{N}$ tyuu]]
b. $[_{NP}$ $[_{NP}$ $[_{N}$ kenkyuu]]-no $[_{N}$ sai]]

In NC-TACs, their head element consists of two nouns, an inner argument-taking noun (i.e. *kenkyuu* 'research') and an outer (temporal) noun (*tyuu* 'during', *sai* 'occasion'). If a typical temporal affix serves as a head noun of a NC-TAC as in (35a), an inner argument-taking noun cannot be NC-marked in spite of the fact that the inner noun serves as an argument of the outer noun.

The question about NC-assignment in a nominal projection is not a serious problem for our analysis, since we do not assume that a NC is assigned by a nominal head but that it is licensed by phrase structure. In (35a), the outer noun selects an argument NP which has no case morphology. Moreover, even those who assume the case assignment by a nominal head might be able to conceive the fact as suggesting that NC-assignment is optional, unlike obligatory VC-assignment. In any case, further investigation is needed to give a satisfactory account for the question.

The other question is whether case marking can take place within a word. This question is raised when we consider the morphology of the head element in VC- or MC-TACs, as shown below.

(36)a. $[_{VP}$ $[_{V}$ kenkyuu-tyuu]]
b. $[_{VP}$ $[_{V}$ [kenkyuu]-no [sai]]]

In VC-TACs, their head element serves as a single verb. If a VC-TAC takes a periphrastic temporal affix as a part of the head element, the affix appears to assign a NC to its host N within the head verb, as in (36b).

It is beyond the scope of this paper to answer this question, but one might be able to pursue the following possibilities. One possibility is that the morpheme *–no* is not a case particle, but a pre-nominal form of the copula (Iwasaki 1999), though this analysis might leave further questions about word formation in (36b). Another possibility is to permit case marking within a word. It is not impossible to pursue this possibility if we consider cross-linguistic facts (Blake 2001: 104-109) or genitive compounds in English or other languages (Shimamura 2001, Hoekstra 2002). However, this possibility might not be preferable within a LFG framework until case marking is proven to be a lexical process.

In addition to the questions raised above, one might wonder whether a lexical item can behave as either an affix or a word (i.e. head elements in VC-/MC-TACs vs. NC-TACs), and whether two nominal elements can derive a verb (i.e. head elements in VC-/MC-TAC)[16]. Besides, one can ask a question about constraints on morphological derivatives. That is, one might ask what kind of verbalization/ nominalization allows extended heads. Or, one can seek the source of extended heads in their sub-lexical semantics, following the lead of Iida (1987), since the phenomena of mixed case marking are relevant to a range of head elements such as argument-taking nouns and verbalizing elements. We leave these questions open. Also, we leave further investigation of mixed case marking or mixed categories for future research. Due to space limitations, we cannot touch upon other constructions which involve mixed case marking or mixed categories in Japanese or other languages such as Verbalized Nominalization Constructions (Morimoto 1996, Bresnan 1997), Purpose Expressions (Miyagawa 1987, Matsumoto 1996), TACs in Korean (Lee 1993), Light Verb Constructions (Grimshaw and Mester 1988), some copula constructions in

[16] These questions were raised by Peter Sells and Stephen Wechsler (p.c.).

Japanese and Korean (Sells 1996, Yoon 2002), and some nominalization constructions in Japanese and Korean (Kikuta 2002, Chun et al. 2001). Also, in relation to TACs, we can ask whether and how they are related to the so-called post-syntactic compounds (Shibatani and Kageyama 1988).

6. Conclusion

In this paper, we claimed that, to account for mixed case marking in Japanese temporal affix constructions, a head sharing analysis is empirically preferable to other rival approaches. In addition, our theory of case can explain not only mixed case marking but also verbal and nominal case marking in a consistent way.

Appendix

As we suggested in section 2.1.3, among the criteria of lexical integrity, conjoinability and gapping are sensitive to phonological wordhood, which is irrelevant to our discussion. They show a difference between two types of temporal affixes, typical and periphrastic, rather than a difference in wordhood of the head elements[17]. Thus, we cannot see a contrast between NC-TAC and VC-/MC-TAC in the following data. On the one hand, the conjoinability is used to show that a stem and an affix cannot be coordinated, though full-fledged words can (e.g. **Mary outran and –swam Bill.* vs *Mary outran and outswam Bill*). Argument-taking nouns and typical temporal affixes cannot be coordinated in VC-TACs, while argument-taking nouns and periphrastic affixes marginally can[18]. Moreover, the periphrastic affixes become more independent from their preceding argument-taking nouns in NC-/MC-TACs.

(37)a. *John-ga ainugo-o kenkyuu to tyoosa-tyuu [VC]
John-NOM Ainu-ACC research and survey-mid
'during John's research and survey of Ainu'

b. ?John-ga ainugo-o kenkyuu to tyoosa no sai [VC]
John-NOM Ainu-ACC research and survey GEN occasion
'on the occasion of John's research and survey of Ainu'

(38)a. *John-no ainugo-no kenkyuu to tyoosa-tyuu [NC]
John-GEN Ainu-GEN research and survey-mid
'during John's research and survey of Ainu'

a'. *John-ga ainugo-no kenkyuu to tyoosa-tyuu, [MC]
John-NOM Ainu-GEN research and survey-mid
Mary-ga ronbun-o kaita.
Mary-NOM paper-ACC wrote
'Mary wrote a paper during John's research and survey of Ainu'

b. John-no ainugo-no kenkyuu to tyoosa no sai [NC]
John-GEN Ainu-GEN research and survey GEN occasion
'on the occasion of John's research and survey of Ainu'

b'. John-ga ainugo-no kenkyuu to tyoosa no sai, [MC]
John-NOM Ainu-GEN research and survey-GEN occasion,

[17] According to the phonological wordhood, hyphenation for head elements of TACs in the Appendix is different from that in the body of this paper.

[18] Here, we do not deal with sub-lexical coordination, which involves *oyobi* 'and' (Kageyama 1993) or *naisi* 'or' (Sato 1998). Both coordinators can coordinate only an argument-taking noun which is a part of head elements of TACs (e.g. *kenkyuu oyobi tyoosa tyuu* 'during a study and a survey').

Mary-ga ronbun-o kaita.
Mary-NOM paper-ACC wrote
'Mary wrote a paper on the occasion of John's research and survey of Ainu'

On the other hand, gapping is used to show that ellipsis cannot be applied to part of a word (e.g. **John outran Bill and Mary –swam Patrick* vs *John outran Bill and Mary, Patrick*). Typical affixes cannot be gapped in VC-TACs (14a), while periphrastic ones can marginally (14b). Periphrastic affixes become more independent from their preceding argument-taking nouns in NC-/MC-TACs.

(39)a. *John-wa ainugo-o kenkyuu-~~tyuu~~, Mary-wa suwahirigo-o tyoosa-tyuu,
John-TOP Ainu-ACC research-~~mid~~, Mary-TOP Swahili-ACC survey-mid,
ronbun-o kaita. [VC]
paper-ACC wrote.
'John wrote a paper during his study of Ainu and Mary did so during her survey of Swahili.'

b. ?John-wa ainugo-o kenkyuu ~~no sai~~,
John-TOP Ainu-ACC research ~~GEN occasion~~,
Mary-wa suwahirigo-o tyoosa no sai, ronbun-o kaita. [VC]
Mary-TOP Swahili-ACC survey GEN occasion, paper-ACC wrote
'John wrote a paper on the occasion of his study of Ainu and Mary did so on the occasion of her survey of Swahili.'

(40)a. *John-wa ainugo-no kenkyuu-~~tyuu~~, [NC/MC]
John-TOP Ainu-GEN research-mid,
Mary-wa suwahirigo-no tyoosa-tyuu, ronbun-o kaita.
Mary-TOP Swahili-GEN survey-mid, paper-ACC wrote.
'John wrote a paper during his study of Ainu and Mary did so during her survey of Swahili.'

b. John-wa ainugo-no kenkyuu ~~no sai~~, [NC/MC]
John-TOP Ainu-GEN research GEN occasion,
Mary-wa suwahirigo-no tyoosa no sai, ronbun-o kaita.
Mary-TOP Swahili-GEN survey GEN occasion, paper-ACC wrote
. 'John wrote a paper on the occasion of studying Ainu and Mary did so on the occasion of surveying Swahili.'

The data on conjoinability and gapping suggest a phonological difference between the two types of temporal affixes. That is, the typical affixes must be phonologically dependent on the host nouns, while the periphrastic affixes can be taken as phonologically full-fledged words. The phonological problem of conjoinability and gapping is also pointed out by Bresnan and Mchombo (1995). To solve the problem, they propose a prosodic ellipsis analysis. For example, the apparent counterexamples to conjoinability and gapping in (41) can be explained by assuming prosodically conditioned ellipsis as in (42).

(41)a. infra e ultrasuoni 'infra and ultra-sounds' (Italien)
b. Freund oder Feindschaft 'friendship or hostility' (German)

(42)a. $(\text{infra})_w$__ e ultrasuoni
b. $(\text{Freund})_w$__ oder Feindschaft

The same analysis can be applied to periphrastic temporal affixes as in (18).

(43) (kenkyuu)$_w$__to tyoosa no sai 'on the occasion of research and survey'

The prosodic ellipsis analysis for the periphrastic temporal affixes is supported by the following fact. In general, a word accent can be altered only if the status of the word is demoted to a part of a word (e.g. *ka'ta* 'shoulder' + *tataki* 'patting' → *kata-ta'taki* 'shoulder-patting'). An argument-taking noun like *tyoosa* 'survey' as in (44a) preserves its word accent pattern, which is indicated by a pitch fall ('), if the noun is followed by a periphrastic temporal affix as in (44b), whereas the word accent is altered if the noun is followed by a typical temporal affix as in (44c). Therefore, the periphrastic affix can be taken as a phonological word, while the typical one cannot.

(44)a. tyo'osa
'a survey'

b. tyo'osa no sai
survey GEN occasion
'on the occasion of a survey'

c. tyoosa-tyuu
survey-mid
'during a survey'

References

Baker, Mark. 2003. *Lexical Categories*. Cambridge University Press.

Blake, Barry J. 2001. *Case* [Second Edition]. Cambridge University Press.

Bresnan, Joan. 1997. Mixed Categories as Head Sharing Constructions. In Butt, Miriam and Tracy Holloway King (eds.) *Proceedings of the LFG 97 Conference*. CSLI Publications.

Bresnan, Joan. 2001. *Lexical-Functional Syntax*. Blackwell Publishers.

Bresnan, Joan, and Sam A. Mchombo. 1995. The Lexical Integrity Principle: Evidence from Bantu. *Natural Language and Linguistic Theory* 13: 181-252.

Chomsky, Noam. 1981. *Lectures on Government and Binding*. Foris.

Chun, Chan, Jong-Bok Kim, Byung-Soo Park, and Peter Sells. 2001. Mixed categories and multiple inheritance hierarchies in English and Korean gerundive phrases. *Language Research* 37-4: 763-797.

Grimshaw, Jane and Armin Mester. 1988. Light Verbs and Theta Marking. *Linguistic Inquiry* 19: 205-232.

Horiuchi, Hitoshi. 2004. Extended Heads and Mixed Case Marking in Japanese. *Proceedings of the 2004 LSK International Conference, Vol 1: Forum Lectures and Workshops*. The Linguistic Society of Korea.

Hoshi, Hiroto. 1997. Incorporation in Syntax and LF: the case of light verb constructions and temporal affix constructions in Japanese. In H. Sohn and J. Haig, eds., *Japanese/Korean Linguistics* vol. 6: 473-491. CSLI.

Hoekstra, Jarich. 2003. Genitive Compounds in Frisian as Lexical Phrases. *Journal of Comparative Germanic Linguistics 6*: 227-259. Kluwer Academic Publishers.

Iida, Masayo. 1987. Case-Assignment by Nominals in Japanese. In M. Iida, S. Wechsler, and D. Zec (eds.), *Working Papers in Grammatical Theory and Discourse Structure: Interactions of Morphology, Syntax, and Discourse*, 93-138. Stanford, CSLI.

Iwasaki, Yasufumi. 1999. *Three Subclasses of Nouns in Japanese*. Ph.D Diss. University of Illinois at Urbana-Champaign.

Kageyama, Taro. 1993. *Bunpoo-to gokeisei [Grammar and Word Formation]*. Hituzi Shobo.

Kageyama, Taro. 1999. Word formation. In Tsujimura, Natsuko (ed.), *The Handbook of Japanese Linguistics*. Blackwell.

Kikuta, Chiharu. 2001. *Ga-no kootaigensyoo-no hihaseitekibunseki: jutsugorentaikei-no meisisei*. [*Ga-no* conversion in the new light: A non-derivational, mixed category analysis]. *Doshisha Studies in*

English 74: 93-136.
Lapointe, Steven G. 1993. Dual Lexical Categories and the Syntax of Mixed Category Phrases. In *Proceedings of ESCOL 93*: 199-210.
Lee, Young-Suk. 1993. Case Alternation and Word Order Variation in Nominal. In Patricia M. Clancy (ed.), *Japanese/Korean Linguistics vol 2*: 464-480. CSLI Publications.
Malouf, Robert P. 2000. *Mixed Categories in the Hierachical Lexicon*. CSLI Publication.
Manning, Christopher. 1993. Analyzing the verbal noun: internal and external constraints. *Japanese/ Korean Linguistics 3*: 236-53. Stanford, CSLI.
Martin, Samuel E. 1975. *A Reference Grammar of Japanese*. Yale University Press.
Matsumoto, Yo. 1996. *Complex Predicates in Japanese*. CSLI & Kurosio.
Miyagawa, Shigeru. 1987. Restructuring in Japanese. In Imai, Kunio and Mamoru Saito (eds.), *Issues in Japanese Linguistics* 273-300. Dordrecht: Foris.
Miyagawa, Shigeru. 1991. Case realization and scrambling. Ms. Ohio State University.
Morimoto, Yukiko. 1996. Nominalization or Verbalization?: Analyzing Mixed Case Marking in Japanese. Ms. Stanford University.
Morimoto, Yukiko. 2000. Argument Structure Linking of Nominals in English and Japanese. *Proceedings of the Texas Linguistics Society 99*.
Nordlinger, Rachel. 1997. Morphology building syntax: constructive case in Australian languages. In Miriam Butt and Tracy Holloway King (eds.), *Proceedings of the LFG97 Conference*. CSLI Publications.
Ohara, Masako. 2000. *An Analysis of Verbal Nouns in Japanese*. Ph. D diss. University of Essex.
Rappaport, Malka. 1983. On the Nature of Derived Nominals. In Levin, Lorraine, Malka Rappaport, and Annie Zaenen (eds.), *Papers in Lexical Functional Grammar*. Indiana University Linguistics Club.
Saiki, Mariko. 1987. *Grammatical Functions in the Syntax of Japanese Nominals*. Ph. D. diss. Stanford University.
Sato, Yutaka. 1998. Some evidence for a zero light verb in Japanese. In M. Nakayama and C. Quinn (eds.), *Japanese/Korean Linguistics 9*: 365-378. CSLI.
Sells, Peter. 1990. More on light verbs and theta marking. Ms. Stanford University.
Sells, Peter. 1995. Korean and Japanese morphology from a lexical perspective. *Linguistic Inquiry* 26, 277-325.
Sells, Peter. 1996. Case, Categories and Projection in Korean and Japanese. In *Proceedings of 1996 Seoul International Conference on Generative Grammar*.
Sells, Peter. 2003. Mismatches between Morphology and Syntax in Japanese Complex Predicates. Ms. Stanford University.
Shibatani, Masayoshi, and Taro Kageyama. 1988. Word formation and modular theory of grammar: postsyntactic compounds in Japanese. *Language 64*, 3, 451-484.
Shimamura, Reiko. 2000. Lexicalization of Syntactic Phrases: The Case of Genitive Compounds like *Woman's Magazine*. Available at http://coe-sun.kuis.ac.jp/coe/public/paper/outside/shimamura2.pdf.
Yoon, James. 2002. What the Korean Copula Reveals about the Interaction of Morphology and Syntax. In *Japanese/Korean Linguistics vol. 11*. CSLI Publication.

BINDING IN PICTURE NPs REVISITED:
EVIDENCE FOR A SEMANTIC PRINCIPLE OF EXTENDED ARGUMENT-HOOD

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ABSTRACT – This paper investigates the distribution of pronouns and anaphors in picture NPs (cf. Keller & Asudeh 2001; Runner et al. 2003). I discuss the predictions of current LFG and HSPG binding theories, none of which make the right predictions. I present new results showing that the acceptability of pronouns is influenced by AGENTIVITY. That is, pronouns are less acceptable if their binder bears the agent-role of the predicate that also assigns an argument-role to the pronoun. This result is discussed with regard to the well-known constraints on pronoun against binding a co-argument. In light of recent findings by Kaiser et al. (2004a,b), the result raises the question whether AGENTIVITY of the binder is a factor in binding beyond the domain of picture NPs. On the methodological side, the current study shows that acceptability judgments – if properly elicited under well-controlled conditions – can provide meaningful linguistic insights.

I Introduction*

Early generative approaches to binding theory (cf. Jackendoff 1972) predicted strict complementarity of pronouns (e.g. *him*, *our*) and anaphors (e.g. *himself*, *ourselves*). For example, Chomsky (1981:188) defined the well-known principle A and principle B (I am not concerned with principle C here) as follows:

Principle A – An anaphor must be bound within its Governing Category.
Principle B – A pronoun must be free within its Governing Category.

Without going into detail as to the definition of Governing Category, it is clear that Chomsky's account predicts anaphors and pronouns to be in strictly complementary distribution (for a recent account that predicts complementarity, see Kiparsky 2002). However, Huang (1983) provides examples like (1a,b) to show that pronouns (here *their*) and anaphors (here *each other*) do not have to be in complementary distribution.

(1) a. They$_i$ saw [each other$_i$'s friends]
    b. They$_i$ saw [their$_i$ friends]

This lead Chomsky (1986) to revise principle A and B to incorporate the asymmetry in the relevant domains for pronouns and anaphors. The intuition behind Chomsky's revision is that, for the anaphor in (1a), it is the whole sentence that forms its binding domain (i.e. the "Complete Functional Complex"), whereas, for the pronoun in (1b), it is the NP *their friends* that forms the relevant domain.[1] In other words, the anaphor in (1a) has to be bound within the sentence (which it is) and the pronoun has to be free within the NP (which it is).

The idea to account for apparent cases of non-complementarity by means of asymmetries in the domain restrictions has also been incorporated into LFG binding theories (e.g. Bresnan 2001; Dalrymple 1993, 2001) although the implementation is slightly different in spirit.

[*] I would like to thank Paul Kiparsky for sharing his intuition with me that agentivity is a determining factor for the acceptability of pronouns in picture NPs. I am grateful for discussions with and feedback from, especially, Ash Asudeh, Elizabeth Coppock, Dan Jurafsky, David Oshima, Ivan Sag, and Joan Bresnan, as well as several members of the LFG04 audience. As always, none of the above mentioned researchers necessarily shares the views presented here and all remaining mistakes remain mine, mine, mine. Finally, I am extremely grateful to my sponsors for making it possible for me to attend the conference and to visit the beautiful country of New Zealand.

[1] For a complete discussion of the formal implementation of this intuition, I refer the reader to Chomsky (1986) or to a recent overview by Everaert (2003).

A different approach is taken by HPSG binding theories (e.g. Pollard & Sag 1992, 1994; Manning & Sag 1998; Asudeh 1998) and, independently, by Reinhart and Reuland (1993). The core of this alternative is the idea of *exemption* – an anaphor *only* has to be bound by a dominating coargument if there is such a coargument.

In this paper, I investigate binding in the empirical domain of picture NPs. Picture NPs have received a lot of attention in the literature on binding because of the violations of core binding constraints (like Principle A and B) they seem to facilitate. More recently, empirical studies have also shown that picture NPs seem to facilitate non-complementary distribution of pronouns and anaphors. For example, Keller & Asudeh (2001) and Runner et al. (2002) have shown (2a) and (2b) to be equally grammatical while (3a) and (3b) aren't. In (2a) and (3a), the subject of the sentence binds a *pronoun*. In (2b) and (3b), the subject of the sentence binds an *anaphor*

Binding in picture NPs with a syntactic possessor

(2) a. *John*$_i$ finally saw Mary's picture of *him*$_i$.
b. *John*$_i$ finally saw Mary's picture of *himself*$_i$.

Binding in picture NPs without a syntactic possessor

(3) a. **John*$_i$ finally painted a picture of *him*$_i$.
b. *John*$_i$ finally painted a picture of *himself*$_i$.

The lack of a contrast between (2a) and (2b) is in conflict with accounts that predict strict complementarity of pronouns and anaphors (e.g. Chomsky 1981; Kiparsky 2002). But the examples in (2) and (3) are also problematic for any current state-of-the-art binding theory in LFG and HSPG, all of which do allow non-complementary distribution of pronouns and anaphors. Binding theories building on the notion of exemption (Pollard & Sag 1992, 1994; Reinhart & Reuland 1993; also Asudeh 1998; Manning & Sag 1998) wrongly predict (2b) to be ungrammatical and (3a) to be grammatical. Current LFG binding theories, which do not include a notion of exemption, (e.g. Bresnan 2001; Dalrymple 2001) make the right predictions for examples like (2a,b) and (3b), but they make the wrong predictions for examples like (3a).[2]

In this paper, I present new evidence from the study of binding in picture NPs. I show that *agentivity of the binder* is a determining factor for the acceptability of examples like (2) and (3). I propose that pronouns are ungrammatical in examples like (2a) and (3a) if the binder is interpreted as the agent/creator of the picture NP. The ungrammaticality of pronouns in such cases is then reduced to the fact that they would be bound by a co-argument. In other words, what matters for the grammaticality of a pronoun in examples like (2a) and (3a) is the semantic interpretation of the binder with respect to the picture NP's argument structure.

The remainder of this paper is organized as follows. Section II defines the empirical domain investigated in this paper and provides an overview of previous empirical studies, the employed methodology and the results. Section III summarizes the relevant predictions made by current binding theories in HSPG and LFG. Although the conclusions of the current paper pertain to principles that govern the distribution of pronouns, I will provide all necessary background for anaphors as well, since I take it to be impossible to understand the binding behavior of one kind of pronominal without understanding the other.[3] Section IV discusses previously suggested refinements to current binding theories, especially the *Pronoun Distribution Principle* (Asudeh & Keller 2001) and sets the ground for the experimental hypotheses considered in this paper. Section V spells out the hypotheses, presents the experiment, and discusses its results. Finally, Section VI summarizes the conclusions.

[2] The reasoning behind the above-mentioned predictions will be provided in Section III.
[3] Throughout this paper, I use the term pronominal to refer to pronouns and anaphors together.

II The empirical domain of picture NPs

Throughout this paper, I'll use the term picture NPs to refer to an NP that is (a) headed by a representational noun like *picture*, *book*, *painting*, etc., and (b) optionally contains the arguments of the head noun, as in, e.g., *a picture of John*, *Chomsky's book*, or *the film about Carl*. Although the study I present in Section V focuses on picture NPs with both possessors and *of*-PPs, as in *Andy Warhol's print of Marilyn Monroe* (cf. (2) and (3) above), the findings should generally extend to other picture NPs with arguments headed by case-marking prepositions, as in, e.g., *the story about Kasper Hauser*.

Due to their theoretical significance picture NPs have received a fair amount of attention in the empirically oriented literature on binding. Most relevant for the current discussion are two series of studies by Keller & Asudeh (2000, 2001; based on Keller 2000) and Runner and his colleagues (Runner 2000; Runner et al. 2002, 2003). Before I present their results, I briefly address some methodological issues.

Keller & Asudeh (2000, 2001) used an offline judgment task paradigm to elicit normalized acceptability ratings. Runner and his colleagues used a more complicated but also more sensitive online decision task paradigm. They used eye-tracking to determine which candidates in a visual context were considered as binders. In this paradigm, participants were looking at a board with pictures of discourse referents while listening to short, task-oriented monologues that referred to one or more of those referents. In addition to the board with pictures, several dolls depicting the same referents as those shown on the pictures were placed in front of participants. The monologues instructed participants to pick up a certain doll and to touch a certain picture with it. A minimal pair of example monologues is shown below:

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(4)  a. Look at Joe. Have Ken touch Harry's picture of him.
     b. Look at Joe. Have Ken touch Harry's picture of himself.
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As shown above, the discourses contained an anaphor or pronoun. Runner and his colleagues tracked participants' eye-movements while they heard the pronominal to determine which of the discourse referents (depicted in the pictures) was taken to be the binder of – and therefore co-indexed with – that pronominal. This methodology enabled Runner et al. to tap directly into the resolution process without having any interference due to participants being asked for conscious judgments about the acceptability of sentences (for a critical review of the merits and limits of acceptability judgments, see Schütze 1996). Conveniently, Runner et al.'s results confirm the results of the much simpler offline judgment studies by Keller & Asudeh (2000, 2001). This argues that Keller & Asudeh's methodology is sufficiently sensitive and stable for investigations of binding in picture NPs. This is relevant to the current paper because the experiment presented below in Section V employs the same methodology as Keller & Asudeh's studies. Below, I therefore limit myself to summarizing Keller & Asudeh results.

Keller & Asudeh (2000, 2001) asked participants to rate each sentence with respect to a reference sentence (which was the same for all trials and participants). This procedure, called magnitude estimation (Stevens 1975), has been shown to produce reliable results for linguistic acceptability judgments (e.g. Bard et al. 1996; Cowart 1997) and WebExp (Keller et al. 1998), the software package used by Keller & Asudeh for their experiments, has successfully been employed in numerous linguistic studies.[4] Sentences were presented in random order with minimal pairs never occurring adjacent to each other. To distract participants from the real purpose of the study, half of the stimuli were fillers.

[4] See Keller 2000 for a detailed discussion of magnitude estimation, the use of acceptability judgments in linguistic research, and the WebExp software package. See http://www.language-experiments.org for a list of current and past linguistic studies employing the WebExp software package and magnitude estimation.

The minimal stimulus pair that most of the discussion in this paper is concerned with, is given below (for both pronouns and anaphors). Whereas in (5) a possessive phrase intervenes between the pronouns and its binder (the subject), this is not the case in (6).[5]

Binding in picture NPs: Subject binds; intervening possessor

(5) a. *John*$_i$ finally saw Mary's picture of *him*$_i$.
    b. *John*$_i$ finally saw Mary's picture of *himself*$_i$.

Binding in picture NPs: Subject binds; no intervening possessor

(6) a. **John*$_i$ finally painted a picture of *him*$_i$.
    b. *John*$_i$ finally painted a picture of *himself*$_i$.

Comparing the mean normalized judgments for examples like (5) and (6), Keller & Asudeh observed (as indicated in the examples) that (a) anaphors were perfectly grammatical regardless of whether there was an intervening possessor in the picture NP or not; (b) pronouns were only grammatical if there was an intervening possessor in the picture NP. Prima facie, both of these findings are surprising. With respect to (a), under the assumption that the possessor is the subject of the picture NP, anaphors should have to be bound within the picture NP.[6] With respect to (b), under the assumption that the picture NP forms a Complete Functional Complex (i.e. contains all its thematic roles) in both (5) and (6), a subject-bound pronoun would be free in the Complete Functional Complex and should therefore be grammatical. Less surprisingly, Keller & Asudeh further observed that anaphors but not pronouns were grammatical if bound by the possessor, as in the following example:

Binding in picture NPs: Possessor binds

(7) a. *Mary finally saw *John*$_i$'s picture of *him*$_i$.
    b. Mary finally saw *John*$_i$'s picture of *himself*$_i$.

Keller & Asudeh's observations (2000, 2001), also supported by Runner et al. (2003), are summed up in Table 1. In the examples discussed above, pronouns are as acceptable as anaphors (indicated by '~' in Table 1 and throughout the paper) only if bound by the subject with an overt intervening possessor. In all other cases under discussion anaphors are significantly more acceptable than pronouns (indicated by '>').[7]

Intervener / Binder	Yes	No
Possessor	ANA > *PRO	–
Subject	ANA ~ PRO	ANA > *PRO

TABLE 1 – Results of Keller & Asudeh (2000, 2001) and Runner et al. (2003)

Before I discuss the predictions of existing HPSG and LFG binding theories in light of the results in Table 1, I introduce one additional observation made in Keller & Asudeh (2000, 2001). Rather than being a special case (as suggested in Asudeh & Keller 2001), this observation, I argue below, provides a highly relevant insight into binding in picture NPs. Keller & Asudeh (2001)

[5] In the experiments conducted by Keller & Asudeh (2000, 2001), the set of sentences that contained overt possessors differed from the set of sentences without an overt possessor in terms of the types of verbs used. Keller & Asudeh investigated the effect of different aspectual classes of verb for sentences without a possessor but only used achievement verbs (e.g. *saw*, *found*) for sentences with overt possessors. I will come back to this difference below.

[6] For a recent discussion of the analysis of possessors (in terms of their argument-role and their syntactic/c-structural position), see Alexiadou et al. (to appear).

[7] The '*' in Table 1 indicates ungrammaticality. The criteria for ungrammaticality will be addressed and slightly revised in Section IV.

observed that the bad mean acceptability ratings for subject-bound pronouns in the absence of a possessor (as in e.g. (6a)) were significantly improved when the verb wasn't a "+existence accomplishment verb" (henceforth 'creation verb' or '+creation verb'), as in (8a), but a -existence accomplishment or an achievement verb (henceforth grouped together under the label '-creation verb'), as in (8b).

(8) a. **John*$_i$ painted a picture of *him*$_i$.
b. *John*$_i$ found/burned a picture of *him*$_i$.

Keller & Asudeh (2000, 2001) originally analyzed this effect as due to the aspectual class of the verb. Later, Asudeh & Keller (2001) proposed an account that makes reference to complex predicates. I will discuss their proposal in Section IV. In Section V, I propose an alternative analysis based on semantic roles and argument structure. For now, it suffices to point out that all current standard HPSG (e.g. Pollard & Sag 1994; Manning & Sag 1998) and LFG (e.g. Bresnan 2001; Dalrymple 2001) binding theories remain agnostic about the effect of creation verbs.

III Predictions of HPSG and LFG binding theories

In this section, I summarize the core concepts of current HPSG and LFG binding theories and review their predictions in light of the empirical results summarized in the previous section. The review is almost entirely limited to examples like the ones discussed in the previous section. Since all binding theories under discussion make the correct predictions for examples in which the possessor is the binder of the pronominal, cf. (9) below and Table 1 above, the discussion focuses on cases with a subject-bound pronominal, as in (10) - (11) (the corresponding results are summarized in the last row of Table 1).[8]

(9) John saw *Peter*$_i$'s picture of *himself*$_i$/**him*$_i$.
(10) a. *John*$_i$ painted Catherine's picture of *him*$_i$.
b. **John*$_i$ painted a/the/every picture of *him*$_i$.
(11) a. *John*$_i$ painted Catherine's picture of *himself*$_i$.
b. *John*$_i$ painted a/the/every picture of *himself*$_i$.

I begin with the predictions for pronouns. It seems fair to say that the majority of binding theories (including Bresnan 2001; Chomsky 1981, 1986; Chomsky & Lasnik 1995; Dalrymple 1993, 2001; Kiparsky 2002; Manning & Sag 1998; Pollard & Sag 1992, 1994; Reinhart & Reuland 1993) share the same underlying intuitions about the distribution of pronouns – pronouns cannot be bound by a coargument. Although binding theories differ with respect to how this intuition is implemented, Everaert (2001, 2003) points out that the different formalizations mostly make the same predictions. As I show in the next paragraph, this is also the case for pronouns in examples like (10).

Building on Pollard & Sag (1992, 1994), Manning & Sag (1998:111) define the HPSG constraints on the distribution of pronouns and anaphors on the hierarchically organized lexical argument structure. A pronoun must be locally a-free (i.e. it cannot be co-indexed with another member of the same ARG-ST list). The subtle difference to current LFG binding theories (e.g. Bresnan 1985, 2001; Dalrymple 1993, 2001:285) is that LFG binding constraints are defined on the functional structure (f-structure) rather than argument structure (a-structure).[9] In LFG terms, pronouns must be free within their *minimal Coargument Domain*, i.e. the minimal f-structure

[8] If not noted otherwise, grammaticality judgments are based on the above-mentioned empirical studies or on the study introduced in Section V.

[9] See Manning (1996a) for a discussion of the advantages of an argument structure-based binding theory.

containing a predicate (PRED) and all grammatical functions (GF) it governs. Since the f-structure of a picture NP contains a PRED value, and since the picture NPs arguments (e.g. the pronoun in the *of*-PP in the above examples) are governed by this PRED, a subject-bound pronoun is free in its co-argument domain. For (10), pronouns are therefore predicted to be grammatical. This holds regardless of whether the sentence contains an overt possessor (POSS), as in (10a), or not, as in (10b) above.[10] The same chain of reasoning (formulated on ARG-ST) holds for current HPSG binding theories. Thus, both HPSG and LFG binding theories make the wrong predictions for subject-bound pronouns in the absence of an intervening possessor, as in (10b).

Next, I turn to the predictions for the grammaticality of anaphors in examples like (11), repeated below as (12).

(12) a. *John*$_i$ saw Catherine's picture of *himself*$_i$.
     b. *John*$_i$ painted a/the/every picture of *himself*$_i$.

Both HPSG and LFG binding theories state constraints on anaphors on the same level as constraints on pronouns (ARG-ST and f-structure, respectively). In LFG terms, an anaphor must be bound within the *Minimal Complete Nucleus* (cf. Complete Functional Complex, Chomsky 1986). The Minimal Complete Nucleus of an anaphor is the minimal f-structure containing a subject function (SUBJ) and the anaphor. This raises an interesting question for examples like (11a). If the possessor is analyzed as bearing the picture NP's SUBJ function, the phrase *Catherine's picture of himself* forms the anaphor's Minimal Complete Nucleus and the anaphor must be bound *within* this phrase. This would incorrectly predict (11a) to be ungrammatical. The alternative view, taken by Bresnan (2001:216) and Dalrymple (2001:160), is to analyze the possessor as being subject-*like* but not actually bearing the SUBJ function. Instead, both Bresnan and Dalrymple analyze the possessor as bearing the POSS function of the picture NP's PRED (see also Chisarik & Payne 2003; Laczkó 2004 for recent LFG analyses of possessors). Thus, in their accounts, the Minimal Complete Nucleus is the f-structure corresponding to the whole sentence and examples like (11a) are correctly predicted to be grammatical. Note that, assuming optional suppression of the picture NP's POSS/SUBJ argument (e.g. by a lexical rule), either of the two alternative LFG analyses correctly predicts examples like (11b) to be grammatical.

In sum, LFG binding theories like Bresnan (2001) and Dalrymple (2001) get three out of the four cases discussed above right, namely (10a) and (11a,b), but make the wrong prediction for subject-bound pronouns if no intervening possessor is present, as in (10b). The evaluation of current LFG binding theories is given in Table 2, where the incorrect prediction is highlighted by boldface and italics.

Intervener / Binder	Yes	No
Possessor	ANA > *PRO	–
Subject	ANA ~ PRO	ANA ~ ***PRO***

TABLE 2 – Predictions of the LFG model (Bresnan 2001; Dalrymple 2001)

HPSG binding theories differ slightly from LFG accounts with regard to their predictions for anaphors in examples like (12). Whereas LFG describes the asymmetry in distribution of pronouns and anaphors by means of *domain* constraints (the Coargument Domain is the relevant domain for pronouns, and the Minimal Complete Nucleus is the relevant domain for anaphors; cf. Dalrymple 2001:285), HPSG accounts (e.g. Pollard & Sag 1992, 1994; Asudeh 1998; Manning & Sag 1998) uses the same domain constraint for both pronouns and anaphors but incorporate an additional

[10] Even if the possessor is present and analyzed as governed by the picture NP's PRED, the subject of the sentence lies outside the pronoun's co-argument domain.

notion, called *exemption*, for anaphors.[11] An anaphor is exempt from binding theory in case it is not outranked by *any* of its coarguments (i.e. if there is no less oblique argument on the same ARG-ST as the anaphor). In all other cases, an anaphor is subject to the usual binding constraints, i.e. the anaphor must be locally a-commanded by its binder (the binder must be a less oblique argument on the same ARG-ST as the anaphor). In other words, an anaphor must be locally a-commanded by its binder *iff* it is locally a-commanded by anything at all. This raises a similar question as the one discussed above for the LFG account. Is the anaphor locally a-commanded in examples like the ones in (12)? This is clearly not the case in (12b) because there is no element (at least not on the surface) that could *locally* a-command the anaphor. The anaphor is therefore predicted to be exempt from binding theory and cases like (12b) are correctly predicted to be grammatical.

It gets slightly more complicated for cases with an intervening possessor, as in (12a), repeated below as (13).

(13) *John*$_{i}$ saw Catherine's picture of *himself*$_{i}$.

The question here is whether the possessor in (13) is bearing a less oblique role than the anaphor, which arguably bears the patient/theme/object role. If the answer is 'yes' (as analyzed in Pollard & Sag 1994 and Manning & Sag 1998), then the anaphor would have to be bound by the possessor and (13) would wrongly be predicted to be ungrammatical. This HPSG model fares slightly worse than the best LFG model. Pollard & Sag (1992, 1994) get two out of the four examples discussed above right. The evaluation summary of Pollard & Sag's (1992, 1994) binding theory is given in Table 3. As mentioned at the beginning of this Section, both the standard LFG and the standard HPSG model make the correct predictions in case the possessor is the binder (cf. the first column of Table 2 and Table 3).

Binder \ Intervener	Yes	No
Possessor	ANA > *PRO	–
Subject	*ANA < PRO	ANA ~ *PRO*

TABLE 3 – Predictions of the HPSG model (Pollard & Sag 1992, 1994; Manning & Sag 1998)

If, on the other hand, the possessor wasn't analyzed as an argument of the picture NP, the anaphor in (13) would be *exempt from binding theory* (since it would not be locally a-commanded by anything) and (13) would be correctly predicted to be grammatical. Note, however, that such an analysis would entail that the possessor is not an argument of the picture NP and therefore not an element of the ARG-ST that the anaphor is an element of. Without additional changes, this would wrongly predict pronouns to be grammatical in examples like (9), repeated below as (14). In a nutshell, so far, this alternative HPSG account avoids one problem but creates another one.

(14) *John saw *Peter*$_{i}$'s picture of *him*$_{i}$.

The latter problem (the wrongly predicted grammaticality of (14)) can be avoided by a minor modification of principle A suggested to me by Ivan Sag (p.c.). Instead of basing exemption on the presence of an a-commander, the modified principle A would state that 'a locally *s*-commanded anaphor, must be locally a-bound.', where an anaphor is *s*-commanded if it is a-commanded by an a-*subject* (i.e. preceded on the ARG-ST list by an element that is also a member of the SUBJ list). In this approach possessors would still be analyzed as arguments and therefore appear on ARG-ST. While maintaining the exempt status for anaphors in examples like (13), this approach correctly

[11] For the notion of exemption see also Reinhart & Reuland (1993). Exempt anaphors are also discussed in e.g. Culy (1997) and Kuno (1987).

predicts the ungrammaticality of (14) because the possessor is a coargument of the pronoun.[12] This alternative HPSG approach makes the same predictions as the LFG binding theories summarized in Table 2, which is not surprising given that it more or less parallels the spirit of the LFG accounts discussed above in an HPSG framework (the notion of s-command serves the same purpose as the Minimal Complete Nucleus).

In sum, neither the standard LFG nor the HPSG model makes satisfying predictions given the current analysis of picture NPs. Furthermore, both models leave the 'intervention effect' unaccounted for – i.e. none of the models provided explains why subject-bound pronouns are acceptable only in case there is an intervening possessor.[13] Finally, recall the contrast between (15a) and (15b), mentioned at the end of section II. The grammaticality of a subject-bound pronoun is significantly reduced if the verb is a +creation verb (compared to –creation verbs). Without further modification, none of the current binding theories captures this contrast.

(15) a. **John*$_i$ painted a picture of *him*$_i$.
     b. *John*$_i$ found/burned a picture of *him*$_i$.

Next, I discuss a revised HPSG binding theory suggested by Asudeh & Keller (2001) that has been argued to accommodate the empirical observations of Keller & Asudeh (2000, 2001) and Runner et al. (2003).

IV Previously suggested refinements

Based on Pollard & Sag's (1994) HPSG model, Asudeh & Keller (2001) propose a revision of predication-based binding theories (e.g. Williams 1987, 1992; Pollard & Sag 1992, 1994; Reinhart & Reuland 1993; Manning & Sag 1998; Asudeh 1998). Asudeh & Keller's proposal has three parts, two of which are considerations independent of binding theory. The first suggested refinement pertains to the analysis of possessive phrases in terms of their function/argument role (and is therefore independent of binding theory). Second, Asudeh & Keller introduce an addendum to current binding theories, the *Pronoun Distribution Principle*. The third part of their proposal aims at integrating the effect of creation verb on the acceptability of pronouns mentioned at the end of the previous section. For Asudeh & Keller this effect is a property of the creation verb. In the remainder of this section, I will discuss the three parts of their proposal in the order mentioned.

IV-a The analysis of the possessive phrase

Parallel to current LFG analyses of possessive phrases (e.g. Bresnan 2001; Dalrymple 2001) and contrary to Pollard & Sag (1994), Asudeh & Keller suggest that the possessor argument of an NP (including picture NPs) does *not* outrank the object argument of that NP.[14] The immediate consequences of this alternative to Pollard & Sag's analysis have already been outlined in the previous Section. On the one hand, the distribution of anaphors is accounted for correctly. In

[12] The sensitivity of anaphors to subject binders (formalized via s-command in HPSG) is well motivated from languages other than English (Ivan Sag, p.c.; cf. Dalrymple 1993). For the idea of an 'a-subject', see Manning (1996b).

[13] Even though this paper focuses on HPSG and LFG binding theories, note that many of the observations made above hold in essentially the same way for GB binding theories (e.g. Chomsky 1986; Chomsky & Lasnik 1995). Furthermore, note that binding theories that predict strict complementarity of pronouns and anaphors (e.g. Chomsky 1981; Kiparsky 2002) are at odds with the fact that both anaphors and pronouns are acceptable in the presence of an intervening possessor if bound by the subject, cf. (10a) and (11a) above.

[14] Asudeh & Keller (2001:10) refer to Williams (1985) for an argument that possessors "are not a subject or any other sort of external argument" and to Barker (1995:6), according to which the NP in a genitive possessive phrase is not an argument of the NP *at all*. Note, however, the literature on possessive phrases is still split with regard to the question whether genitive possessor phrases are subjects (or, for that matter, to which extent possessors resemble subjects of verbs). For a recent discussion, see Alexiadou, et al. (to appear).

examples like (16), the anaphor can be bound by the possessor or the subject. More precisely, it is predicted that the anaphor in (16) is only subject to discourse-based constraints on binding, because it is exempt from binding theory (since there is not other argument of the picture NP that could locally a-command the anaphor/outrank the anaphor on ARG-ST).

(16) Hannah$_i$ found Peter$_j$'s picture of himself$_{i/j}$.

On the other hand, as it stands, the first refinement incorrectly predicts (14), repeated below as (17), to be grammatical since the pronoun would not be bound by a co-argument.

(17) *John saw *Peter*$_i$'s picture of *him*$_i$.

IV-b The Pronoun Distribution Principle

This is where the Pronoun Distribution Principle (henceforth PDP; Asudeh & Keller 2001:11) enters the picture. The PDP states that pronouns aren't fully grammatical if their binder is the closest potential binder for an anaphor in the same position as the pronoun.[15] In other words, if one was to substitute the pronoun with an anaphor and the binder was the *closest* grammatical binder of that anaphor, the anaphor would be preferred over the pronoun.[16] This in turn reduces the grammaticality of the pronoun.

> **Pronoun Distribution Principle (Asudeh & Keller 2001:11)**
> A pronoun is fully grammatical *iff* a reflexive [i.e. an anaphor; F.J.] in the same position would not be bound by the closest potential binder (under the same assignment of indices).

The PDP predicts reduced grammaticality of pronouns in examples like (18). In (18a), an anaphor in the pronoun's position could be bound by the subject (cf. (19a)) because the anaphor would be exempt (nothing a-commands it) and the subject is also the closest binder. In combination with the analysis of possessive phrases given above, an anaphor in (18b) would be exempt, too, and could therefore be bound by the possessor (cf. (19b)), which is also the closest potential binder.[17]

Reduced grammaticality of pronouns due to the Pronoun Distribution Principle

(18) a. ?**John*$_i$ saw a picture of *him*$_i$.
b. ?*John saw *Peter*$_i$'s picture of *him*$_i$.

(19) a. *John*$_i$ saw a picture of *himself*$_i$.
b. John saw *Peter*$_i$'s picture of *himself*$_i$.

In examples similar to (18a) but with an intervening possessor, e.g. (20), anaphors are not bound by the closest potential binder (the possessor). The revised binding theory therefore predicts *pronouns* in (20) to be fully grammatical. As shown in Table 1, Section II this prediction is correct. In the domain of picture NPs, examples like (20) are the only environments in which anaphors and pronouns are fully acceptable.

(20) *John*$_i$ saw Peter's picture of *him*$_i$/*himself*$_i$.

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[15] For references on the well-established notion of "the closest potential binder", see Asudeh & Keller (2001:11).

[16] A variety of reasons for the apparent preference of anaphors over pronouns have been discussed in the literature, including pragmatic considerations of specificity (Reinhart 1983), and featural economy (Kiparsky 2002). Here I do not discuss this preference further.

[17] Recall that sentences like (18a) were only rated as absolutely unacceptable if they contained a verb of creation (cf. Section II). The contrast between "?**John*$_i$ saw a picture of *him*$_i$" and "**John*$_i$ painted a picture of *him*$_i$" is addressed in the next section.

The predictions of Asudeh & Keller's (2001) proposal are summarized in Table 4. Changes to Pollard & Sag (1994) are given in boldface. If we interpret "reduced grammaticality of pronouns" to refer to cases in which pronouns were judged less acceptable than anaphors, the revised model seems to make correct predictions only for the data considered here (cf. Table 1). The revised HPSG model therefore fares better than any of the standard models described in the previous section.

Intervener / Binder	Yes	No
Possessor	ANA > **?*PRO**	–
Subject	**ANA** ~ PRO	ANA > **?*PRO**

TABLE 4 – Predictions of Asudeh & Keller (2001)

This raises the question whether it is possible to improve current LFG binding theories by incorporating the PDP (note that the first part of Asudeh & Keller's proposal, namely the analysis of genitive possessive phrases as non-subjects, already is a part of LFG current binding theories; cf. Section III).

The predictions of current LFG binding theories after incorporation of the PDP are subtly different from (and, as I will show shortly, also more adequate than) Asudeh & Keller's (2001). Since the possessor is analyzed as an argument of the picture NP, possessor-bound pronouns are predicted to be ungrammatical – rather than only being reduced in grammaticality. Thus, for the cases considered here, the PDP applies only to examples like (18a) above. This is summarized in Table 5 where differences from current LFG binding theories (e.g. Bresnan 2001) are given in italics and differences from Asudeh & Keller's model are marked by boldface.

Intervener / Binder	Yes	No
Possessor	ANA > ***PRO**	–
Subject	ANA ~ PRO	ANA > *?*PRO*

TABLE 5 – Predictions of LFG binding theories with Pronoun Distribution Principle

Asudeh & Keller (2001) use "?*" to mark examples with pronouns that were rated significantly lower than comparable examples with anaphors but still significantly higher than examples that constitute violations of core binding theory as in e.g. (21).

(21) *Hannah$_i$ criticized her$_i$.

A closer examination of Keller & Asudeh's (2000, 2001) data and the data collected in the experiment presented in the next section suggests that the prediction of the revised LFG model (in Table 5) is more accurate than the Asudeh & Keller's (2001) proposal.[18] The mean acceptability ratings for examples with a possessor-bound pronoun (cf. (18b) above), do not justify a distinction between *their* degree of ungrammaticality and the ungrammaticality resulting from violations of core binding theory (see Section V-b for examples that were used to defined the range of violations of core binding theory). The mean acceptability ratings of subject-bound pronouns in the absence of an intervening possessor, however, *are* significantly higher than the ratings of sentences violating core binding theory.[19] Thus the revised LFG model is empirically more adequate than the Asudeh & Keller's (2001) HPSG-based model and therefore the best model considered here so far.

[18] The experiment employed the same methodology and procedures as Keller & Asudeh (2000, 2001).
[19] For more details, I refer the reader to my LFG'04 handout available online at http://www.stanford.edu/~tiflo/.

IV-c Verbs of creation as complex predicates

As mentioned at the end of Section II, Keller & Asudeh (2000, 2001) also observed that examples like (18a) are *completely* ungrammatical (not just reduced in grammaticality) if the sentence predicate is a +creation verb, as in (22):

Pronoun bound by subject; no possessor; + creation verb

(22) **John*$_i$ painted a picture of *him*$_i$.

Asudeh & Keller account for this contrast by positing that +creation verbs form a complex predicate with their picture NP argument, thereby identifying the agent argument of the verb with the agent/creator argument of the picture NP, as illustrated in (23). Thus cases like (22) are predicted to be ungrammatical because the pronoun is bound by a co-argument (in HPSG terms, the pronoun is locally a-bound).

(23) paint a picture: <AGT, PAT>

Asudeh & Keller's (2001) proposal also makes a prediction about examples similar to (22) but with an intervening possessor. Since the effect is assumed to be essentially based on argument structure, it should not be affected by the absence or presence of an intervening possessor. Thus examples like (24), which are equally acceptable with pronoun or anaphor, are predicted to be ungrammatical with a pronouns if the verb is +creation.[20]

Pronoun bound by subject; intervening possessor; - creation verb

(24) *John*$_i$ found Mary's picture of *him*$_i$.

Unfortunately, Keller & Asudeh's experiments tested verb contrasts only for examples *without* an intervening possessive phrase. In their studies, all verbs for stimuli containing an intervening possessor were achievement verbs (i.e. –creation verbs), just as *found* in (24). While the fact that pronouns in those examples were judged grammatical is compatible with the prediction made above, the lack of contrasting examples with +creation verbs means that the prediction cannot be considered proven. In Section V, I will present results that argue against the complex predicate hypothesis of Asudeh & Keller, even though they confirm the prediction that the grammaticality of examples like (24) depends on whether the verb is of type +creation or –creation. Instead, I argue below, it is the likelihood of the binder being interpreted as the agent/creator of the picture NP (and therefore as a co-argument of the pronoun bearing the picture NP's patient role) that is the determining factor behind the observed contrasts in the grammaticality of pronouns.

V The experiment

In this section, I present new results from an experiment that shows that it is agentivity/argument-hood generally rather than *only* verb specific interpretations that determine the grammaticality of pronouns. This argues against attributing the effect of agentivity on the grammaticality of pronouns to the type of verb and more specifically, against the complex predicate hypothesis. Instead, the findings argue for a view in which the observed acceptability ratings are due to the argument structure of picture NPs and the likelihood with which the binder of a pronoun (as the patient argument of a picture NP) is interpreted as the agent of the picture NP.

[20] Admittedly (thanks to Ash Asudeh and Ivan Sag for discussion), this prediction only follows under what I take to be a favorable interpretation of Asudeh & Keller's (2001) Complex Predicate Hypothesis. Otherwise their hypothesis would make no prediction at all about examples with an intervening possessor and a +creation verb.

In the remainder of this section, I outline the experimental hypothesis and its predictions (Section V-a), and summarize the employed methodology (Section V-b) and stimuli (Section V-c), and the results (Section V-d). In Section V-e, I discuss the results and their relevance for binding theory, specifically binding in picture NPs.

V-a The Agentivity Hypothesis and its predictions

The experiment was intended to investigate the hypothesis that the contrast observed by Keller & Asudeh (2000, 2001) between examples like (15a) and (15b), repeated below in (25), is due to the semantic role of the binder with respect to the picture NP (rather than being due to complex predicates, as argued in Asudeh & Keller 2001). A subject that is interpreted as an agent/creator of the picture NP cannot be the binder of a pronoun that bears an argument-role of that picture NP.

(25) a. **John*$_i$ painted a picture of *him*$_i$.
b. *John*$_i$ found/burned a picture of *him*$_i$.

Like Asudeh & Keller's analysis, the AGENTIVITY HYPOTHESIS makes the prediction that the contrast in (25) carries over to examples with intervening possessors. Examples with intervening possessive phrases therefore constitute the empirical domain investigated in the experiment.

AGENTIVITY HYPOTHESIS
A subject that is *semantically interpreted* as an agent/creator of the picture NP cannot be the binder of a pronoun that bears an argument-role of that same picture NP (because of Principle B of binding theory).

The AGENTIVITY HYPOTHESIS rest on the assumption that picture NPs optionally allow identification of their subject (i.e. their agent/creator) with the subject of the verb they are an object of (in other words, the intuition that Asudeh & Keller had about creation verbs is extended to all verbs). The likelihood of the optional reading being employed by a hearer depends on whether the hearer has reason to believe that this is the intended interpretation. This chain of reasoning, for the purpose of the experiment, leads to two predictions, which are discussed below along with their operationalizations. The first prediction is that +creation verbs (in the configurations considered in this paper) result in ungrammaticality of pronouns independent of whether there is an intervening possessive phrase or not, cf. (26) – judgments omitted. This prediction is built on the assumption that the presence of a +creation verb in (26) should force participants to interpret the subject of the sentence as the agent/creator of the picture NP. The prediction is summarized below.

Pronoun bound by subject; +creation verb
(26) *John*$_i$ painted a/the/Mary's picture of *him*$_i$.

Prediction 1: GENERALIZED EFFECT OF CREATION VERBS
The effect observed by Asudeh & Keller (2001) for +creation verbs is not limited to sentences without an intervening possible binder. Instead, for all instances of examples like (26), a subject-bound pronoun in the picture NP is significantly reduced in grammaticality because the +creation verb identifies the subject as the agent/creator of that picture NP.

The second prediction of the AGENTIVITY HYPOTHESIS is that not just the type of verb but *any* manipulation that biases participants to interpret the subject as the agent/creator of the picture NP should correspondingly reduce the mean acceptability ratings of cases with subject-bound pronoun (which, as in all examples above, bears the patient role of the picture NP). This is summarized below for one specific manipulation. The second prediction states that examples like (27) with a salient creator (like *Picasso*) as subject and a subject-bound pronoun are less acceptable than an example in which the subject is not a salient creator. The judgment for (27) is omitted.

Pronoun bound by subject; intervening possessor; -creation verb; subject is salient creator

(27) *Picasso*$_i$ burned Mary's picture of *him*$_i$.

> **Prediction 2: EFFECT OF SALIENT CREATOR**
> Sentences (with –creation verbs) where the subject is a salient creator binding a pronoun have reduced grammaticality compared to sentences where the subject binds a pronoun but is not a salient creator.

V-b Experimental methodology

To elicit well-controlled acceptabiltiy judgments, I conducted an experiment using the same methodology, procedure, and software as Keller & Asudeh (2000, 2001; cf. Section II above). Twenty-one participants from various parts of the U.S. (two subjects were later excluded by an outlier analysis) judged 96 sentences (including 48 fillers) with regard to the same reference sentence. For each participant, sentences were presented in random order.[21]

In order to understand the results presented below, keep in mind that the elicited judgments are a measure of *acceptability*. That is, while it is possible to *bias* participants to a certain interpretation of a sentence they are to judge, the effect will be a reflected as a tendency rather than an absolute, categorical distinction (cf. Schütze 1996). Rather than dismissing empirical evidence though, this is just to say, that mean judgments have to be seen in light of judgments on a reference sentence. The results presented below are normalized (i.e. they range from 0 to 1). In addition, a group of filler stimuli was used to define the interval of mean acceptability ratings for violations of core binding theory. Some examples are given in (28). In the figures in the results section this interval is marked by dashed lines. All cases with mean acceptability rating within or below that interval are considered ungrammatical.[22]

Examples used to define the interval of 'ungrammatical' sentences

(28) a. *She$_i$ visited Lisa$_i$'s brother at college.
b. *Mary asked him$_i$ about Michael$_i$'s parents.

V-c Stimuli

To test for a GENERALIZED EFFECT OF CREATION VERBS, I compared the mean normalized acceptability ratings for sentences with or without +creation verbs in which the pronominal is subject-bound (recall that the subject only contained sentences with possessors). A minimal pair is given below (grammaticality judgments are omitted).[23]

VERB is *+creation*; Subject binds; intervening possessor

(29) Manray$_i$ took Mary's photo of him$_i$/himself$_i$.

VERB is *–creation*; Subject binds; intervening possessor

(30) Manray$_i$ burned Mary's photo of him$_i$/himself$_i$.

To test for an EFFECT OF SALIENT CREATORs, I compared the mean normalized acceptability ratings for sentences in which the subject was a salient creator with sentences in which it wasn't.

[21] For more details on the methods and procedure, see Jaeger (2004).

[22] It is important to understand why the interval of mean normalized judgments does not start at zero. While each individual judgment is normalized, it is still the case that the lowest *mean* normalized judgment for any stimulus was approximately 0.2 on the scale from 0 to 1 (this is due to variation across subjects; in other words, there was no stimulus that everyone agreed upon as entirely ungrammatical). Effectively, the *mean* normalized judgments varied from 0.2 to 0.85.

[23] Not all participants seemed to know that *Manray* is a famous photographer. This may have weakened the effect for this and similar examples.

The sentences always contained a salient creator either as the binder or as the possessor (to avoid them being rated as more acceptable simply because they contained a famous person).

***Subject* is salient CREATOR; VERB is *-creation*; Subject binds; intervening possessor**
(31) Manray$_i$ burned Mary's photo of him$_i$/himself$_i$.

***Possessor* is salient CREATOR; VERB is *-creation*; Subject binds; intervening possessor**
(32) Mary$_i$ burned Manray's photo of her$_i$/herself$_i$.

V-d Results

I first present the results pertaining to the prediction of a GENERALIZED EFFECT OF CREATION VERBS and then turn to the results relevant for the predicted EFFECT OF SALIENT CREATORS.[24]

The results for the first part of the experiment are summarized in Figure 1. Just as for sentences without a possessor, there is a significant effect of creation verbs on the acceptability of pronouns. Subject-bound pronouns are less acceptable if the verb is +creation than if it is –creation. The effect is even strong enough to make pronouns less acceptable than anaphors if the verb is a +creation verb (even though pronouns and anaphors are equally acceptable for –creation verbs, as shown in Keller & Asudeh 2000, 2001, and replicated here). These results support Prediction 1.

As for the second prediction, there *is* a significant main effect of salient creators on the acceptability of pronouns. The results are summarized in Figure 2. Pronouns are less acceptable when they are subject-bound by a salient creator than if their binder isn't a salient creator. Even though slightly weaker than the effect of creation verbs, the effect is strong enough to make pronouns bound by a salient creator subject less acceptable than anaphors under the same condition.[25] These results support Prediction 2.

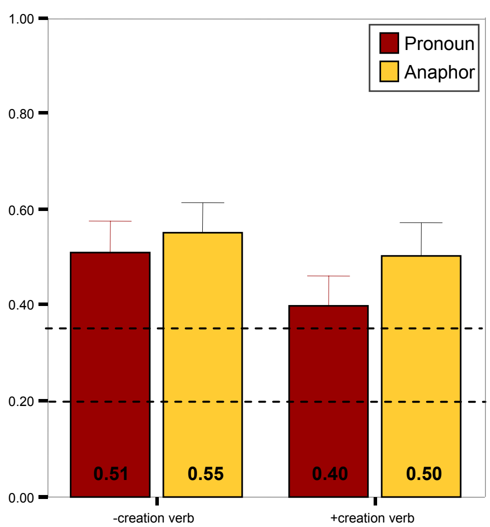

FIGURE 1 – Mean normalized acceptability of examples like (29) and (30) depending on whether the verb is +/-creation (subject binds; possessor present).

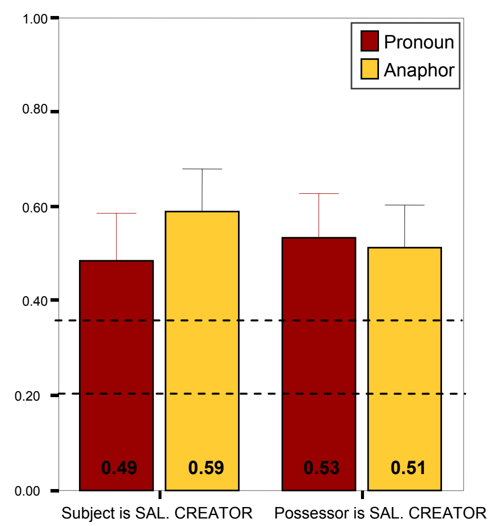

FIGURE 2 – Mean normalized acceptability of examples like (31) and (32) depending on whether the subject is a salient creator (subject binds; possessor present; -creation verb).

[24] Throughout this paper, I have opted to omit the numerical results of statistical tests. Instead I limited myself to stating whether an effect was significant or not. All analyses were performed with repeated measure ANOVAs with both subjects and items as random factors (cf. Clark 1974).

[25] Recall also that participants apparently didn't know some of the names used as lexicalizations of salient creators, e.g. *Manray*. The EFFECT OF SALIENT CREATORS is probably stronger than revealed in this experiment.

In sum, both predictions are met and the results support the AGENTIVITY HYPOTHESIS. This becomes even clearer if one takes the two factors (salient creator, and verb semantics) together to define a scale of likelihood of the subject being interpreted as the agent of the picture NP. On this scale, the subject is most likely to be interpreted as the agent/creator of the picture NP in examples like (29), followed by examples like (31), and finally, with the lowest likelihood in examples like (32). As shown in Figure 3, this scale has the predicted (significant) effect on the acceptability of pronouns. The more likely the subject is to be interpreted as the agent/creator of the picture NP, the less acceptable are the mean normalized acceptability ratings for pronouns.

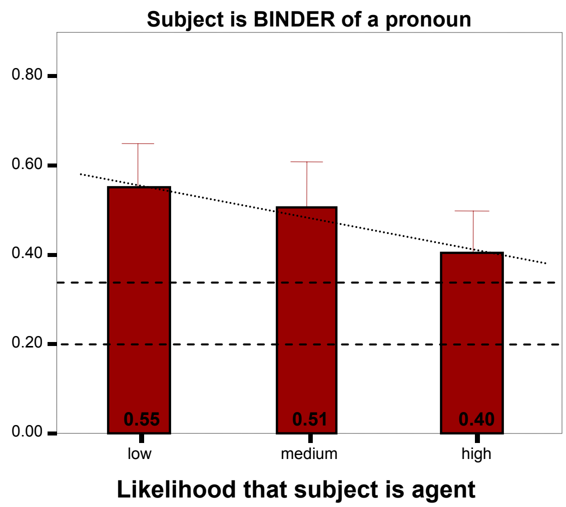

FIGURE 3 – Mean normalized acceptability of pronouns in examples like (29), and (31) and (32) depending on the likelihood of the subject being interpreted as the agent of the picture NP (subject binds; possessor present).

V-e Discussion

The results argue that Asudeh & Keller's (2001) analysis of the effect of verbal semantics on the acceptability is too narrow. While the GENERALIZED EFFECT OF CREATION VERBS is compatible with Asudeh & Keller's (2001) Complex Predicate Hypothesis (cf. Section IV-c), the AGENTIVITY HYPOTHESIS subsumes both the GENERALIZED EFFECT OF CREATION VERBS and the EFFECT OF SALIENT CREATORs under one simple principle and should therefore be preferred over the Complex Predicate Analysis. For examples like the ones in (33) and (34), it is the agentive interpretation of the subject that matters, and not only the verbal semantics. Attributing the effect to the verb/complex predicates rather than agentivity fails to capture the relevant generalization about binding.[26]

Contrast between +/- creation verbs; Subject binds; no possessor

(33) a. **John*$_i$ painted a picture of *him*$_i$.
     b. *John*$_i$ found/burned a picture of *him*$_i$.

Contrast between +/- creation verbs; Subject binds; intervening possessor

(34) a. ?*Manray$_i$ took Mary's photo of him$_i$.
     b. Manray$_i$ burned Mary's photo of him$_i$.

[26] Note, however, that both Asudeh & Keller (2001:14) and Runner (2002:173) provide independent evidence for their proposal that +creation verbs and picture NPs form complex predicates.

Before I discuss some of the consequences for future research, it is worth mentioning that one of the results is not quite as strong as expected. Although the effect of creation verbs on the acceptability of pronouns is clearly significant, pronouns weren't judged as absolutely ungrammatical (the mean acceptability ratings are just above the ratings for violations of core binding theory). This raises the question whether the identification of the subject as the agent/creator of the picture NP is an optional process for the hearer even if the meaning of the sentence (or for that matter, anything in the context) unambiguously identifies the subject as the agent/creator. I (have to) leave this question open for future investigation. More generally, it is unclear whether the observed effects are due to lexical properties of the picture NPs (and maybe other types of nouns), or a more general semantic principle.

One of the questions the current study poses for future research stems from the *interpretation* of the AGENTIVITY effect. On the one hand, the effect could be due to the fact that the binder is interpreted as *a* 'creator'.[27] In this case, the effect would simply follow from certain preferences based on which semantic role a binder has. I will refer to this interpretation as AGENTIVITY-1. On the other hand, the effect could be due to the fact that the binder is the agent/creator *of the picture NP*. I will refer to this interpretation as AGENTIVITY-2. In this case, the effect argues for the relevance of extended argument structure. I use the term *extended* argument structure to stress that, for all examples discussed above with a subject-bound pronoun, the binder was not in the (surface) position of the picture NP's subject (the binder was not *in* the picture NP at all). If one wants to maintain that AGENTIVITY-2 is the correct interpretation of the observed effect, this leads to the conclusion that some mechanism has to identify the subject of the sentence as the agent/creator of the picture NP.[28] In this sense, it is *extended* argument-hood that matters. The AGENTIVITY-2 HYPOTHESIS is especially appealing because it reduced the cases discussed above to the well-known constraint against co-arguments as binders of a pronoun (i.e. the principle of Obviation; incorporated into many binding theories as Principle B).

The only study I know of that may be taken to provide evidence for either of the two interpretations of AGENTIVITY is Kaiser et al. (2004a,b). Kaiser and her colleagues investigated sentence like (35) using an eye-tracking paradigm. They found that participants were significantly less likely to choose the subject *Peter* (rather than the object *Andrew*) as the antecedent of the pronoun if the verb was marking the subject as a receiver of information, e.g. *told*, than if the verb was marking the subject as a source of information, e.g. *heard*.

```
(35) Peter {told/heard from} Andrew about the picture of him on the wall.
```

Kaiser and her colleagues analyze the effect as support for Tenny's (1996, 2003) proposal that receivers of information are preferred binders of short distance pronouns. Alternatively, the results can be interpreted in terms of AGENTIVITY-1 since verbs like *tell* assign an agentive creator-role to their subject, while verbs like *hear* don't.[29]

[27] The effect cannot be reduced to the binder being an agent since, for the cases discussed here, the binder was always the subject, and therefore, since all verbs had agentive subjects, always an agent. Thus the contrast between examples like (29) and (30) could not be due to the fact that the binder is an agent.

[28] The mechanism that accomplishes this could be part of syntax (e.g. movement out of the picture NP's subject position into the subject position of the sentence), or semantic/pragmatic identification due to established co-reference (which, without further constraints, clearly is too general). Although, admittedly, the nature of the mechanism and the constraints on when it applies are of great interest, I do not discuss this any further here. In lack of further evidence for the distribution of the AGENTIVITY effect, this would seem premature.

[29] At this point, it is important to be more precise about what I have so far informally referred to as the agent/creator role. As Ash Asudeh has pointed out to me, one could argue that *hear*, too, assigns a creator role (to its object). Although this it is admittedly necessary to be more precise about the nature of the AGENTIVITY effect, for the current purpose it is sufficient to state that I am exclusively concerned with logical subjects that bear a creator role. Since the notion of logical subject is defined in argument structure terms, this means that the relevant level of description for the AGENTIVITY effect is argument structure or, as suggested above, extended argument structure.

Under this assumption, the results of Kaiser and her colleagues would follow naturally from the analysis proposed here, whereas I do not see a straight-forward extension of Kaiser et al.'s (2004) and Tenny's (2003) proposal to account for the data discussed here. Although the results of Kaiser et al.'s experiments may be taken to argue in favor of AGENTIVITY-1, clearly more research is needed to decide between the AGENTIVITY-1 and AGENTIVITY-2 analysis.

The confirmation of the AGENTIVITY HYPOTHESIS also raises the question of how general the observed effect is. There are two ways in which the observed effect could be more general. First, AGENTIVITY could turn out to be a factor in binding beyond picture NPs. Thus, understanding precisely when *extended* argument-hood matters (i.e. in which configurations not only argument-hood but extended argument-hood matters), is an interesting subject for future studies. Second, if future research reveals that AGENTIVITY-2 rather than AGENTIVITY-1 turns out to be the correct interpretation of the current findings, extended argument-hood should depend neither on the binder's argument-role nor on the argument-role of the pronoun. It should only matter whether, after the mechanism for extended argument-hood has applied, the pronoun and its binder are assigned argument-roles by the same predicate.

Consider the two examples in (36). Both contain a subject-bound pronoun, which bears a recipient role (rather than being a patient as in all of the above examples). The examples differ only in that, in (36a), the subject is identified as the agent/issuer of the donation and therefore as an extended co-argument of the pronoun. If this factor is strong enough to influence the likelihood of the binder (i.e. the first object) being interpreted as the agent/creator of the donation, (36a) should be judged less acceptable than (36b). I leave it to future research to test this prediction.

```
(36) a. Mary issued the bank [a donation for her].
     b. Mary showed the bank [a donation for her].
```

Finally, note that the confirmation of the AGENTIVITY HYPOTHESIS (regardless of which interpretation of the observed effects, AGENTIVITY-1 or AGENTIVITY-2, turns out to be correct) offers an alternative explanation for the reduced grammaticality of examples like (18a) without an intervening possessor, repeated below as (37). Recall (cf. Section IV-b) that, within a LFG account, this type of examples is the only remaining motivation for the Pronoun Distribution Principle (PDP) proposed in Asudeh & Keller (2001). Given the results of the current study, the reduced grammaticality of examples like (37), could be due to an inherent bias to interpret the subject as the agent/creator of the picture NP – even in cases in which nothing in the sentence biases a hearer towards that interpretation (e.g. no salient creator; no creation verb).

Pronoun bound by subject; no possessor

(37) ?**John*$_i$ saw a picture of *him*$_i$.

Although conclusive evidence is needed, the results presented above suggest that it may be possible to derive Asudeh & Keller's PDP as a descriptive generalization from the AGENTIVITY HYPOTHESIS. This could ultimately relate the PDP to well-established constraints on binding of co-arguments (namely, Principle B).[30]

[30] Note that the current proposal does by no means deny the importance of pragmatic factors in binding theory. Even though all effects observed in the experiment presented here can be accounted for by a clear principle, there are other known effects on the acceptability of pronouns (e.g. definiteness of the picture NP; cf. Keller & Asudeh 2001) that are unlikely to be reduced to co-argument-hood.

VI Conclusions

I have shown that the acceptability of a pronoun as an argument of a picture NP depends on (among other things) whether the binder is likely to be interpreted as an agent/creator. In Section V-e, I have proposed that this could eventually be due to *extended* argument-hood. According to the proposed analysis, a creator subject can be interpreted as the agent/creator of the picture NP, which makes the subject a co-argument of a pronoun bearing the patient-role of that picture NP. My proposal reduces the variation in the acceptability of pronouns in the domain of picture NPs to the well-known semantic principle of Obviation/Principle B (pronouns cannot be bound by a co-argument; e.g. Reinhart & Reuland 1993; Kiparsky 2002, among many others). More generally, the proposal predicts that the variation in the acceptability of pronouns being bound by expressions that lie outside their *syntactic*/f-structure co-argument domain depends on whether the binder is (via some semantic or syntactic mechanism) interpreted as a co-argument of the pronoun.

The current study also shows that it is possible to use acceptability judgments for linguistic investigation if they are elicited in a well-controlled way. Among other things, parts of the current study reliably replicated results found in Keller & Asudeh (2000, 2001) and also in the more sophisticated (but also more complicated) experiments by Runner et al. (2003).

VI-a Future research

Several questions for future research arise from the observations made in this paper. First, optimally, the experimentally verified results should be confirmed by a corpus-based study. Experimentally well-controlled elicitation of acceptability judgments is a valid tool of linguistic investigation but should be supplemented by distributional evidence from corpora. Second, as mentioned in the discussion of the experimental results, the current experiment raises many question with respect to the precise nature of the AGENTIVITY effect. Thus it would be worthwhile to investigate the effect of agentivity or, more generally, the effect of extended argument-hood (see Section V-e) in other constructions. Finally, future studies should include a better handle on the contextual effects (saliency, topicality, empathy, perspective, etc.). The current study presented sentences out of context. Although contextual effects have primarily been considered in the research on anaphors (e.g. Culy 1997; Kuno 1987; for a recent overview, see Oshima 2004), they should also be considered in acceptability studies of pronouns. Recently, Kaiser et al. (2004a,b) showed that, at least in some instances, pronouns are clearly more susceptible to semantic/pragmatic factors than anaphors.

VII References

Alexiadou, A., L. Haegeman, and M. Stavrou. To appear. *Issues in the Syntax of Noun Phrases*. New York: de Gruyter.

Asudeh, A. 1998. *Anaphora and argument structure: Topics in the syntax and semantics of reflexives and reciprocals*. M.Phil. Thesis, Centre for Cognitive Science, University of Edinburgh.

Asudeh, A. & Keller, F. 2001. Experimental evidence for a predication-based Binding Theory. In *CLS 37: The main session. Papers from the 37th. meeting of the Chicago Linguistic Society,* Volume 1. Chicago, IL: CLS.

Bard, E. G., Robertson, D. & Sorace, A. 1996. Magnitude estimation of linguistic acceptability. *Language 72(1)*, 32-68.

Barker, C. 1995. *Possessive Descriptions*. Stanford, CA: CSLI Publications.

Bresnan, J. 2001. *Lexical Functional Syntax*. Oxford: Blackwell.

Chisarik, E. and J. Payne. 2003. Possessor constructions in LFG. In M. Butt & T. H. King (eds.) *Nominals: Inside Out*, 181-200. Stanford: CSLI Publications.
Chomsky, N. 1981. *Lectures on Government and Binding*. Dordrecht: Foris.
Chomsky, N. 1986. *Knowledge of Language: its nature, origin and use*, New York: Praeger.
Chomsky, N. 1995. *The Minimalist Program*. Cambridge, Massachusetts: MIT Press.
Chomsky, N. and H. Lasnik. 1993. "The Theory of Principles and Parameters". In J. Jacobs, A. von Stechow, W. Sternefeld and T. Vennemann (eds.) *Syntax: An International Handbook of Contemporary Research*. Berlin: De Gruyter. Reprinted in Chomsky (1995).
Cowart, W. 1997. *Experimental Syntax: Applying Objective Methods to Sentence Judgments*. Thousand Oaks, CA: Sage Publications.
Culy, C. 1997. Logophoric pronouns and point of view. *Linguistics 35*, 845–59.
Dalrymple, M. 1993. *The Syntax of Anaphoric Binding*. Stanford, CA: CSLI Publications.
Dalrymple, M. 2001. *Lexical Functional Grammar*. Volume 34, Syntax and Semantics. Academic Press. 2001.
Everaert, M. 2001. Binding Theories: A Comparison of Grammatical Models. In M. Oostendorp & E. Anagnostopoulou (eds.), *Progress in Grammar. Articles at the 20th Anniversary of the Comparison of Grammatical Models Group*. Tilburg, Utrecht, The Netherlands: Roquade.
Everaert, M. 2003. Binding theories in the generative research tradition. *Research in Language 1*, 33-52.
Huang, J. 1983. A Note on the Binding Theory. *Linguistic Inquiry* 14, 554-61.
Jackendoff, R. 1972. *Semantic Interpretation in Generative Grammar*. Cambridge, Massachusetts: MIT Press.
Jaeger, T. F. 2004. *It matters to be creative. Empirical investigations in Binding Theory*. Ms., Stanford University. Available at http://www.stanford.edu/~tiflo/.
Kaiser, E., J. Runner, R.S. Sussman, and M.K. Tanenhaus. 2004a. Susceptibility to discourse/semantic factors: An experimental approach to short-distance pronouns and logophoric reflexives. Extended abstract for *Workshop on Semantic Approaches to Binding Theory*, August 16th – 20th, ESSLLI'04 - Nancy, France, 41-6.
Kaiser, E., J. Runner, R.S. Sussman, and M.K. Tanenhaus. 2004b. Susceptibility to discourse/semantic factors: An experimental approach to short-distance pronouns and logophoric reflexives. Handout for *Workshop on Semantic Approaches to Binding Theory*, August 16th – 20th, ESSLLI'04 - Nancy, France.
Keller, Frank. 2000. *Gradience in Grammar: Experimental and Computational Aspects of Degrees of Grammaticality*. PhD thesis, University of Edinburgh.
Keller, F. and A. Asudeh. 2000. *Constraints on Linguistic Coreference: An Experimental Investigation of Exempt Anaphors*; Ms., U. of Edinburgh and Stanford University.
Keller, F. and A. Asudeh. 2001. Constraints on Linguistic Coreference: Structural vs. Pragmatic Factors. In *Proceedings of the 23rd Annual Conference of the Cognitive Science Society*. Mahawa, Lawrence Erlbaum.
Keller, F., Corley, M., Corley, S., Konieczny, L., & Todirascu, A. 1998. *Web-Exp: A Java toolbox for web-based psychological experiments* (Technical Report No. HCRC/TR-99). University of Edinburgh: Human Communication Research Centre.
Kiparsky, P. 2002. Disjoint Reference and the typology of pronouns. In Ingrid Kaufmann and Barbara Stiebels (eds.), *More than Words. Studia Grammatica 53*, 179-226. Berlin: Akademie Verlag, 2002.
Kuno, S. 1987. *Functional Syntax: Anaphora, discourse & empathy*. Chicago.
Laczkó, T. 2004. Grammatical Functions, LMT, and control in the Hungarian DP revisited. In M. Butt & T. H. King (eds.) *Proceedings of the LFG04 Conference, Christchurch, New Zealand*. Stanford: CSLI Publications.

Manning, C. 1996a. Argument Structure as the locus for binding theory. In M. Butt and T. H. King (eds.) *Proceedings of the First LFG Conference (LFG96), Rank Xerox, Grenoble*. Stanford: CSLI Publications.

Manning, C. 1996b. *Ergativity: Argument Structure and Grammatical Relations*. Stanford: CSLI Publications.

Manning, C., and I.A. Sag. 1999. Argument Structure, Valence, and Binding. *Nordic Journal of Linguistics 21(2)*, 107-144.

Oshima, D.Y. 2004. On Empathic and Logophoric Binding. Extended abstract for *Workshop on Semantic Approaches to Binding Theory*, August 16th – 20th, ESSLLI'04 - Nancy, France, 54-9.

Pollard, C. and I.A. Sag. 1992. Anaphors in English and the Scope of Binding Theory. *Linguistic Inquiry 23*, 261-303.

Pollard, C. and I.A. Sag. 1994. *Head-Driven Phrase Structure Grammar*. Chicago: Chicago University Press.

Reinhart, T. and E. Reuland. 1993. Reflexivity. *Linguistic Inquiry 24(4)*, 657-720.

Runner, J.T. 2002. When Minimalism isn't enough: An argument for argument structure. *Linguistic Inquiry 33(1)*.

Runner, J.T. 2003. Insights into binding and ellipsis from head-mounted eye-tracking experiments. In *CLS 39*. Chicago, IL: Chicago Linguistic Society.

Runner, J.T., R.S. Sussmann and M.K. Tanenhaus. 2000. Binding reflexives and pronouns in real-time processing. Poster at the *13th CUNY Conference on Human Sentence Processing, San Diego, CA*.

Runner, J.T., R.S. Sussmann and M.K. Tanenhaus. 2002. Logophors in Possessed Picture Noun Phrases. In *WCCFL 21*, pp. 401-14.

Schütze, C.T. 1996. *The Empirical Base of Linguistics: Grammaticality Judgments and Linguistic Methodology*. Chicago: University of Chicago Press.

Stevens, S.S. 1975. *Psychophysics: Introduction to its Perceptual, Neural, and Social Prospects*. New York: John Wiley.

Tenny, C. 1996. *Short distance pronouns and locational deixis*. LinguistList on-line conference.

Tenny, C. 2003. *Short distance pronouns, argument structure, and the grammar of sentience*. Ms., 2003.

Williams, E. 1987. Implicit arguments, the binding theory and control. *Natural Language and Linguistic Theory 5*, 151-180.

Williams, E. 1994. *Thematic Structure in Syntax*. Cambridge, MA: MIT Press.

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AN OPTIMALITY-THEORETIC ALTERNATIVE

TO THE APPARENT *WH*-MOVEMENT IN OLD JAPANESE

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Abstract

This paper claims that the word order restriction observed in Old Japanese (OJ) does not indicate that OJ was a *wh*-movement language, counter to Watanabe's (2002) Minimalist analysis. The apparent *wh*-movement effect is epiphenomenal of the interplay of several constraints sensitive to the profiles of case morphemes. More specifically, the word order restriction reflects a kind of mismatch where the nominal case frame is imposed upon a clause. This curious OJ word order restriction and its loss in Middle Japanese (MJ) simply reflect the gradual and dynamic development of the morphological case system, rather than a change in the *wh*-parameter. The change in the profile of case particles is partly lexical, but it has systematic consequences on the surface syntactic structure. With the mixed category analysis, adopted from Malouf (2000), and Boersma-type OT allowing optionality, the proposed analysis gives a comprehensive picture of the diachronic facts of the language.

1. Introduction*

The purpose of this paper is to present an Optimality-Theoretic LFG alternative to the *wh*-movement analysis of the word order restriction observed in Old Japanese. Diachronic aspects of Japanese have recently aroused strong interest in theoretical linguistics. Among the most remarkable works is Watanabe's (2002) Minimalist analysis, which claims that OJ was in fact a *wh*-movement language. Since Japanese has always been a head-final, scrambling language, it was never expected that Japanese had overt *wh*-movement. And yet, the clean and powerful UG-based account had a tremendous amount of impact, and the *wh*-movement analysis very quickly gained ground among Japanese theoretical linguists.

However, I would like to argue that the *wh*-movement analysis is wrong, and that the apparent *wh*-movement effect is epiphenomenal of the interplay of several constraints sensitive to the profiles of case morphemes. With the mixed category analysis, adopted from Malouf (2000), and Boersma-type OT allowing optionality, the word order restriction and its loss can be obtained quite naturally, and a more comprehensive analysis is possible. The wh-movement analysis claims that the Japanese language underwent a change in syntactic parameter setting between OJ and MJ. I claim instead that what changed between the two stages is not the fundamental "syntactic" property, but the system of morphological case markers.

This paper is organized in the following way. Section 2 describes the facts that motivated the *wh*-movement analysis, as well as the shortcomings of the analysis. Section 3 calls attention to other facets of OJ structure, crucial to my proposal. After all the relevant facts are laid out, I will turn to my analysis in Section 4. Section 5 concludes the paper.

* I wish to thank the audience at the 9th International Lexical Functional Grammar Conference (LFG2004), and particularly Joan Bresnan, for their valuable comments. I also gratefully acknowledge the helpful comments I received on earlier versions of this paper from Satoshi Kinsui, Shigeo Tonoike, Peter Sells, Akira Ishikawa, Kaz Fukushima, among others. All errors and oversights of course remain mine.

2. The wh-movement analysis and its problems

2.1. Word order restriction in OJ and the wh-movement analysis

Watanabe's claim (2002) that OJ had overt wh-movement is based on the word order restriction in OJ, which disappeared in early Middle Japanese (MJ), around 9-10C(entury). By carefully examining data in *Man'yosy*u, which is written in OJ,[1] Nomura (1993) and Sasaki (1992) observe that the order among the interrogative particle [ka] (and [ka-mo]), the topic marker [wa], and the subject marker [no/ga] was not free. The schematic description in (1) shows the pattern, and the number on the right end indicates the number of attested data in *Man'yosyu*. The apparent rule is that [ka] almost always preceded [no/ga], while [wa] almost always preceded [ka]; the reverse is exceptional:

(1)	I. Nominative subject:	XP [ka] . . . Subj [no/ga] . . .	approximately 90
		Subj [no/ga] . . . XP [ka] . . .	4 (or 5)
	II. Topic:	XP [ka] . . . XP [wa] . . .	2 (or 3)
		XP [wa] . . . XP [ka] . . .	approximately 50

From this, one can infer the possible order of the three constituents is as in (2), when all the three appear in a single sentence:[2]

(2) XP [topic: wa]. . . XP [ka] . . . NP [subj: no/ga]

Based on (2), Watanabe (2002) proposes the clause structure with split C system in (3), which follows the insight of Rizzi (1997), and claims that XP[ka] is obligatorily moved out of IP to the Spec of FocP in OJ, as an instance of wh-movement. This is triggered, he claims, by the [-Interpretable] feature of [ka]:

(3) $[_{\text{TopP}}$ Spec Top $[_{\text{FocP}}$ Spec Foc $[_{\text{IP}}$ Subj VP I]]]

Notice at this point that this wh-movement is in fact Focus-movement, and the presence of a wh-phrase is not relevant at all. *Wh-movement* is a misleading term, since the trigger is the interrogative focus particle [ka], which attaches to either a wh- or a non-wh-word (or phrase, or clause.) When it is attached to a non-wh-expression, it turns the sentence into a polar question, and the constituent with [ka] indicates the Focus of interrogation. When it is attached to a

[1] *Man'yosyu* (c760), a collection of over 4000 verses, is the oldest written record of Japanese. The literature in Japan predating *Man'yosyu* is written in Chinese. *Man'yosyu* employs a unique writing system, *Man'yo-gana*, which marks the inception of the Japanese writing system based on the Chinese one. More specifically, *Man'yo-gana* is a set of Chinese characters used as syllabaries (i.e., only as phonological symbols). *Man'yo-gana* is further simplified and modified to derive *hira-gana*, the system of Japanese syllabary used today.

[2] There is only one actual data in *Man'yosyu* representing this very order, but it does not necessarily question the plausibility of (2). The scarcity could partly be because the majority of the data are short verses, and also because the topic [wa] is often a topicalized subject NP.

wh-expression, its function is mostly redundant.

Be this as it may, Watanabe's (2002) analysis had a special appeal because the interrogative particle [ka] has long attracted attention in Japanese philology for a different reason. Namely, when [ka], as well as other focus-marking particles such as polar interrogative [ya] and non-interrogative [so], appear somewhere in a sentence, the predicate takes not the conclusive (or finite) form (*Syusi-kei*) but takes what is called the attributive form (*Rentai-kei*). This "agreement" phenomenon is called *kakarimusubi*, which is virtually the longest-standing conundrum of Japanese grammar.

Against this, Watanabe (2002) presents a very simple answer that *kakarimusubi* is a sign of wh-agreement, which indicates that the IP has a wh-trace in it. So there is really nothing special about *kakarimusubi* if one takes UG into consideration. Incidentally, the restriction in (1)-(2) applies to all the focus particles, including [ya] and [so] (Nomura 2002). Thus the wh-movement analysis simultaneously gives a clever UG-based solution both to the word order restriction and to *kakarimusubi*. For this reason, it is taken almost like a new "discovery" of the unknown "fact" of the Japanese language.

2.2. Problems with the wh-movement analysis

However, it is indeed doubtful if the *wh*-movement analysis is motivated. For one thing, the fronting of a focus phrase does not necessarily require *wh*-movement in Japanese, given that virtually any type of phrase can be fronted by scrambling in the language. Even in Modern Japanese, which is not a wh-movement language in the usual sense, the focused phrase (of various forms) is often fronted for functional reasons, without a [-Interpretable] feature.

Another piece of evidence that obligatory fronting may not be an indication of syntactic movement comes from the cases of base-generated "fronting," like the ones in (4)-(5). Namely, in (4a) and (5a), a whole subordinate (causal) clause with particle [ka(-mo)] precedes the matrix clause. The [ka] clause is supposed to be moved out of the matrix clause. However, the same order, causal clause preceding the matrix clause, is found in (4b) and (5b), which have no focus particle [ka]. This order is actually the norm, since Japanese is a head-final language after all. If the order in (4a) and (5a) were an instance of wh-movement, what was behind the analogous order of the subordinate clause in (4b) and (5b)?

(4) a. [Nubatamano yo -o naga-mi ka-mo] waga seko -ga yume-ni-yume-ni-si
[(epithet) night -o long-because Q] my husband nom dream-dream-in
mie-kaheru-ramu
see-return[attri.]
'Is it because the night is long that my husband keeps coming back in my dream?'

b. [Akiyama -no momizi -o sige-mi] matohinuru imo -o motomemu yamadi
[autumn mountain -gen maple leaf -o thick-because] lost wife -acc search path
sirazumo
do-not-know
'Because maple leaves grow thick in the mountain, I cannot see the path to search for my wife who is lost.

(5) a. [Waga seko-ni mataha awa-zi-kato omohe-ba-ka] kesano wakare-no subenakarituru
my wife-dat again see-not-C think-cond-Q this morning parting-gen sad[attri.]
'Is it because I know I may not see my wife again that the parting this morning is particularly sad?'

b. [Yama-tooki miyako-nisi-are-ba] saozika-no tuma yobu koe wa tomosikumo aru-ka
mountain-far town-loc-be-cond. deer-gen wife call voice top scarece-be-Q
'Is it because I'm in town far away from the mountain that the deer's calling his mate can scarcely be heard?'

One may argue that (4a) and (5a) do involve (string-vacuous) wh-movement because they take the attributive form, showing wh-agreement, while (4b) and (5b) do not. However, this argument is circluar, because it is based on the hypothetical claim that the attributive form is a sign of wh-agreement. In fact, this claim crucially draws on the analysis that *kakarimusubi* involves wh-movement, without external evidence. The fact is that the attributive form is not limited to the context of *kakarimusubi*; it is the predicate form of a nominal clause and noun modificational clause in general.[3] It was also common in ancient Japanese that the nominal clause occurred independently, expressing some kind of non-assertiveness.[4] Most of the researchers in Japanese philology have suggested that the association between the focus particle and the attributive form in *kakarimusubi* has to do with semantics such as information structure rather than syntax (cf. Nomura 1995, Handou 2003). That is, the attributive form is not syntactically triggered by the presence of the focus particle (i.e., showing wh-agreement).[5] If the particle indicates the focus of question (or assertion), the rest conveys the de-focused (presupposed) part of the proposition. The attributive form of the predicate is used to reflect this informational structure.[6] This line of explanation seems particularly feasible, for instance, in view of the example in (6).

(6) Tahagoto-<u>ka</u>, oyodore-<u>ka</u>, komorikuno Hatuse-no yama-ni komori-seri-to-ihu.
insane-word-Q, false-word-Q, (epithet) Hatuse-no mountain-loc hide-do-C-say[attri.]

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[3] This is why it is called the "attributive" form.
[4] The decline of *kakarimusubi* during 14-15C coincides with the loss of the morphological distinction between the conclusive form and the attributive form. Interestingly, it is not the diffusion of the conclusive form but of the attributive form that resulted in the unification of the two conjugational forms.
[5] This, of course, is largely because Japanese philology does not assume syntactic operations analogous to the ones in the generative tradition. And yet, it is significant that a semantic motivation is available for *kakarimusubi.*
[6] Among Japanese philologists, Ohno (1993) proposes the Inversion Hypothesis, by which *kakarimusubi* is considered as a type of displacement. More specifically, the focus [ka] phrase is the fronted predicate, and the following attributive clause is the clausal subject (or topic), from which the topic marker [wa], which ought to occur at the end of the clause, is dropped for some reason. This is a kind of "movement," to be sure, but it is distinct from the wh-movement in the technical sense. Importantly, (i) the example (6), which is problematic for the wh-movement analysis, is perfectly fine for the Inversion Hypothesis, and (ii) the Inversion Hypothesis crucially assumes that the attributive clause is the inverted subject (topic), which is a nominal clause by definition. The latter point is in conformity with my assumption. Therefore, although the present analysis does not assume the Inversion Hypothesis, it is actually compatible with it.

'(lit) A joke? Or a lie? They say that he has hidden himself in Mt. Hatuse.'

Here, in (6), the [ka] phrases seem to be independent, fragmental phrases. It is very unlikely that the matrix clause includes a wh-trace for them, although the predicate takes the attributive form.

Given the limitation of OJ data, such syntactic tests as unbounded dependency and crossover are not available,[7] and the only solid motivation for the analysis is that the word order pattern in (2) is (almost) obligatory. However, being obligatory is not enough because the word order pattern may turn out to be obligatory when other patterns are all blocked for some other reason, which I believe is really the case.

Another serious shortcoming of the wh-movement analysis is found in its implication towards the history of *kakarimusubi*. If Watanabe's wh-movement analysis were correct, we would expect that when the word order restriction is lost, *kakarimusubi* (or wh-agreement) disappears around the same time. However, this is not the case. To be sure, when the word order restriction disappears in MJ, the genuine interrogative function of [ka] is rapidly lost, becoming confined to rhetorical questions. More and more wh-words occur without [ka], and the particle [ka] no longer triggers *kakarimusubi*.[8] This is taken to lend support to his analysis, since the loss of *wh*-movement (word order restriction) coincides with the decline of the interrogative particle [ka], suggesting the loss of the effect of [-Interpretable] feature.

However, such change in the behavior of [ka] may very well be lexical, for the above scenario does not seem to cover the whole class of *kakarimusubi*. For one thing, it is an established fact that the *kakarimusubi* completely disappeared around 14-15C, while the word order restriction was lifted around 9-10C. Even after the decline of [ka], *kakarimusubi* apparently flourished in MJ with relatively free word order and with different membership: i.e., [namu], [so], [ya], and bare *wh*-word.[9]

(7) *Kakarimusubi* (with attributive form) in OJ and MJ:

	Word Order	Trigger Membership
OJ (-9C):	all observe restriction (1)	[ka], [ya], [so]
MJ (9-14C):	(more or less) all free	[ya], [so], [namu], bare wh-word

Thus, although the OJ word order restriction (and its loss in MJ) covers all focus phrases as a class,

[7] No one has the native intuition of OJ, of course. Watanabe (2003) claims that there is one instance of an unbounded dependency. However, as Tonoike (2003) contends, the structure of the data is not clear. More importantly, given that even the word order restriction in (1) allows for a few exceptions, the sole instance will not be reliable evidence. The scarcity may rather indicate its exceptional status.

[8] The focus particle [ka] can occur in two positions: clause-internally and clause-finally. The word order restriction concerns the clause-internal ones, although the clause-final ones outnumbered the clause-internal ones in the actual data. During MJ, the clause-internal [ka] with wh-word is replaced by bare wh-word, and the one with non-wh-word is replaced by [ya]. Thus, [ka] does not participate in *kakarimusubi* in MJ. On the other hand, the clause-final [ka] remains as the interrogative marker until today.

[9] *Kakarimusubi* certainly did not start all at once. It is plausible that [ka] preceded other focus particles in diachronic change, and [namu] is evidently a late comer. But the difference of 500 years reduces the credibility.

the proposed scenario fits only the history of [ka]. Against this, Watanabe (2002) suggests that only the *kakarimusubi* in OJ is the "real" syntactic one, while the one in MJ is merely a stylistic imitation, which somehow lasted very long. This distinction, however, seems arbitrary, with no support outside the theory.[10]

In sum, although the wh-movement analysis has a strong appeal in its clarity, the actual data is much more complex and reveals serious shortcomings of the analysis.[11]

3. Word order restrictions in OJ and Case Morphology

Now, what is really behind the word order restriction in OJ? A key I believe lies in the attributive form of the predicate.

There are good reasons to believe that the attributive form is a nominal/verbal, mixed category.[12] For one thing, the attributive predicate can directly head a nominal clause without any nominalizing particle. Secondly, [no] and [ga] are in fact markers of the genitive as well of the subject (nominative). Besides, curiously, [no] and [ga] mark subjects only in a clause with the attributive form. Otherwise, the subject of the clause with conclusive (or finite) form is marked either with topic marker *wa* or without any marker at all. Markers [no] and [ga] are not even a choice. This unique distribution of [no] and [ga] has been traditionally ascribed to the nominal nature of the attributive form.[13]

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[10] If the *kakarimusubi* with free word order were merely a stylistic issue, imitated and maintained for 500 years, the one with fixed word order could also be a matter of style. It sounds very arbitrary to say that the one which conforms to the "putative" UG prediction is syntactic while the one which does not is stylistic.

[11] Another piece of historical evidence Watanabe provides is that the Internally-Headed Relative Clause, which is generally limited to wh-in-situ languages, gradually developed during MJ; thus, the language turned into the wh-in-situ type at the start of MJ. However, this is only very indirect evidence at best. From the historical fact one can only logically infer that MJ was a wh-in-situ language. It cannot prove that OJ was a wh-movement language.

[12] Japanese presents several different types of verbal-nominal mixed category phenomena besides the attributive predicate clause; i.e., the ones involving *-sa* nominalization (Morimoto 1996) and Sino-Japanese deverbal nouns. The latter are further divided into three types, appearing in Temporal Affix Constructions (Iida 1987; Horiuchi 2004, this volume), Purpose Expressions (Miyagawa 1987), and Light Verb Constructions (Grimshaw and Mester 1988). The relation among these putative mixed category constructions is not clear. The attributive predicate clause is different from all others in that the verb inflection alone is responsible for the nominal projection, while the others involve a deverbal noun or a deverbalizing morpheme such as *-sa* followed by a morpheme imparting the verbal character. Horiuchi (2004) presents a head-sharing analysis of the Japanese mixed category constructions along the line of Bresnan (1997). Although the attributive predicate clause could similarly be analyzed as the case of head-sharing construction, the present analysis adopts Malouf's (2000) style because it better captures the historical change of case marking morphemes. I appreciate the editors of this volume for reminding me of this issue.

[13] Through rigorous examination of data in *Man'yosyu*, Nomura (1993) claims that the traditional nominal hypothesis is not empirically supported. The critical point is that there are two types of context which show systematic irregularities; i.e., when the subject is fronted before the focus phrase in *kakarimusubi*, the attributive predicate allows zero-marking and [wa] on the subject (cf. (1)-II above), and [no/ga] can also appear in a conditional clause which is not headed by the attributive predicate. Nomura (1993) proposes that [no/ga] in OJ marks a phrase within a constituent with "strong unity." Kikuta (2003b) rejects the proposal as vague and argues that the traditional wisdom is tenable within a Stochastic OT

Moreover, in addition to the wh-word order restriction, rephrased in (8a), another restriction in (8b), which involves the direct object, has recently been observed by Kinsui (2001) and Yanagida (2003). Namely, it seems that the Subj with [no/ga] does not allow the object with the accusative marker [o] to come before the attributive predicate.

(8) a. Word Order Restriction [1] [NP[no/ga]. . . *wh([ka]). . . predicate(attributive)]
b. Word Order Restriction [2] [NP[no/ga]. . . *NP[o](=[acc]). . . predicate(attributive)]

Now the question is: are (8a) and (8b) separate? They are separate for Watanabe (2002), since (8b) is observed either with or without [ka], and has nothing to do with wh-movement. And yet their similarity is striking; it is basically a ban on the intervention of the "unity" of [no/ga] and the attributive predicate. Besides, crucially, both of them hold only in OJ, and disappear in MJ. This similarity is unlikely to be an accident.

Another important point is that (8a-b) restrict the surface order of case morphology rather than the possibility of argument realization, given the distribution summarized in (9). The attested patterns are described more schematically in (10). Thus, as in (10a), a direct object with [o] can appear if it is fronted, and the [o]-marked object can occur adjacent to the predicate if [no/ga] are not also present. Moreover, as in (10c) bare NPs are apparently exempt; a bare subject does not induce these restrictions, and, as in (10d), a direct object can occur between [no/ga] and the predicate if it is zero-marked:

(9) a. Direct object can appear with [o], if it is placed before [no/ga].
b. Direct object with [o] can appear adjacent to the predicate, if [no/ga] is not present.
c. Bare NPs are exempt; bare subject appear before or after wh-phrase, and bare direct object can occur between [no/ga] and the predicate.

(10) a. NP[o]. . . [NP[no/ga] . . . predicate(attributive)]
b. NP[o] predicate(attributive)
c. [NP[subj:zero] . . . wh[ka]. . . predicate(attributive)]
d. [NP[no/ga] . . . NP[obj:zero]. . . predicate(attributive)]

If the case markers [no/ga] and the attributive form share some nominal nature, it is not very surprising, intuitively at least, that accusative marking [o] and Focus marking [ka] do not intervene. In general, endocentric nominal phrases do not allow non-modificational phrases to occur between a genitive phrase and the nominal head. So the first approximation is that the OJ word order restriction reflects the nominal case frame, which is curiously imposed on arguments licensed by a predicate.

A note is in order, before we proceed, concerning the status of the particle [o]. Although it is the accusative marker in ModJ, its function was rather vague in OJ. For one thing, (i) bare NP was common for the object (as well as for the subject); secondly, (ii) the particle [o] often carried an

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framework. Importantly, the systematic irregularities, which motivate Nomura's rejection of the nominal hypothesis, fall out automatically as the result of competition among different constraints.

emphatic overtone;[14] and (iii) most curiously, [o] can marks a non-object, and even the subject in a special causal construction, called the *mi*-construction, which is illustrated in (4a-b) above.[15] Marker [o] becomes established as accusative in MJ, and along with it, the *mi*-construction also disappeared.

Finally, Modern Japanese (ModJ) shows a similar but distinct word order restriction. Although [no] in ModJ is unequivocally genitive, and [ga] is nominative, the subject of a nominalized and noun-modificational clause can be marked either with [ga] or [no]. This Ga-No Conversion is a peculiar, but very regular, phenomenon. However, as shown in (11b), genitive [no] subject is not possible for many speakers when it occurs with the accusative [o] object (Harada 1971):

(11)a. Hirosi –ga nikki -o yonda sei –de, Yuko -wa kizutuita.
nom diary acc read because-of top was-hurt
'Yuko was hurt because Hiroshi read her diary.'
b. * Hirosi –no nikki -o yonda sei –de, Yuko -wa kizutuita.
gen diary acc read because-of top was-hurt

This co-occurrence restriction of [no] and [o] is strikingly similar to the OJ restriction in (8b), above.[16] And yet, unexpectedly, neither the preposing of the [o]-marked object as in (12a) nor the dropping of case marker in (12b), improves the sentence at all. This contrasts with the case in OJ, when (10b) and (10c) were just fine:

(12)a. * Nikki -o Hirosi –no yonda sei –de, Yuko -wa kizutuita.
diary acc gen read because-of top was-hurt
b. * Hirosi –no nikki yonda sei –de, Yuko -wa kizutuita.
gen diary (-zero) read because-of top was-hurt

I will later show that this follows naturally from my proposal.

4. Proposal:

[14] If [o] in OJ is not purely a case marker but an emphatic (focus?) marker, one may be tempted to claim that (8a) and (8b) are identical and that the pattern (10a) is a type of wh(Focus)-movement after all. This claim, however, is not valid. While the intended wh(Focus)-movement is triggered by the [-interpretable] feature of [ka], the inhibited pattern in (8b) is observed either with or without [ka]. Similarly, the [o]-marked fronting in (10a) does not require the focus particle. This could also cast doubt on the feature-based Focus movement.

[15] *Mi* is a predicate ending particle which attaches to either a verb or an adjective to show nominalization, imperfectivization, among others. *Mi*-construction is a unique structure which forms a causal clause. The subject of the *mi*-attached causal clause is marked either with [o] or zero.

[16] The judgment of (11b) is known to be subject to individual variation. Watanabe (1996) calls this the "Transitivity restriction" and proposes a wh-movement analysis to explain why (11b) is bad. Kikuta (2003a) shows, on the other hand, that this has to do with more surface case-marking rather than the type of the predicate.

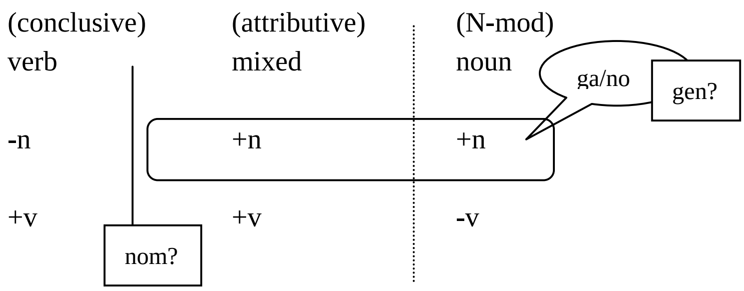
To repeat, the key insight is that the OJ word order reflects some kind of restriction on nominal phrases. The solution is sought in the interaction of the profile of case markers in each period and the ranking of OT constraints.

4.1 Abstract Case and Profile of Morphological Case Markers

From the observation in (8) through (10), we saw that the morphological realization of case, and the syntactic licensing of arguments are separate. Specifically, arguments are licensed in f-structure, by virtue of being an argument of a certain grammatical function of a certain head with appropriate case assigning properties. I tentatively use the term “*abstract case*” in the sense that an argument is syntactically licensed. On the other hand, case particles, such as [no] [ga] [o], are a phonological (and morphological) realization of the abstract case, i.e, case-related properties of an argument. Each case particle has a certain profile, and the particle is used only when its profile is compatible with abstract case, or the type of licensing in the above sense. The profile of each morphological case changes through time.

The figure in (13) shows the case profile of [no] and [ga] in OJ, classified according to the categorial type of the head.[17] Notice that I adopt the idea of Malouf (2000) here in assuming that the attributive form predicate is a [+n, +v] mixed category. The profiles in (13) indicate that, in OJ, [ga] and [no] are simply markers of a dependant of a [+n] category. The value of [+/-v] is irrelevant. This is why they appear as both genitive and nominative, and this is also why the subject of the conclusive form does not occur with [no] or [ga]. The irrelevance of [v] for [no/ga] I claim reflects the overall delay in the establishment of [+v] case morphemes, which is also related to the delay in the establishment of the accusative marker [o]:[18]

(13) OJ

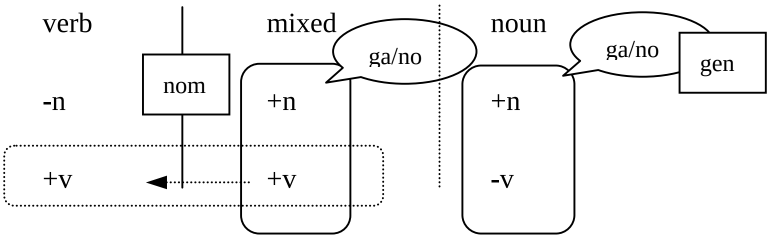


Now the case profile gradually changed. As shown in (14), in MJ, the [+v] feature started to count, since the OJ case system was clearly defective. Although [no] and [ga] were still used for both subjects and noun-modifiers; I claim that they are now ambiguous rather than being underspecified: there are both [+v] version and [-v] version for them:

[17] The other properties such as grammatical function are omitted for expository purposes.

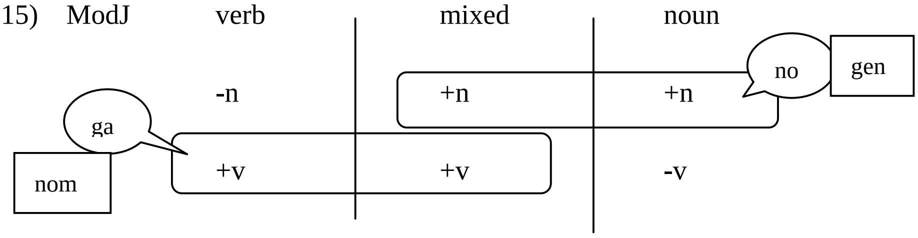
[18] Thus, it does not make much sense to argue if [ga] and [no] in OJ are genitive or nominative. If “nominative” is defined a [-n, +v] case, and “genitive” a [+n, -v] case, no case markers are available in OJ to genuinely represent nominative or genitive case.

(14) MJ



Further down in history, as indicated by the arrow and broken line in the figure (14), [+v] for nominative extended its region even more to cover [-n, +v] as well as [+n, +v], and finally the case profiles developed into a clean two-way system in Modern Japanese, shown in the figure (15). In ModJ, [no] is the [+n] case, and [ga] is the [+v] case.[19] There is no overlap in their profiles:

(15) ModJ



4.2 OT-LFG: Constraints and Their Ranking

The case profiles in the previous section interact with the constraints I propose in (16).

(16) (A) **Appropriate Reflection of Argument Licensing (Abstract Case)**
(B) **Nominal Phrase Tightness:** *[$_{\text{YP}}$ NP[Ncase] XP Y[+N]] where XP = XP[+mark]
(C) **Morphological Case Type Consistency**: Case type of coarguments should be consistent (+N-type case, +V-type case).

The first constraint, (16A) is a simplified form of a Faith constraint. As I said above, each licensed argument bears “case” in an abstract sense, which is equivalent to the type of argument licensing based on the grammatical function and the like. And it is essential in determining the appropriateness of the choice of each morphological case marker. The constraint (16A) checks the basic compatibility in this regard.[20]

[19] How and when [ga] and [no] diverged is another long-discussed issue (cf. Nomura 1996). It is widely known that [ga] and [no] are not completely interchangeable even in OJ-MJ, but they are distinguished in terms of animacy and referentiality, among others. It is also the fact that the rhetorical (metaphorical) noun modification called *makura-kotoba* (as included in (4a) and (6) above) is limited to [no]. The two, however, are not differentiated in (13) and (14) because (i) their difference is hard to make precise in OJ, when [ga] and [no] are often represented with the same character, and (ii) their difference seems mostly semantic rather than categorical in OJ at least. Admittedly, this latter situation gradually changes during the course of MJ, and the change marked by the dotted line in (14) applies only to [ga].

[20] Admittedly, this is an over-simplified assumption. As pointed out by Peter Sells (p.c.), the correspondence between thematic roles (and grammatical functions) and the abstract case is no simple matter but has long challenged theoretical linguists. This constraint is not meant to ignore the

(16B) encodes the "tightness" of a nominal phrase, which means that in an endocentric nominal phrase, the link between the Spec and head should not be interrupted by a noun-modificational phrase. Note that this constraint is very natural for an NP. Reflecting the case profile, I assume that [Ncase] for NP-tightness is [+n] case in OJ and ModJ, while it is [+n, -v] case in MJ.

Constraint (16C) prescribes that coarguments should share the same case type. Generally, case marking falls into nominal (N) type and verbal (V) type: the former includes the typical genitive, while the latter includes nominative, accusative, dative, and oblique, although there are mixed cases as well. The distinction of case type is quite strictly observed in Japanese. For instance, prenominal modifiers must occur with genitive [no] in ModJ, basically never with verbal cases or with postpositions alone. This is reflected in the contrast in (17) of the English preposition "from" and the Japanese counterpart "kara"; a "kara"-phrase can never occur alone as a noun-modifier as shown in (17b):

(17) a. This wine comes from California vs. Kono wain -wa California -kara kiteiru
b. The wine from California vs. California *kara / no / kara-no wain

This principle of case-type consistency obviously lies behind the restriction on [ga/no] conversion in ModJ observed above:

(18) a. John eats bread. vs. John –ga pan -o taberu.
b. John's eating bread vs. John-ga pan –o taberu-koto
*?John-no pan-o taberu-koto

Now I propose that the constraints are ranked as in (19).

(19) OJ: (A) > (B) >> (C)
MJ: (A) > (C) >> (B)

I basically follow the idea of Boersma (1997) in assuming constraints are not only ordered but are separated specific numbers apart in weight, although I do not give the specific value of the constraint weight here.

4.3 Evaluation

The tableaux in (20) – (25) show the schematic evaluation in each period. The input is an f-structure of a [+nominal] predicate (attributive form) with two arguments. I take XP[ka] as being a verbal dependant, and [ka] as [+v] particle.

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importance of the issue in a lexicalist framework. The point, rather, is to show that there can be another layer of correspondence. Most of the previous studies have implicitly assumed that morphological case marking directly reflects the type of abstract case, since their correspondence is often very tight as in ModJ. However, the data in OJ calls for a system which separates the case morpheme from the abstract case.

(20) OJ

GF, GF[Foc], Pred[+v,+n]	AbstCase	NP-tight	Case-type
a. [NP[ga:+n] XP [ka:+v] Pred[+v, +n]]		*	*
b. [NP[no:+n] XP [ka:+v] Pred[+v, +n]]		*	*
c. [NP[ni:+v] XP [ka:+v] Pred[+v, +n]]	*		
☞d. XP [ka:+v] [NP[ga:+n] Pred[+v, +n]]			*
☞e. XP [ka:+v] [NP[no:+n] Pred[+v, +n]]			*
f. XP [ka:+v] [NP[ni:+v] Pred[+v, +n]]	*		

(21)

GF, GF, Pred[+v,+n]	AbstCase	NP-tight	Case-type
a. [NP[ga:+n] NP [o:+v] Pred[+v, +n]]		*	*
b. [NP[no:+n] NP [o:+v] Pred[+v, +n]]		*	*
c. [NP[ni:+v] NP [o:+v] Pred[+v, +n]]	*		
☞d. NP [o:+v] [NP[ga:+n] Pred[+v, +n]]			*
☞e. NP [o:+v] [NP[no:+n] Pred[+v, +n]]			*
f. NP [o:+v] [NP[ni:+v] Pred[+v, +n]]	*		
☞g. [NP[ga:+n] NP [ϕ] Pred[+v, +n]]			
☞h. [NP[no:+n] NP [ϕ] Pred[+v, +n]]			
☞i. NP [ϕ] [NP[ga:+n] Pred[+v, +n]]			
☞j. NP [ϕ] [NP[no:+n] Pred[+v, +n]]			

Among the candidates in (20), (20c) and (20f), violate the strongest constraint AbstCase, since the subject argument cannot normally be marked with the particle [ni], which is roughly dative. Among the rest, (20a) and (20b), where the Focus phrase XP[ka] intervenes between NP[no/ga] and the predicate, are blocked since they violate the nominal tightness constraint. The candidates (20d) and (20e), in which the Focus phrase is preposed outside the nominal domain, survive because they violate only the low-ranked Case-type consistency constraint. Notice that what we have here are the cases of apparent wh-movement. In other words, what caused the word order restriction in OJ is the dominance of the constraint (B). The evaluation of (21), which involves the direct object, proceeds basically the same way.

The evaluation in (20) and (21) may appear incomplete in that it allows too many "optimal" ones. In particular, it gives no prediction as to which candidate will be chosen in a given instance, nor is it clear how the candidates which violate the low-ranked constraints come to survive after all.[21] The evaluation in this section is indeed schematic; it is meant to demonstrate the effect of the word order restriction in OJ and its loss in MJ on the whole class of clauses headed by an

[21] This problem was pointed out by Joan Bresnan. The candidates in (21d-e) violate the NP-tightness constraint, while those in (21g-j) violate none in the evaluation. Nevertheless, the former will survive after all when the object NP bears semantic and thematic weight, which is ignored here. As briefly mentioned in the text, it is generally agreed that the particle [o] indicates some kind of emphasis in OJ.

attributive predicate, rather than to explain each attested pattern. In other words, the evaluation shows all syntactically possible candidates. Undoubtedly, the ultimate choice in each actual instance among viable candidates must refer to other factors ignored here. The actual order is determined by considering at least the following factors: (1) informational/thematic prominence of each constituent, (2) phonological weight (or syllable length) of the constituent. The choice between [ga] and [no] must also consider lexical semantics.[22] I also assume that this system follows Boersma's mechanism, and it allows optionality. So when all factors of two viable candidates are on a par, for instance, their occurrence will be about 50% each.

Now the apparent loss of wh-movement in MJ results from the relative demotion of the constraint (B), which is caused by the promotion of (C), which reflects the development of the morphological V-case system in MJ. The evaluation at this stage is shown in (22). Recall that at this point, the case profiles of [no] and [ga] have changed; they are no longer simply [+n] case morphemes, but are ambiguously [+n,+v] and [+n,-v] morphemes:

(22) MJ

GF, XP[Foc], Pred[+v,+n]	AbstCase	Case-type	NP-tight
☞a. [NP[ga:+v,+n] NP [ka:+v] Pred[+v, +n]]			*
☞b. [NP[no:+v,+n] NP [ka:+v] Pred[+v, +n]]			*
c. [NP[ga:-v,+n] NP [ka:+v] Pred[+v, +n]]		*	*
d. [NP[no:-v,+n] NP [ka:+v] Pred[+v, +n]]		*	*
e. [NP[ni:+v] NP [ka:+v] Pred[+v, +n]]	*		
☞f. NP [ka:+v] [NP[ga:+v,+n] Pred[+v, +n]]			
☞g. NP [ka:+v] [NP[no:+v,+n] Pred[+v, +n]]			
h. NP [ka:+v] [NP[ga:-v,+n] Pred[+v, +n]]		*	
i. NP [ka:+v] [NP[no:-v,+n] Pred[+v, +n]]		*	
j. NP [ka:+v] [NP[ni:+v] Pred[+v, +n]]	*		

[22] For instance, it has been observed that the nominative [no] is used for someone that deserves more respect. The exact semantic nature of the two nominative markers, however, is rather controversial.

(23)

GF, GF, Pred[+v,+n]	AbstCase	Case-type	NP-tight
☞a. [NP[ga:+v,+n] NP [o:+v] Pred[+v, +n]]			*
☞b. [NP[no:+v,+n] NP [o:+v] Pred[+v, +n]]			*
c. [NP[ga:-v,+n] NP [o:+v] Pred[+v, +n]]		*	*
d. [NP[no:-v,+n] NP [o:+v] Pred[+v, +n]]		*	*
e. [NP[ni:+v] NP [o:+v] Pred[+v, +n]]	*		
☞f. NP [o:+v] [NP[ga:+v,+n] Pred[+v, +n]]			
☞g. NP [o:+v] [NP[no:+v,+n] Pred[+v, +n]]			
h. NP [o:+v] [NP[ga:-v,+n] Pred[+v, +n]]		*	
i. NP [o:+v] [NP[no:-v,+n] Pred[+v, +n]]		*	
☞j. [NP[ga:+v,+n] NP [ϕ] Pred[+v, +n]]			
☞k. [NP[no:+v,+n] NP [ϕ] Pred[+v, +n]]			
l. NP [o:+v] [NP[ni:+v] Pred[+v, +n]]	*		
m. [NP[ga:-v,+n] NP [ϕ] Pred[+v, +n]]		*	
n. [NP[no:-v,+n] NP [ϕ] Pred[+v, +n]]		*	
☞o. NP [ϕ] [NP[ga:+v,+n] Pred[+v, +n]]			
☞p. NP [ϕ] [NP[no:+v,+n] Pred[+v, +n]]			
q. NP [ϕ] [NP[ga:-v,+n] Pred[+v, +n]]		*	
r. NP [ϕ] [NP[no:-v,+n] Pred[+v, +n]]		*	

Among the candidates in (22), (22e) and (22j) are blocked for the violation of AbstCase, as in OJ. Among the rest, (22c-d) and (22h-i), which involve "genitive" or [-v] version of [no] and [ga], violate Case-type consistency and are blocked. However, the homophonous strings in (22a-b) and (22f-g) survive because they are marked with the [+v] version of [no] and [ga]. Among the remaining four, (22a-b), where the Focus phrase occurs in the middle, violate the NP tightness, but the violation does not seem to count now. The evaluation for the direct object in (23) proceeds similarly.

Thus the apparent wh-movement in OJ and its loss in MJ result from the interaction of case profiles and the ranked constraints. The dominance of Case Type Consistency reflects the development of the v-case.

4.4 Further Consequences: Ga/No Conversion in ModJ:

Now, given the case profiles I proposed for ModJ, with the same constraint ranking as for MJ, the observation on Ga/No Conversion in (11)-(12) obtains automatically. The data is repeated in (24), and the evaluation is shown in the tableau (25):

(24) a. Hirosi –ga nikki -o yonda sei –de, yuko -wa kizutuita.
b. * Hirosi –no nikki -o yonda sei –de, yuko -wa kizutuita.
c. Nikki -o Hirosi –ga yonda sei –de, yuko -wa kizutuita.

d. * Nikki -o Hirosi –no yonda sei –de, yuko -wa kizutuita.
‘Yoko was hurt because Hiroshi read her diary.’

(25) ModJ: Ga/No Conversion

GF, GF, Pred[+v,+n]	AbstCase	Case-type	NP-tight
☞a. [NP[ga:+v] NP [o:+v] Pred[+v, +n]]			
b. [NP[no:+n] NP [o:+v] Pred[+v, +n]]		*	*
☞c. [NP [o:+v] NP[ga:+v] Pred[+v, +n]]			
d. NP [o:+v] [NP[no:+n] Pred[+v, +n]]		*	

Among the candidates, (24d) is blocked as cleanly as (24b) due to the violation of Case-type. The surface string of (24d), with the [o]-marked direct object preposed before the nominative subject, is similar to the acceptable one in OJ, (21e); however, given the case profile and the ranking in ModJ, it has in fact no room for survival. Thus the contrast of OJ and ModJ is no mystery after all.

In this way, the interplay of the profile of case morphemes and the ranking of the constraint brings forth the desired effect in a simple manner.

5. Conclusion

I have shown that we need no wh-movement in order to account for the word order restriction in OJ and its loss in MJ. They simply reflect the gradual and dynamic development of the morphological case system. It is an undeniable fact that case morphemes such as [no] and [ga] changed their profile over the years. The change in the profile of case particles is partly lexical, but it has systematic consequences on the surface syntactic structure.

The proposed analysis gives a comprehensive picture of the diachronic facts of the language. It captures the fact that *kakarimusubi* flourished both in OJ and MJ, with a difference in the freedom of word order. We do not need to make an arbitrary distinction between the UG-based (=syntactic) *kakarimusubi* in OJ and the mere stylistic one in MJ, which finds no empirical support outside the particular theory.

One of the issues implicitly addressed is the primacy of constraint ranking in syntax. The analysis presented in this paper assumes a dual system of a case profile and constraint ranking, both of which are subject to change. To be sure, there is a conceptual redundancy in this system, but at this point, I believe this duality is necessary to accommodate a syntactic system, so long as the syntax involves lexical items.

The analysis presented here is programmatic in several ways. It ignores the complexity of syntactic (abstract) case licensing, and it does not discuss how functional and phonological factors interact to derive the optimal word order. Another caveat, of course, is the universal applicability of the constraints proposed, which has to be tested against more empirical data from different languages. Nevertheless, I hope to have shown that the OT framework offers a totally new perspective to the diachronic syntactic change of the language.

Selected References

Asudeh, A. 2001. Linking, Optionality, and Ambiguity in Marathi. *Formal and Empirical Issues in Optimality Theoretic Syntax,* ed. P. Sells, 257-312. Stanford, CA: CSLI Publications.

Boersma, P. 1997. How We Learn Variation, Optionality, and Probability. *IFA Proceedings 21*, 43-58. ROA-221-109.

Boersma, P. & Hayes, B. 2001. Empirical Tests of the Gradual Learning Algorithm. *Linguistic Inquiry* 32: 45-86.

Bresnan, J. 1997. Mixed Categories as Head Sharing Constructions. *On-line Proceedings of the LFG1997 Conference,* eds. M. Butt & T. H. King. Stanford, CA: CSLI Publications.

Bresnan, J. & Aissen, J. 2001. Optimality and Functionality: Objections and Refutations. *Natural Language & Linguistic Theory* 20: 81-95.

Bresnan, J., Dingare, S., & Manning, C. D. 2001. Soft Constraints Mirror Hard Constraints: Voice and Person in English and Lummi. *On-line Proceedings of the LFG2001 Conference,* eds. M. Butt & T. H. King. Stanford, CA: CSLI Publications.

Choi, H.-W.1999. *Optimizing Structure in Context: Scrambling and Information Structure*. Stanford, CA: CSLI Publications.

Dingare, S. 2001. The Effect of Feature Hierarchies on Frequencies of Passivization in English. Unpublished MA thesis, Stanford University. ROA-467-0901

Grimshaw, J. & Mester, A. 1988. Light Verbs and Theta Marking. *Linguistic Inquiry* 19: 205-232.

Handou, H. 2003. Kakarimusubi-ron no Saikoutiku [*Kakarimusubi* Revisited], *Kokugo Kokubun*, vol. 72, no 5, 33-45.

Harada, S.I. 1971. “Ga-No Coversion and Ideolectal Variations in Japanese,” *Gengo Kenkyuu* 60, 25-38.

Horiuchi, H. 2004. Lexical Integrity, Head Sharing, and Case Marking in Japanese. *On-line Proceedings of the LFG2004 Conference,* eds. M. Butt & T. H. King. Stanford, CA: CSLI Publications.

Iida, M. 1987. Case-Assignment by Nominals in Japanese. In *Working Papers in Grammatical Theory and Discourse Structure: Interactions of Morphology, Syntax, and Discourse*, eds. M. Iida et al., 93-138. Stanford, CA: CSLI Publications.

Kikuta, C.U. 2003a. Ga-No Kotai-Gensyu ni Hasei wa Hituyou-ka: HPSG de Meisisei to Zyutugosei o tunagu [Is Derivation Necessary for Ga/No Conversion?: A Mixed-Category Analysis in HPSG]. *JELS 20: Papers from the Twentieth National Conference of the English Linguistic Society of Japan*, 61-70.

Kikuta, C.U. 2003b. Subject Case Marking in Early Classical Japanese; A New Perspective from Stochastic Optimality Theory. In *Japanese/Korean Linguistics* 12, ed. W. McClure, 152-164. Stanford, CA: CSLI Publications & SLA.

Kinsui, S. 2001. A History of Japanese Grammar Examined through Case Markers. A lecture given at Tokyo University, August 26, 2001.

Kuhn, J. 2003. *Optimality-Theoretic Syntax: A Declarative Approach.* Stanford, CA: CSLI Publications.

Malouf, R. P. 2000. *Mixed Categories in the Hierarchical Lexicon.* Stanford, CA: CSLI Publications.

Miyagawa, S. 1987. Restructuring in Japanese. In *Issues in Japanese Linguistics*, eds. K. Imai, et al., 273-300. Dordrecht: Foris.

Morimoto, Y. 1996. Nominalization or Verbalization?: Analyzing Mixed Case Marking in Japanese. Ms. Stanford University.

Mugane, J. M. 2003. Hybrid Constructions in Gikuyu: Agentive Nominalizations and Infinitive-gerund Constructions. In Nominals: Inside and Out, eds. M. Butt & T. H. King, 235-265. Stanford, CA: CSLI Publications.

Nomura, T. 1993. Zyodaigo no *no* to *ga* nituite, [On *no* and *ga* in Old Japanese] *Kokugo Kokubun*, vol. 62, nos 2-3, 1-17 & 30-49.

Nomura, T. 1995. Ka-niyoru Kakarimusubi Siron, [On *Kakarimusubi* by *ka*] *Kokugo Kokubun*, vol. 64, no 9, 1-27.

Nomura, T. 1996. Ga-Syusikei e, [Toward Ga-Conclusive Form] *Kokugo Kokubun*, vol. 65 no 5, 524-541.

Nomura, T. 2002. Kakarimsubi no Kobun: Zyodai kara Tyuko e [The *Kakarimusubi* Construction: From OJ to MJ]. Paper presented at the Symposium at Kansai Linguistic Society.

Ohno, S. 1993. *Kakarimusubi no Kenkyu* [*A Study on Kakarimusubi*]. Tokyo: Iwanami.

Sasaki, T. 1992. Joudaigo ni okeru –ka-ha no koubun. [On the construction of –ka-ha in Old Japanese] *Kokugo Kokubun*, vol. 61, no 5, 17-33.

Sigurdsson, H.A. 2003. Case: Abstract vs. Morphological. In *New Perspectives on Case Theory*, eds. E. Brandner & H. Zinsmeister, pp. 223-267. Stanford, CA: CSLI Publications.

Tonoike, S. 2003. Joudai Nihongo ni Sahou Wh-Idou wa soredemo attaka [Should we still believe that Old Japanese had leftward wh-movement?], *Gengo* 32:1, 146-153.

Yanagida, Y. 2003. Obligatory Movement and Head Parameter: Evidence from Early Old Japanese, *Sophia Symposium on Classical Japanese and Linguistic Theory: Sophia Linguistica* 50, 103-116.

Watanabe, A. 1996. Nominative-Genitive Conversion and Agreement in Japanese: A Cross-Linguistic Perspective, *Journal of East Asian Linguistics* 5, 247-286.

Watanabe, A. 2002. Loss of Overt Wh-Movement in Old Japanese. In *Syntactic Effects of Morphological Change*, ed. D.W. Lightfoot, 179-195. Oxford: Oxford UP.

MODERN GREEK DITRANSITIVES IN LMT

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ABSTRACT: Modern Greek distinguishes two types of ditransitive constructions, the genitive ditransitive construction and the double accusative ditransitive construction.

1. In Modern Greek the goal in most ditransitives surfaces as a PP (see example (1)), or as an NP with morphological genitive case (see example (2)):

(1) O Petros estile to paketo s-tin mitera
the Peter.Nom send.3SG.PAST the packet.Acc to-the mother.Acc
tu polu prosfata.
his.Cl.Gen very recently
"Peter sent the packet to his mother very recently".

(2) O Petros estile tis miteras tu to
the Peter.Nom send.3SG.PAST the mother.Gen his.Cl.Gen the
paketo polu prosfata.
packet.Acc very recently
"Peter sent his mother the packet very recently".

2. With a limited set of verbs both the indirect object and the direct object may surface with morphological *accusative* case used without a preposition. These verbs include the predicates *didasko* (teach), *serviro* (serve), *plirono* (pay):

(3) O kathigitis didakse tus fitites tin
the professor.Nom teach.3SG.PAST the student.Acc.PL the
ili ton mathimatikon prosfata.
course-material.Acc the maths.Gen.PL recently
"The professor taught the students the course material for the maths recently".

(4) O kathigitis didakse tin ili ton
the professor.Nom teach.3SG.PAST the course-material.Acc the
mathimatikon s-tus fitites prosfata.
maths.Gen.PL to-the student.Acc.PL recently
"The professor taught the course material for the maths to the students recently".

Adjectival passives with goal externalization are not possible with the verbs forming the genitive ditransitive construction (the following example reads in relation to examples (1) and (2)):

(5) Ena prosfata stalmeno paketo. /* Mia prosfata stalmeni mitera.
a recently sent packet /* a recently sent mother
"A recently sent packet". /* "A recently sent mother".

In contrast, adjectival passives with goal externalization are possible with the verbs forming the double accusative ditransitive construction (the following example reads in relation to examples (3) and (4)):

(6) I prosfata didagmeni ili ton mathimatikon./I prosfata
the recently taught course-material the maths.Gen.PL/the recently
didagmeni fitites.
taught students
"The recently taught course material for the maths"./ "The recently taught students".

Moreover, in Modern Greek the two verb classes differ with respect to nominalization. Nominalizations where the goal surfaces as the non-prepositional complement of the noun are not possible with the verbal predicates participating in the genitive ditransitive construction (examples (7)-(9)), while they are possible with the verbal predicates participating in the double accusative ditransitive construction (example (10) in relation to examples (3) and (4)):

(7) O Petros nikiase to spiti s-ton fititi.
the Peter.Nom rent.3SG.PAST the house.Acc to-the student.Acc
"Peter rent the house to the student".

(8) O Petros nikiase tu fititi to spiti.
the Peter.Nom rent.3SG.PAST the student.Gen the house.Acc
"Peter rent the student the house".

(9) To nikiasma tu spitiu. /* To nikiasma tu fititi.
the rental the house.Gen /* the rental the student.Gen
"The rental of the house". /* "The rental of the student".

(10) I didaskalia tis ilis ton mathimatikon. / I
the teaching the course-material.Gen.SG the maths.Gen.PL / the
didaskalia ton fititon.
teaching the students.Gen.PL
"The teaching of the course material for the maths". / "The teaching of the students".

For Modern Greek genitive ditransitive constructions I argue for an account which shares with the "dative shift" approaches the idea that there is a single verb meaning involved, and with the "dative alternation" approaches the idea that variants are nonderivationally related (see Butt, Dalrymple, and Frank (1997), Wechsler (1995), among others, for similar approaches in LFG and HPSG, respectively, to English ditransitives). The starting point of the analysis for predicates heading Modern Greek genitive ditransitive constructions is that they are not polysemous and, more generally, the genitive ditransitive alternation does not involve two distinct meanings for each individual ditransitive predicate. In the spirit of Levin and Rappaport Hovav (2001), I propose that the key idea is that the genitive ditransitive alternation in Modern Greek is not about alternate objects, like for instance, the locative alternation in Modern Greek, but about alternate expressions of recipients (i.e., animate goals). That is, recipients in Modern Greek genitive ditransitive constructions may be realized in two ways as they are open to two semantic characterizations (see also Goldsmith (1980) for English): (i) a type of possessor, (ii) a type of goal, as the Localist Hypothesis predicts (cf., also Gruber (1965), Jackendoff (1972)). The consequence of the availability of two semantic characterizations for recipients in the case of Modern Greek genitive ditransitive constructions (i.e., possessors and goals) is that recipients have also two potential modes of syntactic instantiation: (i) a genitive case-marked NP (see example (2)), (ii) a PP (*s-tin* (to)-phrase in example (1)). For Modern Greek double accusative ditransitive constructions I propose an analysis which shares with the "dative alternation" approaches the idea that variants are nonderivationally related. I also propose, though, that unlike the genitive ditransitive constructions in Modern Greek the double accusative ditransitive construction is about alternate objects, like for instance, the locative alternation in Modern Greek. This proposal is strongly supported by the evidence from adjectival passives and nominalizations presented above in relation to Modern Greek double accusative ditransitive constructions, which shows that with predicates heading double accusative ditransitives either the *theme* or the *recipient* argument exhibits "object" properties, depending on which is (the primary) object. Such an analysis tends to be accompanied by different lexical semantic entailments in relation to the two variants:

(11) From Arad (1998)
a. *to*-VARIANT: x cause [**y** to come to be at (possession) z]
b. DOUBLE OBJECT VARIANT: x cause [**z** to come to be in STATE (of possession)] by means of [x cause [y to come to be at (poss) z]]

(12) O Petros estile to paketo s-tin mitera
the Peter.Nom send.3SG.PAST the packet.Acc to-the mother.Acc
tu.
his.Cl.Gen

"Peter sent the packet to his mother".

stelno$<$ agent recipient=goal theme $>$
-o ($\hat{\theta}$-arg) -o -r
SUBJ OBL_{θ} OBJ

(13) O Petros estile tis miteras tu to paketo.
the Peter.Nom send.3SG.PAST the mother.Gen his.Cl.Gen the packet.Acc

"Peter sent his mother the packet".

stelno$<$ agent recipient=possessor theme $>$
-o ($\hat{\theta}$-arg) +r -r
SUBJ OBJ_{θ}(genitive) OBJ

(14) O kathigitis didakse tus fitites tin
the professor.Nom teach.3SG.PAST the student.Acc.PL the
ili ton mathimatikon prosfata.
course-material.Acc the maths.Gen.PL recently

"The professor taught the students the course material for the maths recently".

didasko$<$ agent recipient theme $>$
-o ($\hat{\theta}$-arg) -r +o
SUBJ OBJ OBJ_{θ}(second accusative)

(15) O kathigitis didakse tin ili ton
the professor.Nom teach.3SG.PAST the course-material.Acc the
mathimatikon s-tus fitites prosfata.
maths.Gen.PL to-the student.Acc.PL recently

"The professor taught the course material for the maths to the students recently".

didasko$<$ agent recipient theme $>$
-o ($\hat{\theta}$-arg) -o -r
SUBJ OBL_{θ} OBJ

References

Arad, M. (1998). *VP-Structure and the Syntax-Lexicon Interface*. Ph. D. thesis, University College London, London, UK.

Butt, M., M. Dalrymple, and A. Frank (1997). An architecture for linking theory in LFG. In M. Butt and T. H. King (Eds.), *Proceedings of the LFG97 Conference*, University of California, San Diego. CSLI Publications.

Goldsmith, J. (1980). Meaning and Mechanism in Grammar. In S. Kuno (Ed.), *Harvard Studies in Syntax and Semantics*, pp. 423–449.

Gruber, J. S. (1965). *Studies in Lexical Relations*. Ph. D. thesis, MIT.

Jackendoff, R. S. (1972). *Semantic Interpretation in Generative Grammar*. Cambridge, MA: MIT Press.

Levin, B. and M. Rappaport Hovav (2001). What Alternates in the Dative Alternation? Colloquium Series, Department of Linguistics and Philosophy, MIT, Cambridge, MA, November 9, 2001.

Wechsler, S. (1995). *The Semantic Basis of Argument Structure*. Stanford: CSLI Publications. Series: *Dissertations in Linguistics*, Joan Bresnan, Sharon Inkelas, William J. Poser, and Peter Sells (eds.).

GRAMMATICAL FUNCTIONS, LMT, AND CONTROL IN THE HUNGARIAN DP REVISITED

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Abstract

The aim of the paper is to offer a critical evaluation of previous LFG accounts of Hungarian DPs containing derived complex event nominals and, by combining some aspects of some of these accounts, to propose a new and more principled analysis. My main assumptions and claims are as follows. There are two possessor forms and two [-o,-r] grammatical functions in the Hungarian DP: (SUBJ) and (POSS). Either possessor form can realize either grammatical function. The two forms are in complementary distribution. The explanation for this complementarity is that Hungarian possessive constructions are head-marking, and the morphological structure of Hungarian nouns is such that only one overt possessive relationship can be encoded. The highest argument in the argument structure can also be covert, realized by a SUBJ-PRO. LMT as developed for the clausal level can be adopted in this DP domain in a principled manner, including the (SUBJ) Condition.

1. Introduction

All generative approaches so far agree that in Hungarian there is a class of nominals derived from verbs by the *-ás/-és* suffix (glossed as DEV below, short for deverbal nominalizing suffix) which express complex events in Grimshaw's (1990) sense. They are assumed to inherit the argument structure of the input verb in its entirety.

The aim of the paper is to offer a critical evaluation of previous LFG accounts of Hungarian DPs containing derived complex event nominals and, by combining some aspects of some of these accounts, to propose a new and more principled analysis. The main issues to be addressed are as follows:

a) the inventory (and nature) of grammatical functions;

b) the consequences of this inventory for LMT;

c) the treatment of control phenomena.

As will be clear from the subsequent discussion, these aspects of the analysis are interrelated.

My main assumptions and claims will be as follows. There are two possessor forms and two [–o,–r] grammatical functions in the Hungarian DP: (SUBJ) and (POSS). Either possessor form can realize either grammatical function. The two forms are in complementary distribution. The explanation for this complementarity is that Hungarian possessive constructions are head-marking, and the morphological structure of Hungarian nouns is such that only one overt possessive relationship can be encoded. The highest argument in the argument structure can also be covert, realized by a (SUBJ)-PRO. LMT as developed for the clausal level can be adopted in this DP domain in a principled manner, including the (SUBJ) Condition.

The paper has the following structure. After this introduction, first I will present the data: the basic facts (2.1) and the problem (2.2). Next, I will give a critical overview of previous LFG accounts (3). Then I will propose the new account (4). This will be followed by some concluding remarks (5).

2. The data

When referring to the core arguments of intransitive and transitive predicates, I will use the well-established notational convention shown in (1).

(1) a. S: subject of intransitive verbs

b. A: subject of transitive verbs

c. P: object of transitive verbs

2.1. The basic facts

There are two distinct ways of expressing the possessor in the Hungarian DP. It can be in either the nominative or the dative. Consider the examples in (2).

(2)

a. (a)	János	kiabál-ás-a			
the	John.NOM	shout-DEV-3SG			
'John's shouting'					

b. János-nak	a	kiabál-ás-a			
John-DAT	the	shout-DEV-3SG			
'John's shouting'					

c. a	dokumentum	megsemmisít-és-e	(János	által)	
the	document.NOM	destroy-DEV-3SG	(John	by)	
'the destruction of the document (by John)'					

d. a	dokumentum-nak	a	megsemmisít-és-e	(János	által)
the	document-DAT	the	destroy-DEV-3SG	(John	by)
'the destruction of the document (by John)'					

As (2a) and (2b) show, the S argument is realized as the possessor either in the nominative or in the dative, respectively. As is exemplified by (2c) and (2d), in the transitive case it is always the P argument that is expressed as the possessor, again, either in the nominative or in the dative, respectively, and the A argument has an OBL function, and it is optional.

It is important to point out that the two possessor variants are in complementary distribution in Hungarian, as opposed to their English counterparts, the *'s* and *of* constituents. Compare the ungrammatical Hungarian example in (3a) and its felicitous English counterpart in (3b).

(3)

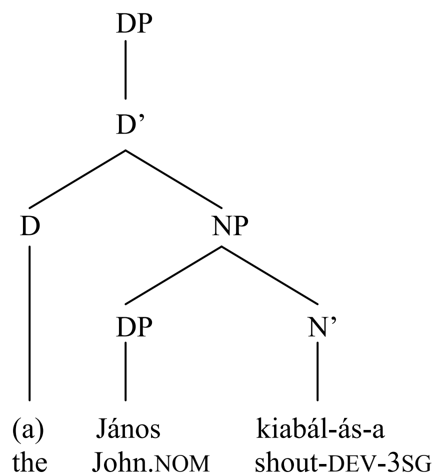
a. *János-nak	a	dokumentum	megsemmisít-és-e
John-DAT	the	document.NOM	destroy-DEV-3SG

b. John's destruction of the document

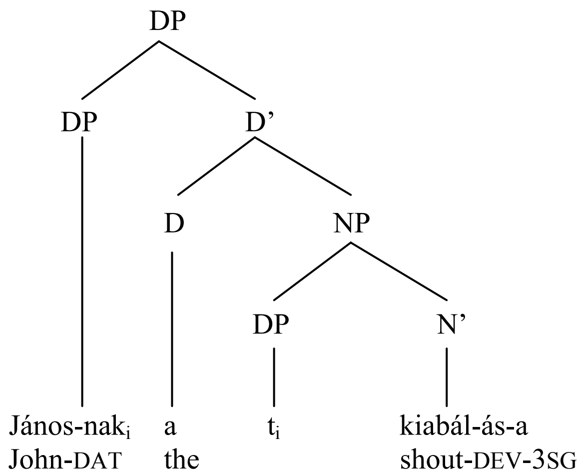
For the purposes of the present paper, I will adopt Szabolcsi's (1994) original structural approach to Hungarian DPs.[1] According to Szabolcsi, the dative possessor and the nominative possessor have two different structural positions: the former precedes the definite article: [SPEC, DP], and the latter follows it: [SPEC, NP].

[1] My adopting Szabolcsi's basic structural view, formulated in a GB framework, does not mean that I also accept the other aspects of her analysis. For instance, I do not assume a derivational (that is, transformational) relationship between the two possessor positions.

(4) a.



b.



As (4b) shows, on Szabolcsi’s GB account the nominative and dative possessor positions are transformationally related. This is an elegant way of capturing the complementary distribution of Hungarian nominative and dative possessors.

2.2. The problem: control

It is a basic requirement for any principled approach to draw parallels between infinitival and derived nominal constructions with respect to control into these constituents when their “subject” argument is unexpressed. It is this problem and its ramifications that have motivated my revisiting previous LFG analyses of these DP phenomena.

Consider the examples in (5).

(5) a. János kiabál-t.
John.NOM shout-PAST.3SG
‘John shouted.’

b. János elkezd-ett kiabál-ni.
John.NOM start-PAST.3SG shout-INF
‘John started to shout.’

c. János kiabál-ás-a
John.NOM shout-DEV-3SG
'John's shouting'

d. János elkezd-te a kiabál-ás-t.
John.NOM start-PAST.3SG.DEF the shout-DEV-ACC
'John started the shouting.'

In (5a), there is a finite intransitive clause with an overt S argument realized as the subject. In (5b), this clause has an embedded infinitival counterpart. Its covert S argument is still assumed to have the subject grammatical function. This is a standard case of functional control. In (5c), there is a DP containing a noun head derived from an intransitive verb. Its overt S argument is realized by the possessor constituent. In (5d), the corresponding "intransitive" DP has been embedded in a clause. The nominal predicate in this DP has a covert S argument which we can assume to have the possessor function. This is another typical control situation. Thus, the intransitive parallel illustrated in (5b) and (5d) can be naturally captured. The subject argument (S) is missing from (5b) and the possessor argument (S) is missing from (5d), and both can be assumed to be controlled in the usual manner.

Now let us take a look at the related transitive cases in (6).

(6) a. János elkezd-te énekel-ni a dal-t.
John.NOM start-PAST.3SG.DEF sing-INF the song-ACC
'John started to sing the song.'

b. János elkezd-te a dal ének-és-é-t.
John.NOM start-PAST.3SG.DEF the song.NOM sing-DEV-3SG-ACC
'John started the singing of the song.'

In (6a), the patient argument has the object function, and it is still the subject argument (A), which is unexpressed, that can be equally naturally handled by the well-established control mechanism. However, the possessor (expressing the P argument) is present in (6b), and there can only be one possessor argument in a Hungarian DP, as was shown in (3a). So the problem (6b) raises is how one can accommodate the missing agent in this system so as to ensure that it should be controllable in a principled manner.

3. Previous LFG accounts

In the three subsections below, the earlier analyses will be given a critical overview with respect to the following criteria:

A) the proposed number and nature of semantically unrestricted grammatical functions in the DP,
B) the applicability of LMT in the given framework,
C) the possible treatment of the control problem presented in section 2.2.

The key examples I will refer back to in the three subsections are as follows.

(7) a. overt S/nom
János kiabál-ás-a cf. (5c)
the John.NOM shout-DEV-3SG
'John's shouting'

b. overt S/dat

János-nak	a	kiabál-ás-a
John-DAT	the	shout-DEV-3SG

'John's shouting'

c. covert S

a	kiabál-ás
the	shout-DEV

'the shouting'

(8) a. overt P/nom – overt A/obl

a	dokumentum	megsemmisít-és-e	János	által
the	document.NOM	destroy-DEV-3SG	John	by

'the destruction of the document by John'

b. overt P/dat – overt A/obl

a	dokumentum-nak	a	megsemmisít-és-e	János	által
the	document-DAT	the	destroy-DEV-3SG	John	by

'the destruction of the document by John'

c. overt P/nom – covert A

a dokumentum	megsemmisít-és-e	cf. (6b)
the document.NOM	destroy-DEV-3SG	

'the destruction of the document'

d. overt P/dat – covert A

a	dokumentum-nak	a	megsemmisít-és-e
the	document-DAT	the	destroy-DEV-3SG

'the destruction of the document'

3.1. Laczkó (1995), (2000), and (2002)

As far as these three works are concerned, Laczkó (1995) offers the basic analysis. Laczkó (2000) modifies the LMT aspect and Laczkó (2002) proposes an alternative way of treating control.

A) On all three accounts, there is only one [–r] grammatical function postulated in the Hungarian DP: (POSS). It is taken to be realized by either nominative or dative possessor constituents, which naturally captures the empirical generalization that the two forms are in complementary distribution.

B) Laczkó (1995) draws a close parallel between (POSS) in Hungarian DPs and (SUBJ) in Hungarian clauses. In the LMT dimension of the analysis, it introduces the (POSS) Condition corresponding to LFG's (SUBJ) Condition at the clause level. The essence of the mapping mechanism is that the deverbal nominalizing suffix optionally demotes the highest [–o] argument.[2] In the intransitive (unergative) case there must not be demotion, otherwise the (POSS) Condition would be violated, while in the transitive case there must be demotion, otherwise it would be impossible to ensure that the [–r] argument should be mapped onto (POSS). By contrast, Laczkó (2000) proposes an ergative mapping pattern, which can be viewed as a more principled analysis:

[2] It does not choose between the two fundamental types of demotion: suppression and associating the [+r] feature with the highest [–o] argument.

(9) a. Map the [–r] argument onto (POSS). Otherwise:

b. Map the highest [–o] argument onto (POSS).

C) In the intransitive control case, Laczkó (1995) simply assumes that there is an anaphorically controlled (POSS)-PRO in the f-structure of the DP. The tentative, and admittedly very marked, solution in the transitive case is that a PRO is inserted in the argument structure of the derived nominal, without any grammatical function, and this PRO is controlled in a special way. Laczkó (2002) sets out to develop a uniform treatment of control. The proposal is that in the transitive case the highest [–o] argument is associated with the ∅ grammatical function symbol, which, contrary to previous assumptions, has two functions: a) the usual encoding of suppression (that is, the existential quantification of the given argument), b) the association of the 'PRO' feature with the given argument. According to this analysis, the control of arguments with a 'PRO' feature uniformly takes place at the level of semantic structure (as opposed to the customary f-structure), irrespective of the question of whether this feature originates from an ordinary "syntactic" PRO, as in the intransitive nominal case, or it is provided by this new function of the ∅ symbol.

(10) and (11) below, corresponding to the examples in (7) and (8), respectively, summarize the most important aspects of the three accounts.

(10)	a. overt S/nom	→ (POSS)			
	b. overt S/dat	→ (POSS)			
	c. covert S	→ (POSS)-PRO			
(11)	a. overt P/nom	→ (POSS)	–	overt A/obl	→ (OBL) / ∅
	b. overt P/dat	→ (POSS)	–	overt A/obl	→ (OBL) / ∅
	c. overt P/nom	→ (POSS)	–	covert A	→ lexical PRO / ∅-PRO
	d. overt P/dat	→ (POSS)	–	covert A	→ lexical PRO / ∅-PRO

My collective assessment of these analyses is as follows. LMT is well-developed, especially the modified version in Laczkó (2000). However, given that only one [–r] grammatical function is assumed, control cannot be treated in a both uniform and unmarked way. Laczkó (1995) violates both requirements, while Laczkó (2002) attains uniformity, but it makes a very radical shift: in order to accommodate the transitive case, it relegates the treatment of all control phenomena to a different domain: semantic structure. This analysis is not fully developed[3] and its ramifications are not considered at all. For instance, one immediate consequence of this stance is that binding phenomena are also supposed to be handled in semantic structure.

[3] In addition, the proposal is spelt out in a somewhat outdated Halvorsen (1983)-style semantic framework.

3.2. Komlósy (1998)

A) This analysis employs two [–r] grammatical functions in the Hungarian DP: a) (POSS), which is always associated with overt constituents, whether in the nominative or in the dative, b) (SUBJ), which is always covert, and it is functionally controlled.

B) There is no LMT aspect to this account.

C) It provides an excellent, unmarked, and uniform treatment of control phenomena in Hungarian DPs, including the recalcitrant transitive case. Its essence is that it is invariably the covert (SUBJ) argument that is controlled.

(12) and (13) below, corresponding to the examples in (7) and (8), respectively, summarize the most important aspects of Komlósy's (1998) analysis.

(12)	a. overt S/nom	→ (POSS)			
	b. overt S/dat	→ (POSS)			
	c. covert S	→ (SUBJ)-PRO			
(13)	a. overt P/nom	→ (POSS)	–	overt A/obl	→ (OBL)
	b. overt P/dat	→ (POSS)	–	overt A/obl	→ (OBL)
	c. overt P/nom	→ (POSS)	–	covert A	→ (SUBJ)-PRO
	d. overt P/dat	→ (POSS)	–	covert A	→ (SUBJ)-PRO

I would like to make the following comments on this approach.

A) I find Komlósy's (SUBJ) function rather mysterious. It is taken to be always phonetically null, which appears to me a stipulation, given that in the intransitive case the following natural parallel suggests itself. (Compare (12) and (14).)

(14)	a. overt S/nom	→ (SUBJ)
	b. overt S/dat	→ (SUBJ)
	c. covert S	→ (SUBJ)-PRO

B) It seems that Komlósy's system could only accommodate an LMT dimension with considerable difficulty. The main problem I envisage is as follows. Although the (SUBJ) function is available in the Hungarian DP domain, in addition to the (POSS) function, with the same [–o, –r] features, the (SUBJ) Condition could not be adopted because of the (12a,b) aspect of Komlósy's analysis. It is easy to see that both my critical remarks pertain to exactly the same property of this account: Komlósy's assuming the (POSS) function to be associated with the overt possessor constituent of the DP containing a noun head derived from an intransitive verb. In my new proposal I will set out to change this aspect of Komlósy's approach, among other things.

C) The unquestionably ingenious trait of Komlósy's account is the proper introduction of a controllable (SUBJ) function in both the intransitive and the transitive cases, thereby rendering the treatment of control phenomena both uniform and unmarked, that is, absolutely principled. In the new proposal I will keep this aspect of his analysis.

3.2. Chisarik and Payne (2003)

A) Chisarik and Payne (2003) also employ two [–r] grammatical functions in the Hungarian DP: a) (SUBJ), which is always expressed by the dative posssessor constituent, b) (ADNOM), which is always realized by the nominative possessor. They propose that English DPs allow exactly the same two [–r] functions: the *'s* genitival constituent has the (SUBJ) function, while the *of* constituent has the (ADNOM) function. The difference between the two languages is that the two functions cannot co-occur in Hungarian, while they can in English, cf. (3a) and (3b). Chisarik and Payne (2003) capture this contrast by introducing what they call the Asymmetrical Possessor Parameter. Its essence is that derived nominal predicates in English and similar languages allow two [–r] arguments in their argument structures, while DPs in Hungarian and similar languages allow only one such argument. Consider:[4]

(15) $$* \quad \begin{array}{cc} \Theta & \Theta \\ | & | \\ -r & -r \end{array}$$

Chisarik and Payne's (2003) further important assumption is that, just like at the clausal level, the (SUBJ) function in the DP domain is discourse-related, most naturally associated with the topic (TOP) discourse function.

B) The LMT dimension of their analysis incorporates the [±discourse] feature as well:

(16)

	+d	–d	
	–r	–r	+r
–o	SUBJ	ADNOM	OBL_{Θ}
+o		OBJ	OBJ_{Θ}

According to them the (SUBJ) function is discourse-oriented both at the clausal and at the DP levels, while all the other functions are [–d]. With respect to the other two features, the (ADNOM) function, peculiar to the DP domain, shares their values with (SUBJ): (ADNOM) → [–d, –r, –o] vs. (SUBJ) → [+d, –r, –o]. Naturally, the (OBJ) and (OBJ_{Θ}) functions are not available at the DP level.

C) Chisarik and Payne (2003) do not discuss control relations at all.

(17) and (18) below, corresponding to the examples in (7) and (8), respectively, summarize the most important aspects of Chisarik and Payne's (2003) analysis.

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[4] The authors claim that their solution is an extension of the clausal asymmetrical object parameter of Bresnan and Moshi (1990) to the DP domain. I would like point out that what the authors really seem to intend simply cannot be such an extension, because Bresnan and Moshi (1990) are concerned with the intrinsic featural classification of arguments in argument structures, while Chisarik and Payne (2003) deal with grammatical functions. The former rule was designed to block the co-occurrence of two arguments with the [–r] intrinsic feature, while, in all probability, the latter was meant to prevent two arguments from being mapped onto grammatical functions with the [–r] feature. Therefore, Chisarik and Payne's (2003) Hungarian parameter should have taken the following form, instead of (15) above:

(i) $$* \quad \begin{array}{cc} \Theta & \Theta \\ | & | \\ GF_i & GF_j \\ [\alpha, -r] & [\beta, -r] \end{array}$$

(17) a. overt S/nom $\rightarrow$ (ADNOM)

b. overt S/dat $\rightarrow$ (SUBJ)

c. covert S $\rightarrow$?

(18) a. overt P/nom $\rightarrow$ (ADNOM) – overt A/obl $\rightarrow$ (OBL)

b. overt P/dat $\rightarrow$ (SUBJ) – overt A/obl $\rightarrow$ (OBL)

c. overt P/nom $\rightarrow$ (ADNOM) – covert A $\rightarrow$?

d. overt P/dat $\rightarrow$ (SUBJ) – covert A $\rightarrow$?

My most important critical remarks are as follows.

A) In agreement with all the other previous analyses (Szabolcsi (1994), Laczkó (1995, 2000), Komlósy (1998), etc.), I do not find Chisarik and Payne's (2003) strict nominative possessor $\rightarrow$ (ADNOM) grammatical function and dative possessor $\rightarrow$ (SUBJ) grammatical function correlation plausible enough, despite the fact that their motivation is clear. a) If there are two distinct positions in a structure and, moreover, two distinct forms are associated with these positions, then naturally the null hypothesis is the postulation of two distinct functions. b) The possibility of the Hungarian-English formal-functional parallel is really appealing (ADNOM: nominative constituent – *of* constituent, SUBJ: dative constituent – *'s* constituent). My fundamental problem is that the relevant English and Hungarian possessor constituents are radically different in nature. While I readily accept the generalization that the English *'s* constituent and *of* constituent differ in that the former, in Chisarik and Payne's (2003) analysis the one realizing the (SUBJ) function, is discourse-, that is, topic-oriented, and the latter, expressing the (ADNOM) function, is not,[5] I think the two corresponding Hungarian possessor constituents simply do not exhibit these characteristic features, contrary to Chisarik and Payne's (2003) claim. My explanation for this contrast is that, as is well-known, English noun phrase structure and clause structure show a very close resemblance:

(19) a. DP's N of DP

b. DP V DP

It is straightforward to draw a parallel between the subject positions (functions) and their well-attested, default topic-relatedness in the two structures. In Hungarian, by contrast, there are topic positions at the clausal level, and although subjects are very strong candidates for topichood, the choice is also determined by other significant factors,[6] and there can be several topics simultaneously. Furthermore, in the Hungarian DP both the dative and the nominative possessor positions precede the noun head; therefore, they do not exhibit the same kind of discourse functional contrast as the English counterparts, compare (19a) and (20):

(20) DP_{dat} D DP_{nom} N

[5] See, for instance, the cognitive grammatical analysis by Taylor (1994) along these lines, also discussed from an LFG perspective in Laczkó (1995).

[6] For an overview, see É. Kiss (1992), among other works.

For instance, the topic (*the lady's*) – non-topic (*of the lady*) contrast in English in (21) does not have a Hungarian parallel in (22).

(21) a. the lady's car

b. the car of the lady

(22) a.

a	hölgy-nek	az	autó-ja
the	lady-DAT	the	car-3SG

'the lady's car'

b.

a	hölgy	autó-ja
the	lady.NOM	car-3SG

'the lady's car'

In the overwhelming majority of the cases the two possessor forms are entirely interchangeable without any systematic semantic (e. g., discourse-related) or other kinds of contrast. Cases when only one of the two forms is possible or (strongly) preferred are discussed in Szabolcsi (1994) and Chisarik and Payne (2003). As has already been mentioned, Szabolcsi postulates one function and Chisarik and Payne (2003) assume two. I agree with Szabolcsi, who offers principled explanations in most instances of this limited partial contrast in the use of the two forms without invoking two distinct grammatical functions.[7] Although Chisarik and Payne's (2003) move is also logical theoretically speaking (two forms → two functions), it is not absolutely necessary. It can be claimed that one and the same function can have two different realizations, and when two forms are available, it is quite natural for them to develop some partial division of labour. It is to be emphasized again in this connection that the two constituents in the Hungarian DP can never co-occur (as opposed to the English DP); thus, there is no unquestionable need for associating two distinct grammatical functions with them (to avoid violating the biuniqueness principle).[8]

I would also like to add that although the fact that the two possessor forms in Hungarian cannot occur simultaneously weakens the motivation for assuming that they realize two distinct functions, it does not automatically justify postulating that they express the same function. There may be several different factors responsible for such non-co-occurrence. As I have shown above, Chisarik and Payne (2003) do propose a principle, see (15). However, in footnote 4 I pointed out that this principle cannot be taken to be an extension of Bresnan and Moshi's (1990) proposal. What is more, it belongs to an entirely different dimension, and it should take a considerably different form, because I do not suppose that Chisarik and Payne (2003) had the following parameter for the English DP in mind, which would follow from their generalizations.

(23)

Θ	Θ
|	|
–r	–r

This would be their Symmetrical Possessor Parameter. Its immediate consequence would be that Chisarik and Payne (2003) would have to assume the following morpholexical process, in Ackerman's (1992) sense, for English nominalization:

[7] Limitations of space prevent me from going into these details; therefore, I defer a detailed discussion to a different forum.
[8] Chisarik and Payne (2003: 196) erroneously mention the principle of coherence in this context.

(24) $\begin{array}{cccccc} <\Theta & \Theta> & & <\Theta & \Theta> \\ | & | & \rightarrow & | & | \\ -o & -r & & -r & -r \end{array}$

This could hardly have been their intention, because in actual fact it would run counter to Bresnan and Moshi's (1990) generalization about English: according to them this language, just like Hungarian, is an asymmetrical language.[9] If we change Chisarik and Payne's (2003) parameter into what most probably they originally intended (see (i) in footnote 4) then, without any further support or elaboration, it will be more stipulative than principled.[10]

B) Chisarik and Payne (2003) assume that although both (SUBJ) and (ADNOM) are [–o, –r] grammatical functions, the former is hierarchically superior to the latter. However, they do not derive this from any principle or factor. Moreover, at a later point they claim that the "SUBJ relations in both languages are […] a subset of the ADNOM relations" (p. 195). I think the relationship between the two functions in Chisarik and Payne's (2003) system would require further elaboration (also see next point).

C) Just like Komlósy's account, Chisarik and Payne's (2003) analysis cannot adopt the classical clausal version of LMT to the DP domain without complications. The main problem is that although they also employ the (SUBJ) function, they cannot retain the (SUBJ) Condition.

D) As has already been mentioned, they do not deal with control at all. In this connection it is a further problem, partially related to the previous point, that despite the fact that their system employs two [–r] grammatical functions, and one of them is the (SUBJ) function, it could only handle control phenomena in a rather marked and complicated way. For instance, it would have to assume that (ADNOM)-PRO was also possible, and, furthermore, that (SUBJ)-PRO could also realize an argument which was not the highest in the hierarchy.

4. The new account

In this section I will develop an analysis which aims at a synthesis of what I consider the favourable aspects of the previous accounts discussed above. It has the following main components.

A) I assume that there are two [–o,–r] functions in the Hungarian DP: (SUBJ) and (POSS). Naturally, this view contrasts with my previous assumptions, and it is comparable, to a considerable extent, both to Komlósy's (1998) and to Chisarik and Payne's (2003) analysis.[11]

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[9] There are two indications that Chisarik and Payne (2003) did not have (n) in mind. On the one hand, when they discuss mapping in the English DP domain, they keep talking about a < –o, –r > argument structure (p. 197). On the other hand, when they explain their formalized parameter they write "… Hungarian […] does not permit two [–o, –r] arguments" […] "English […] does permit two [–o, –r] arguments" (p. 197). I think it obvious that they intended to refer to [–o, –r] *grammatical functions* rather than [–o, –r] arguments.

[10] Let me also mention at this point that in my new solution to be presented in section 4 I also have to cope with a similar kind of complementarity. In my estimation, the explanation I offer will be more principled. It will be based on the obligatory head-marking nature of Hungarian possessive constructions as opposed to the dependent-marking nature of their English counterparts.

[11] For various kinds of justification for allowing at least one [–r] grammatical function in the NP/DP domain (contra Rappaport (1983), for instance), see Laczkó (2000) and Chisarik and Payne (2003). One very strong argument mentioned in Chisarik and Payne (2003) is that in Hungarian it is possible for expletive pronouns to occur as possessor constituents linked to the clausal argument of a derived nominal predicate (the example is mine):

(i)	a-nnak	a	kimond-ás-a,	hogy	János	hibáz-ott
	it-DAT	the	state-DEV-3SG	that	John.NOM	err-PAST.3SG
	lit. '*its stating that John has erred'					

B) Both these grammatical functions can be realized by either dative or nominative possessors. A covert argument always has the (SUBJ) function. This view partially contrasts with Komlósy's (1998) view and fully contrasts with Chisarik and Payne's (2003) assumptions. On Komlósy's account (POSS) can be expressed in either the dative or the nominative, and (SUBJ) is always covert. In Chisarik and Payne's (2003) analysis, on the other hand, the dative possessor always realizes the (SUBJ) function and the nominative possessor expresses the (ADNOM) function (and no mention is made of covert arguments).

C) Control relations are anaphoric. This contrasts with Komlósy's (1998) functional control assumption, for which he gives no justification. My arguments for the anaphoric view are as follows.

Ca) The controller can also have an (OBL) function:

(25)	Mária	ráerőltet-te	*János-ra*	a	dal
	Mary.NOM	force-PAST.3SG.DEF	*John-SUBL*	the	song.NOM

elénekl-és-é-t.
sing-DEV-3SG-ACC

'Mary forced the singing of the song upon John.'

Cb) Split antecedents are possible:

(26)	Mária	ráve-tte	János-t	a	dal	közös
	Mary.NOM	persuade-PAST.3SG.DEF	John-ACC	the	song.NOM	joint

elénekl-és-é-re.
sing-DEV-3SG-SUBL

lit. 'Mary$_{i}$ persuaded John$_{j}$ that they$_{i+j}$ should sing the song jointly.'

Cc) There is no need for postulating that a case-marked DP argument containing a derived nominal head has an (XCOMP) function in Hungarian, in addition to the well-established and typical nominal functions: (SUBJ), (OBJ) and (OBL).

Cd) It is also noteworthy that even in the analysis of English verbal gerunds in Bresnan (2001) anaphoric control is assumed. This is significant because, as is well-known, the internal syntax of these constructions is predominantly verbal (as opposed to their nominal external syntax). By contrast, both the external syntax and the internal syntax of the relevant Hungarian contstructions are strictly nominal and, thus, the motivation for assuming anaphoric control is even stronger.[12]

D) Just like in Komlósy (1998), as opposed to all the other previous analyses, namely Laczkó (1995), (2000), (2002), Chisarik and Payne (2003), control relations can be captured in the well-established way in both the intransitive and the transitive cases. The (SUBJ) in the DP domain can also be a "PRO" (without person and number specification), and I assume with Komlósy (1998) that only the (SUBJ) has this privilege. It is only the highest argument in an

[12] I would like to point out an interesting parallel. Both in Bresnan (2001) and here it is assumed that control *into* these nominal constructions is anaphoric. On the other side of the coin, Rappaport (1983) offers very strong and detailed arguments for anaphoric control *within* English nominal expressions containing a derived nominal head, that is, in cases when the nominal predicate has a clausal argument and another argument of this predicate controls one of the arguments of this clausal argument. The generalization that suggests itself is that in languages like English and Hungarian the category N triggers anaphoric control both externally and internally.

argument structure that can be realized by such a PRO, as is argued independently by Szabolcsi (1992) and Komlósy (1998). This principle can be schematically represented as follows.

```
(27)    a. < Θ   …  >
            |
          PRO-
          SUBJ

        b. * < …   Θ  … >
                   |
                 PRO-
                 SUBJ
```

E) Just like in Chisarik and Payne (2003), the non-co-occurrence of the dative and the nominative possessors (in whatever functions) must be captured. As I pointed out in connection with (4b), Szabolcsi (1994) elegantly captures this complementarity by assuming that the two possessor positions are derivationally related: she employs [SPEC, NP] → [SPEC, DP] movement. The complementarity poses no problem for either Komlósy (1998) or my previous analyses, because on all these accounts there is a single (POSS) grammatical function that can be realized by either nominative or dative possessors.[13]

In Chisarik and Payne's (2003) approach the dative possessor is strictly associated with the (SUBJ) function and the nominative possessor with the (ADNOM) function, so the complementarity of the two forms has to be explained. In section 3.3 I showed and criticized Chisarik and Payne's (2003) solution.

The new analysis I am presenting here is even more permissive in that either possessor form is allowed to express either grammatical function. In theory, the following four instances of co-occurrence are possible.

(28) a. dative → (SUBJ) – nominative → (SUBJ)

b. dative → (POSS) – nominative → (POSS)

c. dative → (SUBJ) – nominative → (POSS)

d. dative → (POSS) – nominative → (SUBJ)

Obviously, (28a) and (28b) can be easily ruled out because they would result in the violation of the biuniqueness principle. (28c) and (28d) are on a par and ideally these cases should be blocked in a principled manner. One could import Chisarik and Payne's (2003) solution offered in their system; however, I have already expressed my reservations about it. Instead, my proposal is as follows. In Hungarian, possessive constructions are *head-marking***,** and the possessed noun agrees with the possessor for person and number. *The morphological make-up of nouns only allows one such relation to be encoded,* that is, loosely speaking, there is only one morphological slot for this purpose. In (29a) and (29b) I give two simple examples with underived nouns.

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[13] A reminder is in order here: the fundamental difference between Komlósy (1998) and my previous accounts is that Komlósy (1998) also postulates an always covert argument with the (SUBJ) function, in addition to the always overt (POSS) realizable in either nominative or dative form.

(29) a. János ház-*a*
John.NOM house-3SG
'John's house'

b. János-nak a ház-*a*
John-DAT the house-3SG
'John's house'

As these phrases illustrate, the possessor, whether in the nominative or in the dative, agrees with the head noun.[14] Thus, although either possessor form can realize either the (SUBJ) or the (POSS) grammatical function, only one overt possessor constituent can occur in each DP. Naturally, a covert PRO argument can also be encoded in the lexical form of the nominal predicate, and it will appear in the f-structure representation of the DP.

F) The inventory of grammatical functions in the DP domain I assume is shown in (30):

(30)

	–o	+o
–r	SUBJ POSS	—
+r	OBL_{Θ}	—

The (SUBJ) and the (POSS) functions are in the same slot; however, (SUBJ) is superior in two respects. On the one hand, it can be an anaphorically controlled PRO, and, on the other hand, when both are available, (SUBJ) and not (POSS) will be selected. These two properties, however, do not have to be stipulated here, because they follow from broader generalizations about clauses. A) Control theory states that only (SUBJ) arguments can be controlled, see, for instance, Bresnan (1982). B) Mapping theory requires that one of the arguments of a verbal predicator must be mapped onto the (SUBJ) function. This is expressed by the Subject Condition, see, e. g., Bresnan (2001). Although my new account has the extra (SUBJ) function in its inventory (contrary to my previous analyses), my claim is that its LMT aspect is even more principled and much more closely related to the classical version of LMT as applied to the clausal level. Before we take a closer look at how all this works in practice, (31) and (32) below, corresponding to the examples in (7) and (8), respectively, summarize the most important aspects of the new account with respect to distribution of covert and overt arguments as well as that of their grammatical functions.

(31) a. overt S/nom → (SUBJ)

b. overt S/dat → (SUBJ)

c. covert S → (SUBJ)-PRO

[14] It is to be noted that Bartos (2000) argues exactly in the case of 3rd person singular and 3rd person plural non-pronominal possessors that the ending traditionally taken to be an agreement marker is actually the marker of the possessive relationship. Even if this view proves tenable it will not considerably weaken my proposal above, because in all the other persons and numbers the original traditional agreement generalization holds according to Bartos (2000) as well, so this exceptional case can always be treated as a paradigm gap. Moreover, one can also argue that in the problematic case the slot in question is filled with a zero marker, or, alternatively, there is an even simpler solution available in a word-and-paradigm style morphological model, more compatible with LFG, see Laczkó (2001).

(32)	a. overt P/nom	→ (SUBJ)	–	overt A/obl	→ (OBL)
	b. overt P/dat	→ (SUBJ)	–	overt A/obl	→ (OBL)
	c. overt P/nom	→ (POSS)	–	covert A	→ (SUBJ)-PRO
	d. overt P/dat	→ (POSS)	–	covert A	→ (SUBJ)-PRO

Now let us take a closer look at the details of the new analysis.

Fa) the transitive case < A , P >

Consider the example in (33). The relevant DP is in italics.

(33) *A* *dal* *el-énekl-és-e* *János* *által* mindenki-t
the song.NOM PERF-sing-DEV-3SG John by everyone-ACC

meglep-ett.
surprise-PAST.3SG

'The singing of the song by John surprised everyone.'

Given that on this account, just as on Komlósy's (1998) and Chisarik and Payne's (2003), in the DP domain there are two grammatical functions with the "subject-like" feature specification [–o, –r], I propose the following basic mapping principle which is more liberal than its clausal counterpart.

(34) Map either the highest [–o] or the [–r] argument onto (SUBJ).

The lexical form of the nominal predicate is shown (35). The arrays of the theoretically available grammatical functions as well as the most important components of the mapping process are indicated below the two arguments.

(35)	elénekl-és-e	N 'SINGING	< agent ,	patient >'
	sing-DEV-3SG		[–o]	[–r]
			SUBJ/POSS/OBL	SUBJ/POSS
		(34):		SUBJ
		biuniqueness:	*SUBJ	
		(27):	*POSS-PRO	*SUBJ-PRO
				→ *overt SUBJ*
		N morphology:	*overt POSS	
		add [+r]:	OBL_{ag}	

Since the version of the nominal predicate that occurs in (33) has its agent argument mapped onto $(OBL)_{ag}$, here we will ignore possible mapping paths which obviously could not yield this result. Therefore, as a first step, we can choose the second option in (34) and map the [–r] argument onto (SUBJ). Naturally, biuniqueness, in addition to the consideration just mentioned, prevents us from mapping the agent onto (SUBJ). Another consequence of mapping the [–r] argument onto (SUBJ) is that because of (27) neither argument can be realized by a PRO, so the possibility of expressing the [–o] argument with a (POSS)-PRO is unavailable, and the (SUBJ)-PRO realization of the [–r] argument is equally impossible. If the [–r] argument is realized as an overt (SUBJ), the morphological make-up of Hungarian nouns also prevents us from realizing the [–o] as an overt (POSS), again in addition to the consideration mentioned above. Thus, this argument has no choice but to be mapped onto (OBL)$_{ag}$ by receiving the [+r] feature. (36) shows the morphosyntactic contribution of the agreement morpheme.

(36) -e: (↑SUBJ PERS) = 3
(↑SUBJ NUM) = SG

And given that the entire DP is in the nominative, it has the (SUBJ) function in the sentence, encoded by the following conventional LFG annotation in the c-structure.

(37) (↓CASE) = NOM
(↑SUBJ) = ↓

Let us now take an example of control into a DP containing a nominal predicate derived from a transitive verb. Again, the relevant DP is in italics.

(38)	János	elkezd-t-e	*a*	*dal*	*énekl-és-é-t.*
	John.NOM	start-PAST-3SG.DEF	the	song.NOM	sing-DEV-3SG-ACC

‘John started the singing of the song.’

(39)	énekl-és-é-t	N ‘SINGING	< agent ,	patient >‘
	sing-DEV-3SG-ACC		[–o]	[–r]
			SUBJ/POSS/OBL	SUBJ/POSS
		(34):	SUBJ	
		biuniqueness:		*SUBJ →POSS
		(27):		*POSS-PRO → *overt POSS*
		N morphology: (27):	*overt SUBJ → *SUBJ-PRO*	

(34) allows us to map the agent onto (SUBJ). Then biuniqueness forces us to map the patient onto (POSS). (27) prevents realizing the patient as a (POSS)-PRO, so it must be overt. The morphological make-up of Hungarian nouns prevents us from also realizing the agent overtly; thus, it has no choice but to be expressed as a (SUBJ)-PRO.

Also note that although in theory (34) also makes it possible for us to swap the mapping of the two arguments: [–o]/(POSS) and [–r]/(SUBJ), the result is predicted to be ungrammatical, consider:

(40)	énekl-és-é-t	N ‘SINGING	< agent ,	patient >‘
	sing-DEV-3SG-ACC		[–o]	[–r]
			SUBJ/POSS/OBL	SUBJ/POSS
		(34):	POSS	
		biuniqueness:		*POSS → SUBJ
		(27):	*POSS-PRO → overt POSS	*SUBJ-PRO → overt SUBJ
		N morphology:	*overt POSS	*overt SUBJ

(27) does not allow either argument to be realized by a PRO. The agent does not have the (SUBJ) function, and although the patient is mapped onto (SUBJ), it is not the highest argument. Therefore, both arguments are required to be overtly realized, and this leads to an inevitable violation of the N morphology principle. (41) shows the morphosyntactic contribution of the agreement morpheme.[15]

(41) -é: (↑POSS PERS) = 3
(↑POSS NUM) = SG

Naturally, the lexical form of the nominal predicate also has to contain the (↑SUBJ PRED) = 'PRO' equation for representing the incorporated (SUBJ)-PRO argument.

And given that the entire DP is in the accusative, it has the (OBJ) function in the sentence, encoded by the following conventional LFG annotation in the c-structure.

(42) -t: (↓CASE) = ACC
(↑OBJ) = ↓

The example in (43) illustrates the fact that possessor pro-drop is also possible, just like other kinds of pro-drop in Hungarian.

(43)	János	elkezd-t-e	*az*	*énekl-és-é-t*.
	John.NOM	start-PAST-3SG.DEF	the	sing-DEV-3SG-ACC
	lit. 'John started its singing.'			

The (simplified) lexical form of the relevant morpheme is given in (44).

(44) -é: (↑POSS PERS) = 3
(↑POSS NUM) = SG
(↑POSS PRED) = 'PRO'

As this representation shows, the morpheme is not only an agreement marker, but also an incorporated pronoun, a (POSS)-PRO.[16]

Fb) The intransitive case < S >

In this model, in the intransitive case an overt possessor, whether in the nominative or in the dative, always realizes the (SUBJ) function, for example in (45a) and (45b), respectively. This follows from the (SUBJ) Condition adopted from the LMT as applied to the verbal domain, consider:[17]

(45)	a. János	kiabál-ás-a
	John.NOM	shout-DEV-3SG
	'John's shouting'	

---

[15] In the example above it has been lengthened (*e* → *é*) because in this case it is followed by the accusative suffix.

[16] And in this case, too, the lexical form of the nominal predicate also contains the (↑SUBJ PRED) = 'PRO' equation for representing the incorporated (SUBJ)-PRO argument.

[17] (45) and (46) illustrate the unergative case. The unaccusative case follows exactly the same pattern, because (34) allows the mapping of either the highest [–o] argument or the [–r] argument onto (SUBJ).

b. János-nak	a	kiabál-ás-a
John-DAT	the	shout-DEV-3SG
‘John’s shouting’		

(46)	kiabál-ás-a	N ‘SHOUTING	< agent >‘
	shout-DEV-3SG		[–o]
			SUBJ/POSS/OBL
		(34):	*SUBJ*

When the S argument is covert, it is assumed to be realized by a (SUBJ)-PRO.

(47)	János	elkezd-t-e	*a*	*kiabál-ás-t*.
	John.NOM	start-PAST-3SG.DEF	the	shout-DEV-ACC
	‘John started the shouting.’			

(48)	kiabál-ás-t	N ‘SHOUTING	< agent >‘
	shout-DEV-ACC		[–o]
			SUBJ/POSS/OBL
		(34):	SUBJ
		(27):	*SUBJ-PRO*

So this scenario follows from the (SUBJ) Condition, on the one hand, and our anaphoric control assumptions in combination with (27), on the other.

5. Concluding remarks

In this paper I have revisited Hungarian DPs containing complex event nominal predicates. I proposed a modified analysis based on a synthesis of some salient aspects of previous LFG accounts and on some additional ideas. I hope to have proved that this alternative approach is more principled on the whole. The crucial aspects of the analysis are as follows.

(a) There are two possessor forms (nominative and dative) and positions ([SPEC, NP] and [SPEC, DP]) in the Hungarian DP.
(b) There are two [–o,–r] grammatical functions in this domain: (SUBJ) and (POSS).
(c) Either possessor form can realize either grammatical function.
(d) The two forms are in complementary distribution.
(e) The explanation for this complementarity is that Hungarian possessive constructions are head-marking (that is, there is obligatory head–possessor agreement), and the morphological structure of Hungarian nouns is such that only one overt possessive relationship can be encoded.
(f) The highest argument in the argument structure can also be covert.
(g) The covert argument of the nominal predicate is anaphorically controlled: it is always a (SUBJ)-PRO.
(h) LMT as developed for the clausal level can be adopted in this DP domain in a principled manner, including the (SUBJ) Condition.
(i) Although the (SUBJ) and the (POSS) functions have the same featural specifications: [–o,–r], the former is superior in two important and interrelated respects: a) a PRO argument can only be mapped onto (SUBJ), b) one of the arguments in the argument structure of any derived nominal predicate expressing a complex event must be mapped onto (SUBJ).

Finally, let me make two additional remarks.

A) Recently, Kenesei (2003) in an MP framework, criticizing Szabolcsi (1994) and Laczkó (1995), has argued that these Hungarian DPs should be derived from underlying, embedded clauses. He pointed out the shortcomings of these two works with respect to the treatment of control phenomena, and he also claimed that binding relationships can also be naturally captured along his clausal lines. However, I think that the new account I have developed in this paper can cope with all these phenomena in an equally principled manner, without invoking a clausal analysis, which may induce some complications in different (but related) domains.[18]

B) I find interesting Chisarik and Payne's (2003) proposal that in the English DP there are also two [–r] grammatical functions: *'s* – (SUBJ) and *of* – (ADNOM). In a future paper I would like to explore the possibility of extending my analysis of the Hungarian DP to the English facts. It would be a logical extension (and modification in their system) to assume that the *of* constituent can realize either the (SUBJ) or the (ADNOM) function. One immediate and favourable consequence of this move would be that the (SUBJ) Condition could be adopted in the English DP domain as well. But all this requires further investigations.

References

Ackerman, Farrell. 1992. "Complex predicates and morpholexical relatedness: locative alternation in Hungarian." *Lexical Matters,* ed. by Ivan A. Sag and Anna Szabolcsi. Stanford, CA: Center for the Study of Language and Information, 55–83.

Bartos, Huba. 2000. "Az inflexiós jelenségek szintaktikai háttere [The syntactic background of inflectional phenomena]." *Strukturális magyar nyelvtan 3. Morfológia* [Structural Hungarian Grammar. Volume 3. Morphology], ed. by Ferenc Kiefer. Budapest: Akadémiai Kiadó, 653–762.

Bresnan, Joan. 1982. "Control and Complementation." *The Mental Representation of Grammatical Relations*, ed. by Joan Bresnan, 282–390. Cambridge, Mass.: MIT Press.

Bresnan, Joan. 2001. *Lexical-Functional Syntax*. Oxford: Basil Blackwell.

Bresnan, Joan and Lioba Moshi. 1990. "Object Asymmetries in Comparative Bantu Syntax." *Linguistic Inquiry* 21, 147–185.

Chisarik, Erika and John Payne. 2003. "Modelling Possessor Constructions in LFG: English and Hungarian". *Nominals: Inside and Out*, ed. by Miriam Butt and Tracy H. King. Stanford: CSLI Publications, 181–199.

É. Kiss, Katalin. 1992. Az egyszerű mondat szerkezete [The Structure of the Simple Sentence]. *Strukturális magyar nyelvtan 1. Mondattan* [Structural Hungarian Grammar. Volume 1. Syntax], ed by Ferenc Kiefer. Budapest: Akadémiai Kiadó, 83–171.

Grimshaw, Jane. 1990. *Argument Structure*. Cambridge, Mass.: The MIT Press.

Halvorsen, Per-Kristian. 1983. "Semantics for Lexical-Functional Grammar." *Linguistic Inquiry* 14, 567–615.

Kenesei, István. 2003. "Nonfinite clauses in derived nominals." *Approaches to Hungarian. Volume 9. Papers from the Düsseldorf Conference,* ed. by Christopher Piñón and Péter Siptár. Budapest: Akadémiai Kiadó. (to appear)

Komlósy, András. 1998. *A nomen actionis argumentumainak szintaktikai funkcióiról* [On the Syntactic Functions of the Arguments of the Nomen Actionis]. Manuscript. Budapest: Institute for Linguistics, Hungarian Academy of Sciences.

Laczkó, Tibor. 1995. *The Syntax of Hungarian Noun Phrases: A Lexical-Functional Approach.* Frankfurt am Main: Peter Lang.

Laczkó, Tibor. 2000. "Derived Nominals, Possessors and Lexical Mapping Theory in Hungarian DPs". *Argument Realization*, ed. by Miriam Butt and Tracy H. King, 189–227. Stanford: CSLI Publications.

[18] I plan to make a detailed comparison between the two types of approaches elsewhere.

Laczkó, Tibor. 2001. "A magyar birtokos DP inflexiós morfológiájáról lexikai-funkcionális megközelítésben [On the Inflectional Morphology of the Hungarian DP in a Lexical-Functional Framework]." *Újabb tanulmányok a strukturális magyar nyelvtan és a nyelvtörténet köréből. Kiefer Ferenc tiszteletére barátai és tanítványai* [New Studies in Hungarian Structural Grammar and Historical Linguistics. In Honour of Ferenc Kiefer from His Friends and Disciples], ed. by Bakró-Nagy, Marianne, Zoltán Bánréti and Katalin É. Kiss. Budapest: Osiris Kiadó. 2001, 59–77.

Laczkó, Tibor. 2002. "Control and Complex Event Nominals in Hungarian." *Proceedings of the LFG '02 Conference*, ed. by Miriam Butt and Tracy H. King. (http://www-csli.stanford.edu/publications/LFG2/lfg02.html)

Rappaport, Malka. 1983. "On the nature of derived nominals." *Papers in LFG,* ed. by Lori Levin, Malka Rappaport and Annie Zaenen. Bloomington, Ind.: Indiana University Linguistic Club, 113–142.

Szabolcsi, Anna. 1992. "Subject Suppression or Lexical PRO? – The Case of Derived Nominals in Hungarian." *Lingua* 86, 149–176.

Szabolcsi, Anna. 1994. "The Noun Phrase." *The Syntactic Structure of Hungarian. Syntax and Semantics 27*, ed. by Ferenc Kiefer and Katalin É. Kiss, 179–274. New York: Academic Press.

Taylor, J. Robert. 1994. "Subjective and objective readings of possessor nominals." *Cognitive Linguistics* 5–3, 201–242.

PROCLITIC CONTEXTS IN EUROPEAN PORTUGUESE AND THEIR EFFECT ON CLITIC PLACEMENT

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Abstract

The preverbal and postverbal placement of clitic pronouns in European Portuguese (EP) is determined by any one of a specific set of words and phrases in preverbal position. Existing studies by Vigário (1999), Gerlach (2001) and Crysmann (2002) argue that an inflectional analysis of EP cliticisation is untenable on the grounds that proclitic triggers are not readily available to the morphology. This paper builds on an earlier analysis by Luís and Sadler (2003) and argues that the syntactic conditioning of proclisis can and should be accounted for without invalidating the inflectional status of the pronominal clitic system in EP. The proclitic contexts are defined in terms of f-precedence relations. These are mapped onto the morphology and put in correspondence with the morphological placement function. The interaction between inflectional morphology and f-structure information is formalised within the architecture of Lexical-Functional Grammar in combination with the realizational theory of Paradigm Function Morphology, following insights by Sadler and Spencer (2001), Luís and Sadler (2003), Sadler and Nordlinger (2004), Otoguro (2003) and Luís (2004). In connection with EP proclisis, we also discuss the c-structure representation of phrasal affixes. We assume that proclitics constitute phrasal inflections and argue that their partly syntactic and partly morphological properties follow from a mismatch between the morphological token structure and c-structure syntax.

1 Introduction

Given the evidence that shows cliticization in European Portuguese (EP) constitutes an essentially inflectional phenomenon, this paper attempts to reconcile two apparently irreconcilable facts about the EP clitic system: first, the fact that pronominal clitics are generated as verbal affixes and aligned to the left or right of the verb by a morphological alignment function; and second, the fact that this alignment function must have access to a specific set of syntactic contexts to determine whether affixal clitics should appear preverbally or postverbally.[1] At issue then is the question of how inflectional morphology interacts with the contexts triggering proclisis. In section 2, we present a heterogeneous group of proclitic contexts and survey previous inflectional treatments of the EP clitic system. Section 3 summarises the proposal sketched in Luís and Sadler (2003) for proclitic contexts, and section 4 presents our analysis: we offer an outline the basic phrase structure of EP (4.1) and investigate ways in which phrasal affixes may be represented within Lexical-Functional Grammar (LFG) (4.2). We then formulate the idea that proclitics (and their linear order) can be defined in terms of f-precedence relations between triggers and targets (4.3-4.4). Having laid out the necessary LFG machinery, section 4.5 examines in detail each one of the proclitic contexts. A short summary is provided in section 5.

2 Overview

2.1 Proclitic triggers

In most Romance languages (e.g., Spanish, French, Italian), the alternation between the preverbal and postverbal placement of pronominal clitics is conditioned by the finiteness of the verb. In contrast, clitic placement in European Portuguese is sensitive to words and phrases in preverbal position (Martins 1994). In the presence of such elements, pronominal clitics must occur preverbally. Compare the alternation between enclisis in the first clause and proclisis in the second clause found in (1a) and (1b).

(1) a. O Pedro encontrou **-os**, *porque* **os** procurou.
the Pedro brought -3PL.ACC.M, because 3PL.ACC.M searched
'Pedro found them, because he searched for them.'

[1]We are grateful to Louisa Sadler and Andrew Spencer for the discussions since the early stage of this work. Various parts of the paper have greatly benefited from the comments and clarifications by Ron Kaplan and Tracy Holloway King. We also thank Ash Asudeh, Joan Bresnan, Miriam Butt, Andrew Carstairs-McCarthy and Mary Dalrymple for their comments. Remaining errors are ours. Ryo Otoguro gratefully acknowledges the financial support of the University of Essex Sir Eric Berthoud Travel Grant and Department of Language and Linguistics, University of Essex.

b. As professoras deram **-lhes** lápis, mas *não* **lhes** deram papel.
the teachers gave -3PL.DAT pencils; but not 3PL.DAT gave paper
'The teachers gave them pencils, but they didn't give them paper.'

In (1), proclitic placement is determined by a clause-initial subordinating conjunction, *porque* 'because' (1a), and by the preverbal negation marker *não* 'not' (1b). In each one of the first clauses, clitics appear postverbally, in their default position. Other contexts triggering proclisis include embedded clauses introduced either by complementisers (2a) or relative pronouns (2b); fronted focus phrases (2c); operator/like adverbs, such as *também* 'also', *até* 'even' and *já* 'already' (2d); wh-phrases in main or embedded clauses (2e), and quantified subjects (2f).

(2) a. Eu sei *que* ele **o** encontrará.
I know that he 3.SG.MASC.ACC wii-find
'I know that he will still find it.'

b. *A quem* **os** entregaste?
to whom 2.PL.MASC.ACC give
'Who did you give them to?'

c. *Deste livro* **me** lembro bem.
of-this book 1.SG.REFL remember well
'I remember this book well.'

d. As crianças *também* **o** viram.
the children also 1.SG.MASC.ACC saw
'The children saw him, too.'

e. *Quantos presentes* **te** ofereceram?
how-many gifts 2.SG.DAT gave
'How many presents did they give you?'

f. *Todas* as crianças **nos** disseram a verdade.
all.PL.FEM the children 1.PL.DAT said the truth
'All the children told us the truth.'

2.2 Clitics as affixes

Enclitics, as shown in (1), constitute the default case in EP. As argued in Crysmann (2002) and Luís (2004), verb-final clitics exhibit a significant number of affixal properties. In particular, they a) cannot be separated from the verb, b) may intervene between the verbal stem and tense/agreement suffixes, b) induce stem allomorphy and d) undergo non-productive phonological alternation. In combination with each other, pronominal clitics also display rigid ordering, idiosyncratic co-occurrence restrictions, fusion, syncretism, and cluster-internal allomorphy.

Unlike enclitics, proclitics display distributional and scopal properties that are untypical of verbal affixes: they can have wide scope over two conjoined VPs as in (3) and do not need to be strictly adjacent to the verb as in (4).

(3) a. Apenas a minha mãe me [ajudou e incentivou].
only the my mother 1.SG.ACC helped and encouraged
'Only my mother helped me and encouraged me.'

b. Acho que lhes [tinham lido uma história e tinham dado um livro].
think.1.SG that 3.PL.DAT had read a story and had given a book
'I think that they had read them a story and given them a book.'

(4) Eu sei que ele o ainda não visitou.
I know that he 3.SG.M.ACC yet not visited
'I know that he still has not visited him.'

Given the syntactic behaviour of proclitics, Vigário (1999), Gerlach (2001) and Crysmann (2002) argue that the proclitic data seriously weakens the inflectional status of EP pronominal clitics. Luís (2002, 2004) however observes that proclitics and enclitics are formally exactly identical and display exactly the same range of cluster-internal allomorphy and rigid ordering.

To capture the idea that enclitics and proclitics constitute the same affixal unit, Luís and Spencer (In press) generate enclitics and proclitics as one and the same affixal unit. Within a revised model of Paradigm Function Morphology (Spencer ms), the scopal and distributional differences are accounted for through a morphological placement function, which aligns affixal clitics either to the right edge of a verbal stem, for enclisis, or to the left of a phrasal node, for proclisis. Under this view, enclitics are derived as genuine verbal suffixes, while proclitics constitute *phrasal* affixes (i.e., affixes that do not form a morphological cohering unit with the verb, but instead attach to a phrasal position). This paper assumes an inflectional view of cliticisation and adopts the distinction between morphological suffixation and phrasal prefixation.

3 Previous LFG account of proclitic contexts

The need to reconcile the inflectional status of cliticisation and the syntactic aspects of proclitic placement has been investigated in Luís and Sadler (2003), within the theory of LFG. In particular, they have explored the idea that inflectional morphology may sometimes be just a reflex of a set of marked syntactic contexts.

To account for proclitic contexts, the view is taken that all proclitic constructions are mapped onto an abstract functional feature (↑ TYPE) = NON-NEUTRAL, which reflects the fact that proclisis is the marked placement in EP. In (5b), for example, this feature is associated with a negative construction.

(5) a. O João *não* **me** deu o livro
the João not 1.SG.DAT gave the book
'João didn't give me the book.'

b.
$$\begin{bmatrix} \text{PRED} & \text{`GIVE}\,\langle\text{SUBJ,OBJ,OBJ2}\rangle\text{'} \\ \text{POL} & \text{NEG} \\ \text{TYPE} & \text{NON-NEUTRAL} \\ \ldots & \end{bmatrix}$$

trigger
abstract syntactic feature for proclisis

The idea of mapping all proclitic contexts onto an abstract functional feature is motivated by the difficulty in finding a common configurational or semantic/discourse denominator for the set of syntactic contexts.

The analysis further suggests that the TYPE feature is placed in correspondence with the proclitic placement rule/function. (6) states that the linearisation rule 'Proclitic-LR', which ensures the clitic cluster is placed preverbally, applies only under the existence of (↑ TYPE) = NON-NEUTRAL feature in the f-structure of the verb.

(6) Proclitic-LR iff (↑ TYPE) $=_c$ NON-NEUTRAL

One of the problems with this proposal is that it merely assumes precedence relations between the verb and the triggers but does not make the relations explict. The aim of our analysis is precisely to emphasise the importance of the 'linear' order between the triggers and the clitics (cf. Crysmann (2002) within HPSG).

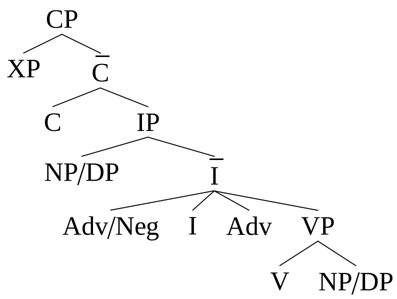
One further difficulty is that it is not clear how (↑ TYPE) = NON-NEUTRAL is associated with the various proclitic contexts. One possible option would be to specify the feature in the lexical entries of the triggering elements (e.g., negative markers, complementisers and relative pronouns). However, this approach would not work for all the relevant contexts. In particular, since various elements can be fronted as focused phrases, it would be implausible to specify ((FOCUS↑) TYPE) = NON-NEUTRAL in the lexical entry of every word.

4 Proposal

The properties of proclitics and proclitic triggers in EP can be summarised as follows: a) proclitic triggers always precede the finite verb, but their preverbal position cannot be reduced to one single phrase structure position; b) in preverbal position, clitic affixes select a phrasal host and behave therefore like phrasal inflections; and c) proclitic triggers constitute a heterogeneous group of elements which contribute a wide range of information to f-structure (and other structures). Any account of EP proclisis must properly capture these three points. We start our analysis of EP proclitic triggers by laying out basic assumptions about EP phrase structure.

4.1 Basic phrase structure

The schematic c-structure for EP comprises the lexical projection VP and the functional projections IP and CP, as given in (7).

(7)


Briefly, we assume that finite verbs/auxiliaries are base-generated in I or C, whereas non-finite verbs are generated in V (cf. Kroeger (1993), King (1995), Bresnan (2001)). Adverbs are left-/right-adjoined to I; and negations are treated as a type of ADJUNCT (Sells 2001). Spec-IP is the position for the subject NP/DP, annotated as (↑ SUBJ) = ↓. Spec-CP is the position of a fronted focused phrase or a wh-phrase, both annotated as (↑ FOCUS) = ↓. We also assume that the discourse function TOPIC appears in Spec-CP (cf. Sells (2001) for Swedish). With respect to TOPIC, the data in (2) seem to suggest that it is adjoined to IP, as assumed for English (Bresnan 2001:180-3):

(8) a. Ao João, a professora deu(-lhe) um livro.
to João the teacher gave(-3.SG.ACC.M) a book
'To João, the teacher gave a book.'

b. Ao João, o livro, a professora deu-lho.
to João the book the teacher gave-3.SG.DAT/3.SG.ACC.M
'To João, the book, the teacher gave.'

In (8a) the fronted phrase *ao João* appears to be adjoined to IP; likewise, (8b) could be analysed as two topicalised phrases multiply adjoined to IP. However, other data suggest that the topicalised phrase appears in a higher c-structure position:

(9) a. Este livro, dou-te eu
this book give-2.SG.DAT/3.SG.ACC.M I
'This book I give it to you.'

b. Deste livro, lembro-me eu
this book, remember-1.SG.REFL I
'This book I remember.'

In each structure in (9), the fronted topic phrase is actually followed by the finite verb and the subject. For clauses in which both topicalisation and subject-verb inversion occur, we would like to propose that the subject is sitting in Spec-IP while the verb is base-generated at C. The verb's higher position makes the Spec-CP position available for the fronted topic.

Following standard LFG assumptions about c-structure/f-structure correspondence, we also assume that the functional head and its complement are f-structure co-heads. Therefore, V, $\overline{\text{V}}$, VP, I, $\overline{\text{I}}$, IP, C, $\overline{\text{C}}$ and CP are all annotated as ↑=↓ (Bresnan 2001:102). Finally, we treat the complement of V as an OBJ in the f-structure.

4.2 Phrasal affixation[2]

Before we look in detail at the contexts triggering proclisis, we will need to address the phenomenon of phrasal affixation and examine its representation within LFG. As summarised in section 2, both enclitics and proclitics in EP are verbal inflectional affixes. In particular, enclitics constitute genuine suffixes, while proclitics are regarded as phrasal affixes. In LFG terms, it appears to be uncontroversial that enclitics and proclitics contribute the same f-structure information (i.e., OBJ/OBJ2), however, at the level of c-structure it is not entirely clear how phrasal affixes ought to be analysed. The issue then is how to represent phrasal affixes within the LFG framework.

4.2.1 Previous LFG analysis

Recent studies by Luís and Sadler (2003) and Otoguro (2003) assume that phrasal affixation must be stated in the placement rule/function provided by the morphological component. For EP proclitics, Luís and Sadler (2003) formulate the placement rule 'Preverbal LR: <cl - [VP, V]>' to ensure that proclitics are attached to the left of a syntactic verbal domain. That is, morphological placement rules attach inflectional exponents directly to a phrasal or preterminal node in the c-structure (whereas postverbal clitics combine with the verb in the morphology, like genuine verbal suffixes, as shown in (10b)).

In addition, Luís and Sadler (2003) assume that proclitics (i.e., phrasal affixes) constitute affixes without c-structure representation and associate pronominal f-structure information with either a V or a VP node (cf. (10)a).[3] Among the arguments motivating this view, is the idea that the representation of affixes as c-structure terminals constitutes a serious violation of one of the building blocks of lexicalist syntax, namely the Lexical Integrity Hypothesis (cf. Bresnan (2001:92)). In this respect, the treatment of EP phrasal affixation sketched by Luís and Sadler (2003) presupposes an unconventional view of the LFG c-structure and f-structure correspondence. It assumes that the affixal proclitic selects a phrasal or preterminal node, but the exponent itself does not appear in the c-structure.

(10) a. Proclisis

```
          VP
          |
         ↑=↓
 (↑ OBJ PRED) = PRO
      nos = V
          |
        vêem
  '(they) see us.'
```

b. Enclisis

```
          VP
          |
         ↑=↓
          V
          |
      vêem-nos
 (↑ OBJ PRED) = PRO
  '(they) see us.'
```

4.2.2 Alternative view

Building on the work by Luís and Sadler (2003), this section attempts to offer a solution to the problems posed by the c-structure representation of phrasal inflections. In our LFG treatment of phrasal affixes, we assume that the morphology generates inflectional strings as sequences of morphological tokens (i.e., the stem-affix combinations). We also suggest that these tokens and their corresponding boundaries constitute an additional morphological 'structure' which resides in the morphological component. Lexical

[2]We are indebted to Ron Kaplan for comments and suggestions which helped us formulate the ideas contained in this section.

[3]In Luís and Sadler (2003), proclitics attach to VP when they have wide scope over coordinated Vs or VPs (cf. (3)).

word boundaries may, but need not, coincide with morphological token boundaries, and their correspondence is defined at the interface between morphology and c-structure. Crucial for our analysis of phrasal affixation is the claim that, by introducing a new morphology-internal structure, placement rules do not need to refer to the c-structure configuration directly, as in previous LFG approaches, but they simply construct a well-formed string of exponents within the morphological component. Once the inflectional strings have been defined by the morphology, they will be properly mapped onto the c-structure (see below).

To begin with, the string of formatives defined by the morphology is independent of phrase structure. This is achieved within Paradigm Function Morphology (PFM) through the successive application of Realisation Rules (RRs) to the root of a given lexeme (Stump 2001). In the extended version of PFM found in Spencer (2000, ms), a cluster of affixes is independently defined by a composition of RRs and is attached to either the left or right of the stem by a placement function. The revised model of Paradigm Function Morphology (PFM) is adopted by Luís (2004) for EP pronominal clitics. Let us look at the two types of clitic-verb combinations in (11).

(11) a. O João raramente me vê
the João rarely 1.SG.DAT sees
'João rarely sees me.'

b. O João vê-me raramente
the João 1.SG.DAT-sees rarely

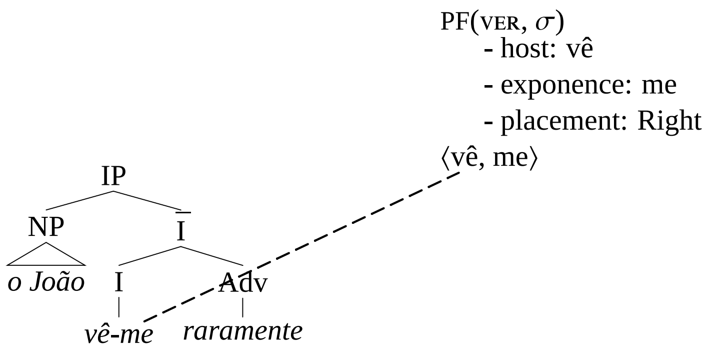
It is the role of the morphology to specify each one of the above patterns of clitic alignment:

(12) a. ⟨me, vê⟩
b. ⟨vê, me⟩

At this stage, the difference between each pattern is mainly a question of linearisation, i.e. in (12a) the affixal clitic, *me*, is placed before the stem vê; in (12b) it is placed after it.

Let us now see how the inflectional strings defined by the morphology are mapped onto the c-structure.[4] In most cases, a morphologically single token is mapped onto a single c-structure word. EP enclitics are of this type, as shown in (13a). However, sometimes two or more c-structure terminals correspond to a single morphological token. Phrasal affixation is an example of that. In this case EP proclitics are mapped onto c-structure as illustrated in (13b).[5,6]

(13) a.

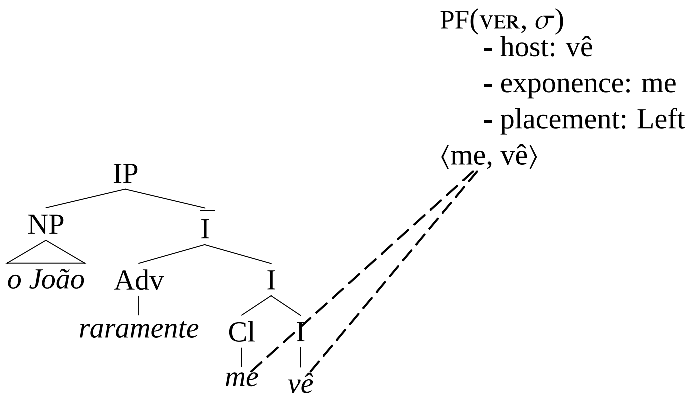


[4]This process is similar to tokenisation in XLE (e.g. Kaplan and Newman (1997), Butt et al. (1999), Kaplan et al. (2004)).

[5]On the surface, the current proposal appears to be similar to Sadock's (1991) Autolexical treatment of cliticisation. However, closer inspection shows that the morphological component in our paper is quite different from the one assumed by Sadock. First, unlike in Autolexical Syntax, the hierarchical organisation of stems and affixes is not assumed in PFM. Second, a morphological token is not an extension of the c-structure below X^0, as found also in Andrews (1996), for example. In our paper, morphological tokens are produced by the Paradigm Function (PF) and reside therefore inside the morphological component.

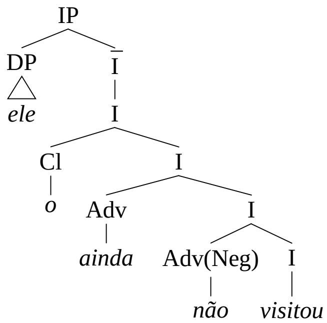
[6]In (13), we represent the PF through abbreviated notations. For more detailed formalisation, see Luís (2004).

b.



We position the pronominal clitic under Cl in the c-structure and adjoin it to X^0 (cf. Sadler and Arnold (1994), Sadler (1997), Toivonen (2003)). We also assume that proclitic clusters appear under one Cl node. They are generated as a sequence of clitics (Luís 2004) and mapped onto one single phrase-structure position. Interpolated elements, such adverbs and the negation marker, examplified in (4) are allowed to undergo multiple X^0 adjunctions, following the proposal by Luís and Sadler (2003).

(14)



Under this proposal, morphological formatives are allowed to behave as syntactic objects. Even though this idea appears to be in contradiction with the principles of realisational morphology, closer inspection shows that it is not.[7] Let us consider, for example, Beard's (1995) Lexeme-Morpheme Base Morphology, in which inflectional formatives, as generally assumed, are defined as grammatical morphemes distinct from lexemes. For the present discussion, what is important is that his theory also assumes that grammatical morphemes can be realised as words (i.e., free grammatical morphemes, such as auxiliaries) and placed in syntactic positions (Beard 1995:44). It is therefore worth emphasising that there is no necessary correlation between the phrase structure status and the grammatical morpheme/lexeme status of a given formative.

The upshot of our proposal is that we have four types of mappings between morphological token structure and c-structure. In the first type of mapping, we have simple affixation: affixes attach to the stem and the whole stem-affix string is mapped onto a single c-structure terminal, as in EP enclisis. In the second type, we find periphrastic inflections: here the morphology uses free grammatical morphemes to realise morphosyntactic properties (cf. Ackerman and Webelhuth (1998), Spencer (2001, to appear)). In this case, the lexeme is mapped onto a lexical head and the free grammatical morpheme is mapped onto a node in the extended projection of that lexical head (cf. Otoguro (2004)). The two last types constitute mismatch patterns: either a morphologically single token corresponds syntactically to two terminals, as in EP proclisis, or the opposite holds (as in some types of compounding). We leave the details of each one of these mappings for further research.

[7] Our proposal may be incompatible with Anderson's (1992) model of morphology in which realisational processes involve essentially phonological rules.

4.3 F-precedence

Having examined the representation of EP proclitics (i.e., phrasal affixes) within LFG's c-structure, this section will briefly outline the basic ideas of our LFG-treatment of proclitic contexts in EP. As observed earlier, the triggers display two crucial properties: a) they constitute a heterogeneous group of elements and b) they always precede the clitic host. We will show that LFG's f(unctional)-precedence is suitable for capturing these two generalisations (Bresnan 2001:195):[8]

(15) F-precedence ($<_f$)
$\alpha <_f \beta$ if the rightmost node in $\phi^{-1}(\alpha)$ precedes the rightmost node of $\phi^{-1}(\beta)$

F-precedence is defined in terms of the linear precedence relation between c-structure nodes contributing particular information to the f-structure. For instance, the constraint ($\uparrow$ SUBJ) $<_f$ ($\uparrow$ OBJ) describes the situation where the rightmost c-structure node among the nodes corresponding to SUBJ in the local f-structure (ϕ^{-1}($\uparrow$ SUBJ)) linearly precedes (c-precedes) the rightmost c-structure node among the nodes corresponding to OBJ in the same f-structure (ϕ^{-1}($\uparrow$ OBJ)).

By applying f-precedence to EP cliticisation, we can neatly describe the effect of proclitic contexts on clitic placement. In particular, we will assume that the information contributed by each trigger f-precedes the information provided by the pronominal clitic. Some f-precedence relations are expressed below:

(16) ($\uparrow$ FOCUS) $<_f$ ($\uparrow$ OBJ(2))
($\uparrow$ ADJ$\in$) $<_f$ ($\uparrow$ OBJ(2))
($\uparrow$ SUBJ SPEC) $<_f$ ($\uparrow$ OBJ(2))
...

For example, for clitic structures with preposed focus we will say that FOCUS f-precedes OBJ and/or OBJ2 in the same f-structure. This can also be expressed as ($\uparrow$ FOCUS) $<_f$ ($\uparrow$ OBJ). Each proclitic context will be discussed in detail in section 4.5, including those which require a slightly more complex descriptions.

4.4 Morphology-syntax interface

To begin with, we adopt the distinction between s(yntactic)-features and m(orphological)-features, as proposed in Sadler and Spencer (2001)[9] In LFG terms, s-features are operative at f-structure; these s-features include grammatical function (SUBJ, OBJ, etc.), TENSE, PRED and so on. M-features constitute purely formal features which are crucial for defining a lexemes' morphological paradigm. Sometimes the same feature can be operative at both levels of grammar (e.g., PERSON/NUMBER features not only play a crucial role in syntactic agreement, but they also determine the structure of inflectional paradigm).

The distinction between both types of features is formalised in Luís and Sadler (2003) and Sadler and Nordlinger (2004) who postulate a morphology-syntax interface level where explicit mappings from f-descriptions to m-features are described.[10] In this paper we adopt the mappings proposed in Luís and Sadler (2003):

(17)

a.	{Case:Acc, Pers:3, Num:Sg, Gen:M} ($\uparrow$ OBJ PRED) = PRO ($\uparrow$ OBJ PERS) = 3 ($\uparrow$ OBJ NUM) = SG ($\uparrow$ OBJ GEN) = M	b.	{Case:Acc, Pers:3, Num:Pl, Gen:M} ($\uparrow$ OBJ PRED) = PRO ($\uparrow$ OBJ PERS) = 3 ($\uparrow$ OBJ NUM) = PL ($\uparrow$ OBJ GEN) = M

[8]Kaplan and Zaenen's (1989) definition is slightly different. This, however, does not affect our argument.

[9]In effect, the mismatch between s-features and m-features is virtually absent in our data and therefore nothing in our analysis hinges on the distinction between these features.

[10]Under different assumptions about morphology, a similar approach can be found in XLE's lexical entries where tags assign f-descriptions, e.g. +Masc GEND TAG ($\uparrow$ GEND) = MASC (Butt et al. 1999:165)

In addition, we assume that the contexts defined by the f-precedence constraints in (17) are mapped onto the morphological markedness feature [Restricted:Yes], as schematically representated in (18):

(18)
$$\left.\begin{array}{l}(\uparrow \textsc{focus}) <_f (\uparrow \textsc{obj}(2))\\ (\uparrow \textsc{adj}\in) <_f (\uparrow \textsc{obj}(2))\\ (\uparrow \textsc{subj spec}) <_f (\uparrow \textsc{obj}(2))\\ \ldots\end{array}\right\} \Rightarrow \quad \text{[Restricted:Yes]}$$

As the arrow shows, at the morphology-syntax interface, a formal morphological feature is linked to the contexts triggering proclisis, capturing the fact that clitic placement is determined by syntactic principles. F-precedence constraints, on the left hand side, serve as input to the morphology. The formal feature, on the right hand side, triggers the morphological placement function which aligns affixal clitics to the left of the clitic host, delivering proclisis.

Even though purely formal features should be avoided, EP is not the only language in which morphological alternations are the reflex of phrasal properties (Luís 2004). A formal feature [Restricted:Yes] also appears to be necessary in Somali inflectional morphology where a 'special' conjugation class is selected whenever the subject is focused (Svolaccia et al. 1995). Under the current porposal, the syntactic selection of the conjugation class is captured by assuming that (↑ SUBJ) = (↑ FOCUS) maps onto [Restricted:Yes] at the morphology-syntax interface.

4.5 Analysis

In section 4.3 we looked briefly at the precedence relations between triggers and targets in EP, and suggested that they should be captured through f-precedence constraints. In this section, we look in detail at each one of triggering contexts referred to in section 2.1.

4.5.1 Fronted focus

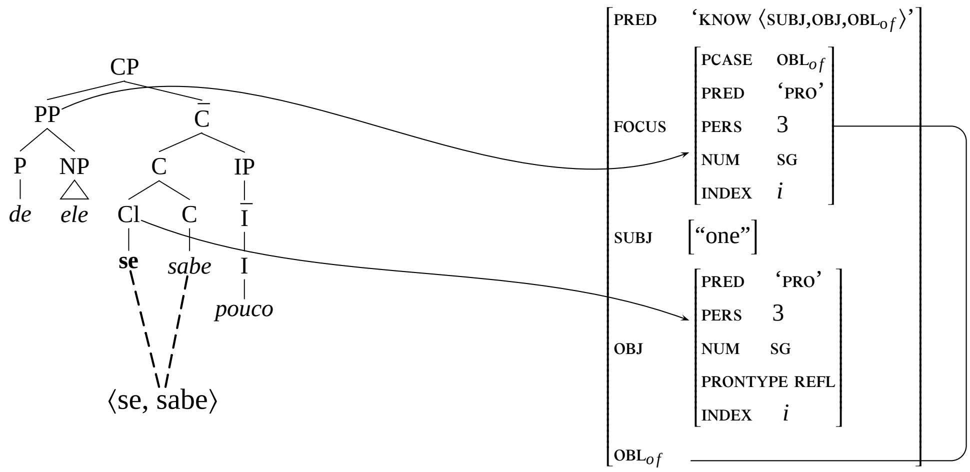
As referred to before, clitics must be placed preverbally if a clause contains a focused element preceding the verb:

(19) a. *Dele* **se** sabe pouco.
of him 3.SG.REFL knows little
'One knows little about him'

b. **Dele* sabe-**se** pouco.

The c-structure and f-structure associated with (19a) are given in (20). Based on this representation, the effect of focus fronting on proclisis is ensured by well-formedness constraints in (21). The first line describes the f-precedence relation between the proclitic trigger and the clitic pronoun. This information is mapped onto the formal feature [Restricted:Yes] at the morphology-syntax interface. The second line says that, in the morphology, any verb form associated with the feature [Restricted:Yes] triggers the alignment function 'align (Left)'. The third line captures the idea, formulated in section 4.2, that one single morphological token (in this case the cliticised verb form *se-sabe*) can correspond to two nodes in the c-structure. We recall that under the current proposal, preverbal affixes are X^0 adjunctions in the c-structure.

(20)



(21) a. (↑ FOCUS) $<_f$ (↑ OBJ) ⇒ [Restricted:Yes] (morphology/syntax interface)

b. [Restricted:Yes] ⇒ align(Left) (morphology)

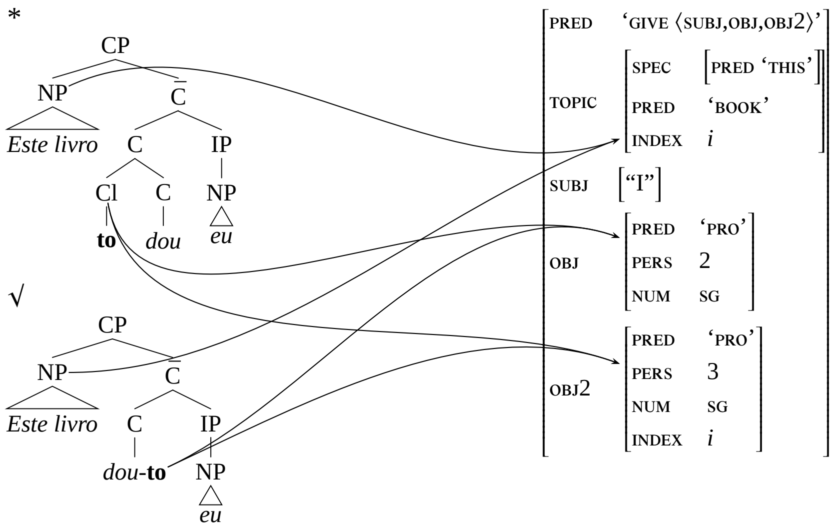
c. aff-V_{stem}-aff ⇒ $[_X\ [_{Cl}$ aff $[_X\ V_{stem}$-aff]]] (morphology/c-structure interface)

Interestingly, unlike focused phrases, a fronted topic phrase does not trigger proclisis. So, only (22a) with a postverbal pronominal clitic is grammatical. The c-/f-structures associated with the constructions in (22a, b) are shown in (22c):[11]

(22) a. *Este livro*, dou-**to** eu.
this book give-2.SG.DAT/3.SG.ACC.M I
‘This BOOK, I give it to you’

b. **Este livro*, **to** dou eu.

c. *



The data suggest that EP grammar does not contain the rule associating (↑ TOPIC) $<_f$ (↑ OBJ(2)) with [Restricted:Yes] at the morphology-syntax interface level. Therefore, the structure where the pronominal clitic is placed preverbally is morphologically ill-formed. In the absence of the formal feature [Restricted:Yes], the default placement ‘align(Right)’ must apply. Since the stem and suffix string corresponds to a single c-structure terminal, the lower c-structure in (22c) is well-formed.

4.5.2 Wh-questions

Wh-questions also constitute proclisis triggers. If a wh-phrase is fronted, the pronominal clitic must appear in front of the verb as shown in the contrast between (23a) and (23b):

[11] For ease of exposition, TOPIC does not take a set value here.

(23) a. *O que* **lhes** contaste?
the what 3.PL.DAT tell
'What did you tell them?'

b. **O que* contaste-**lhes**?

If the wh-phrase is *in situ*, as an echo question, clitic placament must instead be postverbal:

(24) a. ***Lhes** contaste o *quê*?

b. Contaste-**lhes** o *quê*?

A wh-fronted sentence and a wh-in-situ echo sentence have different f-structures. Only the former has a wh-phrase which is mapped onto FOCUS and identified with one of the GFS. This f-structural difference is illustrated in (25a, b) for (23a, b) respectively:

(25) a.
$$\left[\begin{array}{ll} \text{PRED} & \text{`TELL}\,\langle\text{SUBJ,OBJ,OBJ2}\rangle\text{'} \\ \text{FOCUS} & \left[\begin{array}{ll}\text{PRED} & \text{`WHAT'}\end{array}\right] \\ \text{Q} & \\ \text{SUBJ} & \left[\text{“you”}\right] \\ \text{OBJ} & \left[\begin{array}{ll}\text{PRED} & \text{`PRO'} \\ \text{PRES} & 3 \\ \text{NUM} & \text{PL}\end{array}\right] \\ \text{OBJ2} & \end{array}\right]$$

b.
$$\left[\begin{array}{ll} \text{PRED} & \text{`TELL}\,\langle\text{SUBJ,OBJ,OBJ2}\rangle\text{'} \\ \text{SUBJ} & \left[\text{“you”}\right] \\ \text{OBJ} & \left[\begin{array}{ll}\text{PRED} & \text{`PRO'} \\ \text{PRES} & 3 \\ \text{NUM} & \text{PL}\end{array}\right] \\ \text{OBJ2} & \left[\begin{array}{ll}\text{PRED} & \text{`WHAT'}\end{array}\right] \end{array}\right]$$

Returning now to the f-precedence relations and to the description of the conditions triggering proclisis, (25a) shows that we do not need an additional constraint to account for proclisis in clauses with wh-fronted phrases. Instead, the well-formedness constraints adopted in (21) to account for the effect of focus fronting on proclisis can also be adopted for the wh-context. In particular, we assume that the f-precedence relation – formulated as $(\uparrow \text{FOCUS}) <_f (\uparrow \text{OBJ})$ in (21a) – also applies to fronted wh-phrases; this information is mapped onto the formal feature triggering clitic left alignment as specified in (21b); finally, we also assume a mismatch between the morphological token boundary and the lexical word boundary (21c). In effect, the well-formed constraints given in (21b) and (21c) apply invariably to all contexts. In the remaining discussion about proclitic contexts, we will therefore not repeat these constraints but simply assume that they are part of our LFG account of phrasal affixation.

4.5.3 Adverbs and negation marker

Adverbs nicely illustrate how decisive the precedence relation between the trigger and the target can be in determing where the affixal clitic will appear. While some adverbs can only appear preverbally, other adverbs can appear both preverbally and postverbally either with the same or with a different meaning. Particularly revealing are those adverbs which can occur in both positions with the same meaning. If we take the minimal pairs in (26) with preverbal adverbs and post-verbal adverbs, we notice that proclisis can only occur if the adverb appears preverbally:[12]

(26) a. O João *raramente* **me** vê.
the João rarely 1.SG.DAT sees
'João rarely sees me.'

b. *O João *raramente* vê-**me**.

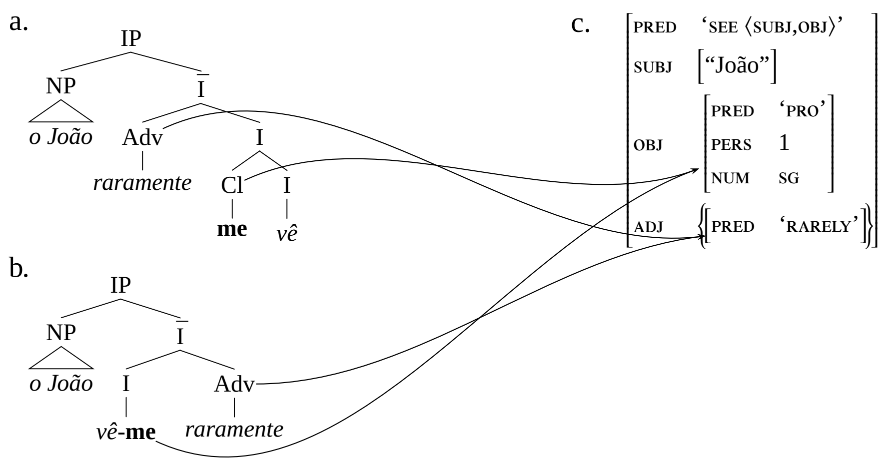
c. O João vê-**me** *raramente*.

d. *O João **me** vê *raramente*.

[12] Semantically, it is interesting to observe that adverbs like *raramente* are placed in preverbal position for emphatic purposes, while the unmarked position is generally postverbal.

The f-structure for the adverbial clauses in (26a) and (26c) is identical, but each clause must be assigned a distinct c-structure:

(27)



The syntactic information required to license the proclisis seems to be like (28):

(28) $(\uparrow$ ADJ$\in) <_f (\uparrow$ OBJ$)$

However, upon closer inspection, this f-precedence is insufficent, given that not all preverbal adverbs trigger proclisis (e.g., *ontem* ‘yesterday’). What we will assume for the present analysis is that adverbs triggering proclisis (including the negation marker) belong to a set of adverbials sometimes referred to as operator-like modifiers. We will therefore need to add more constraints to (28). This is what we want to say: a) the adverb which is mapped onto ADJUNCT in f-structure linearly precedes the c-structure node mapped onto OBJ; b) adverbs triggering proclisis are operator-like modifiers. This idea is formulated in (29):

(29) $(\uparrow$ ADJ$\in) = $ %OPADJ $\wedge$ (%OPADJ) $<_f (\uparrow$ OBJ$)$ $\wedge$ (%OPADJ PRED) = OPMOD
OPMOD ≡ {‘RARELY’ | ‘NOT’ | ‘NEVER’ | ‘ONLY’ | ‘ALREADY | ‘ALSO’ | . . . }

Since ADJUNCT constitutes a set, we need to specify the f-structure corresponding to the triggering adverb by using a local name (Kaplan and Maxwell 1996), here %OPADJ. So, (29) says that the ADJUNCT corresponding to the trigger f-precedes the OBJ and the PRED value of this ADJUNCT is OPMOD. The variable OPMOD can be any PRED value associated with the operator-like modifiers such as *raramente* ‘rarely’, *não* ‘not’, *nunca* ‘never’, *só* ‘only’, *já* ‘already’ and *também* ‘also’. (29) properly conditions the syntactic context licensing proclisis which is mapped onto [Restricted:Yes].

4.5.4 Complementisers and subordinate conjunctions

When a clause is introduced by a complementiser or a subordinate conjunction, the pronominal clitic is also placed before the verb as in (30a, c):

(30) a. Eles disseram *que* o João **te** magoou.
they said that the João 2.SG.ACC hurt
‘They said that João had hurt you.’

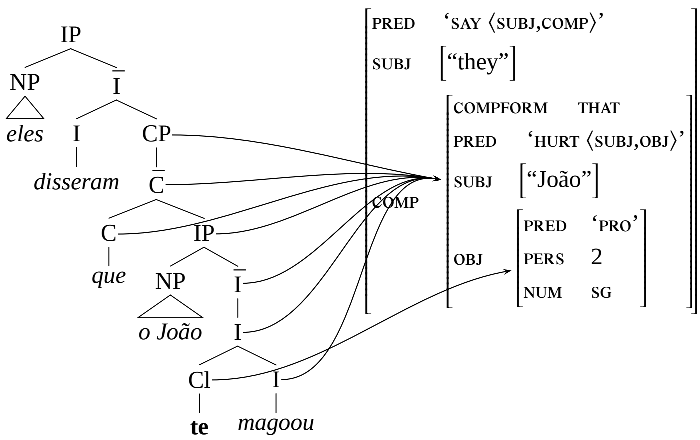
b. *Eles disseram *que* o João magoou-**te**.

c. A Ana ficou contente *quando* ele **a** convidou.
the Ana was happy when he 3.SG.ACC.F invited
‘Ana was happy when he invited her.’

d. *A Ana ficou contente *quando* ele convidou-**a**

One way of analysing the sentences in (30) would be to treat the complementiser/conjunction as a C projecting into CP. This assumption gives us the following structure:

(31)



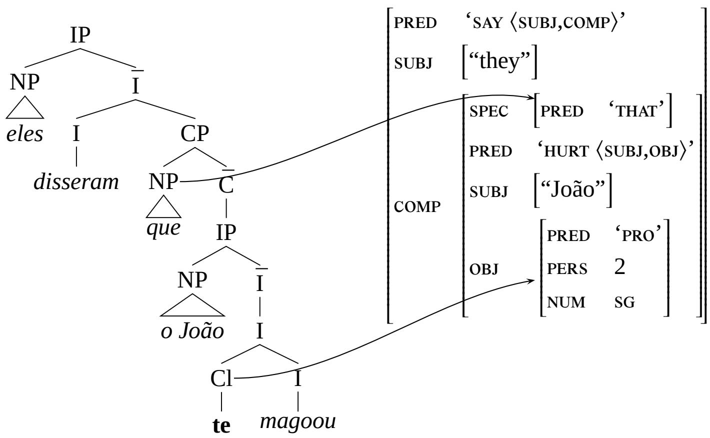
In (31), the complementiser *que* is an f-structure co-head to its complement headed by the verb. This means that both are mapped onto the COMP in the f-structure. Based on this c-structure to f-structure mapping, we formulate the proclisis context as in (32):

(32) $(\textsc{comp}\uparrow) \quad \wedge \quad (\uparrow \textsc{compform}) = \textsc{that}$

The constraint in (32) says that the verb must occur within a clause headed by a complementiser. In LFG, this idea is stated through an inside-out path (COMP ↑) which defines an f-structure bearing the value COMP. The inside-out path designates the higher f-structure, namely the f-structure containing the verb's own f-structure. Finally, since only the overt complementisers license proclisis, an additional constraint is introduced identifying COMPFORM as (↑ COMPFORM) = THAT.

An alternative approach might be adopted by treating complementisers as specifiers of COMP. Under this assumption, the c-/f-structures would be like (33):

(33)



Here, *que* is in Spec-CP and mapped onto SPEC of COMP in the f-structure. It makes a semantic contribution to the complement clause, specifying the type of clause. Given this syntactic representation, we define the proclitic context with the following constraints:

(34) $(\textsc{comp}\uparrow) \quad \wedge \quad (\uparrow \textsc{spec}) <_f (\uparrow \textsc{obj})$

Again, (COMP ↑) designates the higher f-structure containing the verb's f-structure as a value of COMP. Within COMP, SPEC f-precedes OBJ.

For the sake of space, we will not discuss subordinate conjunctions here. Except for minor modifications (such as ADJUNCT instead of COMP), the set of constraints just formulated for complementisers also applies to conjunctions.

4.5.5 Relative pronouns

Even though relative clauses share similarities with both subordinate clauses and wh-fronted clauses (at a purely descriptive level), within LFG they are treated as specific syntactic constructions. This means that in accounting for proclisis triggering, we need to postulate a different set of constraints. Let us first look at the data:

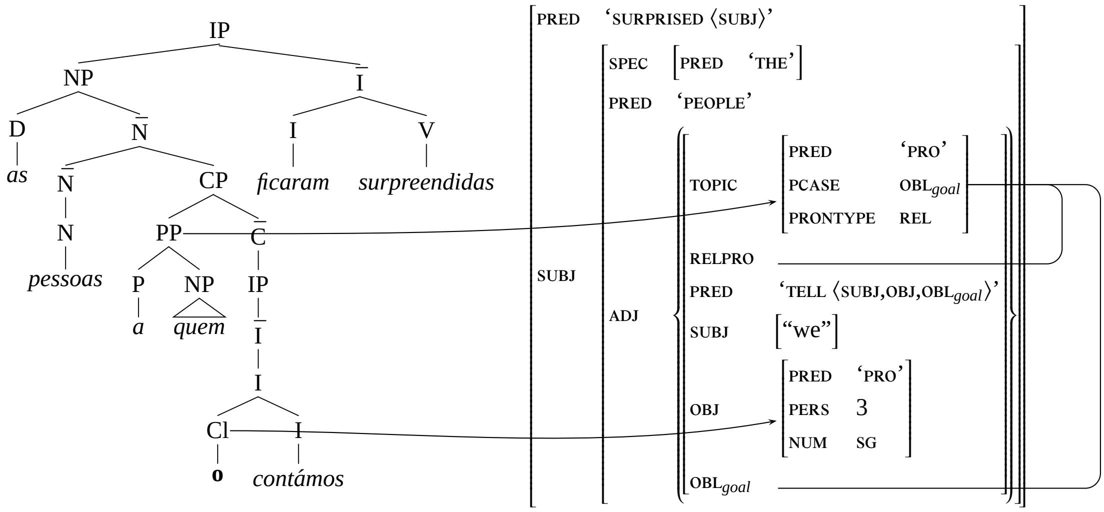
(35) a. As pessoas a *quem* **o** contámos ficaram surpreendidas.
the people to whom 3.SG.ACC.M told were surprised
'The people we told it to were surprised.'

b. *As pessoas a *quem* contámo-**lo** ficaram surpreendidas.

As (35) illustrates, within relative clauses, pronominal clitics must appear before the verb. This supports the claim that clause-initial relative pronouns constitute proclisis triggers.

Given the c-structure in (36), we represent relative clauses as CPs adjoined to $\bar{\text{N}}$ (or NP). The fronted prepositonal phrase *a quem* is placed in Spec-CP. At the f-structure level, the fronted PP is mapped onto the discourse function TOPIC, following standard LFG assumptions. The TOPIC is also linked to one of the GFs through the constraint (↑ TOPIC) = (↑ RTOPICPATH) annotated on the relevant PS rule. In addition, the value of the RELPRO attribute must appear at the end of the RELPATH within the TOPIC f-structure, as required by (↑ RELPRO) = (↑ TOPIC RELPATH). The exact properties of RTOPICPATH and RELPATH in EP are not crucial for clitic placement.

(36)



To account for the fact that relative pronouns constitute proclisis triggers, we may start by proposing a constraint which says that relative pronouns must linearly precede the clitic host. This can be straightforwardly formalised as (↑ TOPIC) $<_f$ (↑ OBJ). However, an additional constraint is necessary, given that fronted topicalised phrases cannot trigger proclisis (cf. (22)). To ensure that the TOPIC, which f-precedes the OBJ is associated with the relative pronoun, we formulate an additional constraint, namely (↑ TOPIC PRONTYPE) = REL. A complete description of the precedence relation between relative pronouns and clitic pronouns is given in (37):

(37) (↑ TOPIC) $<_f$ (↑ OBJ) ∧ (↑ TOPIC PRONTYPE) = REL

4.5.6 Quantified subjects

We conclude our overview of proclitic triggers by looking at quantified subjects. In EP, if the subject is modified by certain quantifiers, the pronominal object clitic must appear preverbally. This is illustrated in (38) with the quantifier *poucos* 'few' which triggers proclisis.

(38) a. *Poucos* alunos **lhe** telefonaram.
few students 3.SG.DAT phoned
'Few students phoned him.'

b. **Poucos* alunos telefonaram-**lhe**.

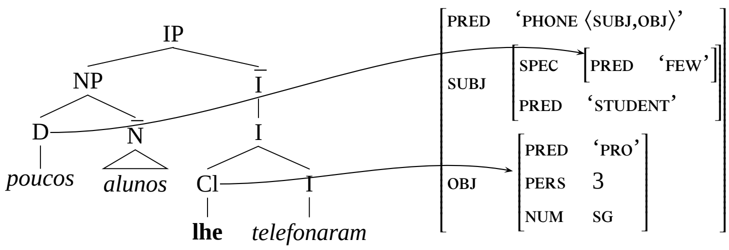
Other quantifiers inducing preverbal cliticisation include *nenhuns* 'none', *todos* 'all', *cada* 'every' and so on. They have been classified as 'downward entailing quantifiers' given that their semantic property appears to be downward monotonicity (Crysmann 2002). On the contrary, non-downward entailing quantifiers such as *alguns* 'some' do not seem to trigger proclisis:

(39) a. *Alguns* alunos telefonaram-**lhe**.
some students phoned-3.SG.DAT
'Some students phoned him.'

b. **Alguns* alunos **lhe** telefonaram.

We propose the following c-/f-structures for the quantified subject sentence (38):

(40)



The proclisis context is defined through the f-precedence relation ($\uparrow$ SUBJ SPEC) $<_f$ ($\uparrow$ OBJ) which ensures that the quantified subject linearly precedes the clitic. In addition, we also need to exclude non-downward entailing quantifiers. We therefore need to specify that the PRED values of SUBJ SPEC is associated with the natural class of downward entailing quantifiers. This specific set of PRED values, we propose, belong to the natural class of the metavariables DEQUAN which comprise 'FEW', 'ALL' 'EVERY', etc. The constraints are summarised as follows:

(41) ($\uparrow$ SUBJ SPEC) $<_f$ ($\uparrow$ OBJ) $\wedge$ ($\uparrow$ SUBJ SPEC PRED) = DEQUAN
DEQUAN $\equiv$ {'FEW' | 'ALL' | 'EVERY' | 'NO' | ...}

Before summing up our paper, we will briefly refer to the case of quantifier floating. This type of syntactic phenomenon also illustrates the idea, put forward in this paper, that precedence relations are crucial in accounting for EP proclisis. In particular, the contrast between (42a-b) illustrates that a dislocated quantifier can only trigger proclisis if it remains in preverbal position (cf. (42a)). If a floating quantifier occurs in postverbal position, then the affixal clitic must be realised as a verbal suffix:

(42) a. Os alunos *todos* **lhe** telefonaram.
the students all 3.SG.DAT phoned
'All the students phoned him.'

b. *Os alunos *todos* telefonaram-**lhe**.

c. Os alunos telefonaram-**lhe** *todos*.

d. *Os alunos **lhe** telefonaram *todos*.

The observed effect of quantifier floating on proclisis might be accounted for in two ways. Under one analysis, we map the dislocated quantifier onto to the same f-structure as a non-floating one, i.e. ($\uparrow$ SUBJ SPEC). This treatment would account for the contrast in (42), given the constraints formulated in (41) for quantified subjects. Another option would be to treat the floating quantifiers as an $\bar{\mathrm{I}}$ adjunction, regardless of whether it appears preverbally or postverbally. Given this hypothesis, the proposal made in section 4.5.3 for adverbial triggers would straightforwardly account for the contrast between (42a) and (42c).

5 Conclusion

In this paper, we looked at a heterogeneous group of preverbal syntactic contexts in EP and examined their effect on clitic placement. Given our assumption that a) cliticization constitutes an inflectional phenomenon and that b) pronominal clitics are generated as affixes, we have argued that i) the morphology must have access to the information associated with the proclisis triggers (Luís and Sadler 2003) and that ii) the 'linear' position of proclitic triggers must be defined in terms of f-precedence relations:

(43)
$$(\uparrow \textsc{focus}) <_f (\uparrow \textsc{obj})$$
$$(\uparrow \textsc{adj}\in) = \%\textsc{opadj} \quad \wedge \quad (\%\textsc{opadj}) <_f (\uparrow \textsc{obj}) \quad \wedge \quad (\%\textsc{opadj pred}) = \text{O}\textsc{p}\text{M}\textsc{od}$$
$$(\textsc{comp}\ \uparrow) \quad \wedge \quad (\uparrow \textsc{compform}) = \textsc{that} \quad / \quad (\textsc{comp}\ \uparrow) \quad \wedge \quad (\uparrow \textsc{spec}) <_f (\uparrow \textsc{obj})$$
$$(\uparrow \textsc{topic}) <_f (\uparrow \textsc{obj}) \quad \wedge \quad (\uparrow \textsc{topic prontype}) = \textsc{rel}$$
$$(\uparrow \textsc{subj spec}) <_f (\uparrow \textsc{obj}) \quad \wedge \quad (\uparrow \textsc{subj spec pred}) = \text{DEQ}\textsc{uan}$$

An explicit mapping has been proposed, which puts f-precedence relations in correspondence with the morphology. So, for each one of the conditions in (43), a placement function of the type align(Left) aligns affixal clitics to the left of the host (proclisis). In the default case, affixal clitics attach to the right of a verbal stem, through align(Right) (enclisis). By making use of f-precedence, our paper shows that neither purely configurational nor purely f-structural information can define proclisis contexts. Instead, both c-structural linear order and f-structural function provide an account of the alternation between enclisis and proclisis.

In our attempt to understand the grammar of proclisis, we also investigated the phenomenon of phrasal affixation. The first results of our study lend support to the view, formulated in Luís and Sadler (2003), that this type of affixation requires a somewhat complex interface between c-structure syntax and the morphology. To capture both the morphological and syntactic properties of phrasal affixes, we have proposed an additional structure within the morphological component which identifies the morphological token boundaries of a cliticised verb (as opposed to the lexical word boundaries represented under c-structure terminals). We show that the behaviour of phrasal affixes, as partly inflectional and partly syntactic units, results from a mismatch between these two structures.

One of the issues we have not touched up in this paper refers to the proclitic's ability to take wide scope. Proclitics can be optionally shared over a coordinated verb phrase, as in (3a), or over a coordinated auxiliary-verb structure, as in (3b). In both these constructions, the clitic functions as the object of two argument-taking verbs. Wide scope reading is not available for enclitics, as would be expected of genuine suffixes which must attach to each one of the members of a verbal/auxiliary conjunct. The scopal behaviour of proclitic may pose problems to our c-structure analysis of phrasal affixation, given that we suggest that proclitics adjoin to X^0. This assumptions predicts, contrary to evidence, that proclitics must appear on each conjunct, i.e., adjoined to each I or C under a coordinated $\overline{\text{I}}$ or IP ($\overline{\text{C}}$ or CP). To correctly capture the data, we need to provide a mechanism by which distributed features receive formal manifestations on only one of the conjuncts. This investigation will be left for further research.

References

Ackerman, Farrell, and Gert Webelhuth. 1998. *A Theory of Predicates*. Stanford, CA: CSLI Publications.

Anderson, Stephen R. 1992. *A-Morphous Morphology*. Cambridge: Cambridge University Press.

Andrews, Avery D. 1996. Semantic case-stacking and inside-out unification. *Australian Journal of Linguistics* 16:1–54.

Beard, Robert. 1995. *Lexeme-Morpheme Base Morphology: A General Theory of Inflection and Word Formation*. Albany, NY: SUNY Press.

Bresnan, Joan. 2001. *Lexical-Functional Syntax*. Oxford: Blackwell.

Butt, Miriam, Tracy Holloway King, María-Eugenia Niño, and Frédérique Segond. 1999. *A Grammar Writer's Cookbook*. Stanford, CA: CSLI Publications.

Crysmann, Berthold. 2002. *Constraint-based Coanalysis*. PhD thesis, Universität des Saarlandes and DFKI Gmbh.

Gerlach, Birgit. 2001. *Clitics Between Syntax and Lexicon*. PhD thesis, Heinrich-Heine Universität, Düsseldorf.

Kaplan, Ronald M., and John T. Maxwell, III. 1996. LFG Grammar Writer's Workbench. Technical report, Xerox Palo Alto Research Center, Stanford, CA.

Kaplan, Ronald M., John T. Maxwell, III, Tracy Holloway King, and Richard Crouch. 2004. Integrating finite-state technology with deep LFG grammars. In *Proceedings of the Workshop on Combining Shallow and Deep Processing for NLP*. ESSLLI.

Kaplan, Ronald M., and Paula S. Newman. 1997. Lexical resource reconciliation in the Xerox Linguistic Environment. In D. Estival, A. Lavelli, K. Netter, and F. Pianesi (Eds.), *Proceedings of the ACL Workshop on Computational Environments for Grammar Development and Linguistic Engineering*, 54–61, Madrid.

Kaplan, Ronald M., and Annie Zaenen. 1989. Long-distnace dependencies, constituent structure, and functional uncertainty. In M. Baltin and A. Kroch (Eds.), *Alternative Conceptions of Phrase Structure*, 17–42. Chicago: Chicago University Press.

King, Tracy Holloway. 1995. *Configuring Topic and Focus in Russian*. Stanford, CA: CSLI Publications.

Kroeger, Paul. 1993. *Phrase Structure and Grammatical Relations in Tagalog*. Stanford, CA: CSLI Publications.

Luís, Ana. 2002. Cluster formation and placement asymmetries. In *Papers from Regional Meeting of the Chicago Linguistic Society*, Vol. 38, Chicago. Chicago Linguistic Society.

Luís, Ana. 2004. *Clitics as Morphology*. PhD thesis, University of Essex.

Luís, Ana, and Louisa Sadler. 2003. Object clitics and marked morphology. In C. Beyssade, O. Bonami, P. Hofherr, and F. Corblin (Eds.), *Empirical Issues in Formal Syntax and Semantics*, Vol. 4, 133–153. Paris: Presses Universitaires de Paris-Sorbonne.

Luís, Ana, and Andrew Spencer. In press. A Paradigm Function account of 'mesoclisis' in European Portuguese. *Yearbook of Morphology*.

Martins, Ana Maria. 1994. *Cliticos na História do Português*. PhD thesis, University of Lisbon.

Otoguro, Ryo. 2003. Focus clitics and discourse information spreading. In M. Butt and T. H. King (Eds.), *Proceedings of the LFG03 Conference*, 367–386, Stanford, CA. CSLI Publications.

Otoguro, Ryo. 2004. Case, adpositions and functional categories in LFG. *York Papers in Linguistics*.

Sadler, Louisa. 1997. Clitics and the structure-function mapping. In M. Butt and T. H. King (Eds.), *Proceedings of the LFG97 Conference*, Stanford, CA. CSLI Publications.

Sadler, Louisa, and Douglas J. Arnold. 1994. Prenominal adjectives and the phrasal/lexical distinction. *Journal of Linguistics* 30:187–226.

Sadler, Louisa, and Rachel Nordlinger. 2004. Relating morphology to syntax. In L. Sadler and A. Spencer (Eds.), *Projecting Morphology*. Stanford, CA: CSLI Publications. In press.

Sadler, Louisa, and Andrew Spencer. 2001. Syntax as an exponent of morphological features. In G. Booij and J. van Marle (Eds.), *Yearbook of Morphology 2000*, 71–96. Dordrecht: Kluwer Academic Publishers.

Sadock, Jerrold M. 1991. *Autolexical Syntax: A Theory of Parallel Grammatical Representations*. Chicago: University of Chicago Press.

Sells, Peter. 2001. *Structure, Alignment and Optimality in Swedish*. Stanford, CA: CSLI Publications.

Spencer, Andrew. 2000. Verbal clitics in Bulgarian: A paradigm function approach. In J. Grijzenhout and B. Gerlach (Eds.), *Clitics in Phonology, Morphology and Syntax*, 355–386. Amsterdam: John Benjamins.

Spencer, Andrew. 2001. The Word-and-Paradigm approach to morphosyntax. *Transactions of the Philological Society* 99:279–313.

Spencer, Andrew. ms. Generalized Paradigm Function Morphology. Unpublished ms., University of Essex.

Spencer, Andrew. to appear. Paradigm-based lexicalism: Negation in Japanese. In F. Ackerman, J. Blevins, and G. Stump (Eds.), *Paradigms and Periphrases*. Stanford, CA: CSLI Publications.

Stump, Gregory T. 2001. *Inflectional Morphology: A Theory of Paradigm Structure*. Cambridge: Cambridge University Press.

Svolaccia, Marco, Mereu Lunella, and Puglielli Annarita. 1995. Aspects of discourse configurationality in Somali. In K. É. Kiss (Ed.), *Discourse Configurational Languages*, 65–98. Oxford: Oxford University Press.

Toivonen, Ida. 2003. *Non-Projecting Words: A Case Study of Swedish Particles*. Dordrecht: Kluwer Academic Publishers.

Vigário, M. 1999. Pronominal cliticization in European Portuguese: A postlexical operation. In *Catalan Working Papers in Linguistics*, Vol. 7, 219–237. Barcelona: Universitat Autònoma de Barcelona.

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Information Processing in Akan Question-word Fronting and Focus Constructions

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1. Introduction[*]

In this paper, we discuss *wh*-question fronting and focus constructions (formally noted as marked sentence-types) and other facts that are related to them in Akan, a Kwa language spoken in Ghana and other parts of West Africa. Three features characterize *wh*-question fronting and focus constructions in Akan: i) left-peripheral dislocation of a constituent, ii) introduction of a clitic morpheme after the dislocated constituent, and iii) pronoun resumption in a canonical clause position. In comparing these constructions to each other and to related canonical constructions, the question that one is confronted with is whether the same discourse-contextual information is consistently expressed in both constructions.

Using the framework of Lexical-Functional Grammar (LFG: Kaplan & Bresnan 1982; Bresnan 2001; etc.), we explore the similarities and differences between *wh*-question fronting and focus constructions. We show in this paper that, in the constituent (c-) structure and the functional (f-) structure, both *wh*-question fronting and focus constructions essentially share common representations. Considering the individual discourse-contextual information that is expressed in *wh*-question fronting and focus constructions, as compared to the discourse-contextual information expressed in the respective *in-situ* and canonical clause counterparts, however, we show that a variance is drawn between them in the information (i-) structure, which is accessible to the semantic (s-) structure (see King (1997) for example).[1] In a further constraint-based analysis, Optimality-Theoretic LFG (OT-LFG: Bresnan 2000; Kuhn 2001; etc.) is used to clarify and strengthen the suggestions made.

The paper is organized as follows: in section *2*, we give a descriptive account of *wh*-question constructions in Akan, including its constituent *in-situ* and constituent left dislocation occurrences. The focus construction in Akan is then described in section *3*. In sections *4* and *5*, we explain how the two constructions are similar to, or different from, each other and throw light on the intricacies involved in their constructions within LFG. With insights from OT-LFG, section *6* illuminates the discussions in sections *4* and *5*. Section *7* provides the conclusion to our observations and analyses.

2. Wh-question constructions

A *wh*-question construction in Akan is primarily identified by any of the following interrogative phrases or pronouns in (1). Following Boadi (1990), we refer to the pronouns in (1) as "question words or question phrases" (hereafter, Q-words/Q-phrases). As discussed in the following sections (*2.1* and *2.2*), each of the Q-words can remain *in-situ* in a canonical clause or fronted in an extra-sentential clause.

(1)	i.	hwáî / hwáánóḿ	'Who / which people'
	ii.	sɛ́ń	'How much, how many or what'
	iii.	á!dɛ́ń / (sɛ́) déɛ́ń /á!dɛ́ń (ńtî)	'Why / for what reason'
	iv.	ɛ̀héé(!fá)	'Where'
	v.	ɛ̀déɛ́ń / ɛ̀déɛ́bɛ́î	'What'
	vi.	bɛ́rɛ́- / dà-bɛ́î	'When'
	vii.	NP + bɛ́î	'Which (of that item)

[*] This paper has benefited from comments and discussions with a number of people at different fora. We will like to thank participants at the LFG2004 conference held in Christchurch, New Zealand. We are especially grateful to Tracy Halloway King and Miriam Butt for very comprehensive comments that have led to substantial revisions of certain parts of the paper.

[1] In LFG, c-structure, f-structure, and i-structure respectively model the categorial representation, the grammatical functions, and the discourse-contextual information aspects of the grammar.

2.1 Q-word *in-situ*

These Q-words are substitutes for the various syntactic categories serving as the traditional argument functions, such as subject, object, etc. As illustrated in (2a) and (2b) for the subject and the object respectively, therefore, these Q-words can remain *in-situ* in a canonical clause as substitutes of the constituents they question. When the verb is questioned in the *in-situ* representation, as shown in (2c), it is replaced by another verb, '*yɛ*', literally meaning '*do*'. In addition, the Q-word occurs in the post-sentential position.

(2) Pàpá rè-sèré àbòfrá nó
father PROG-laugh child the
'Father is laughing at the child.'

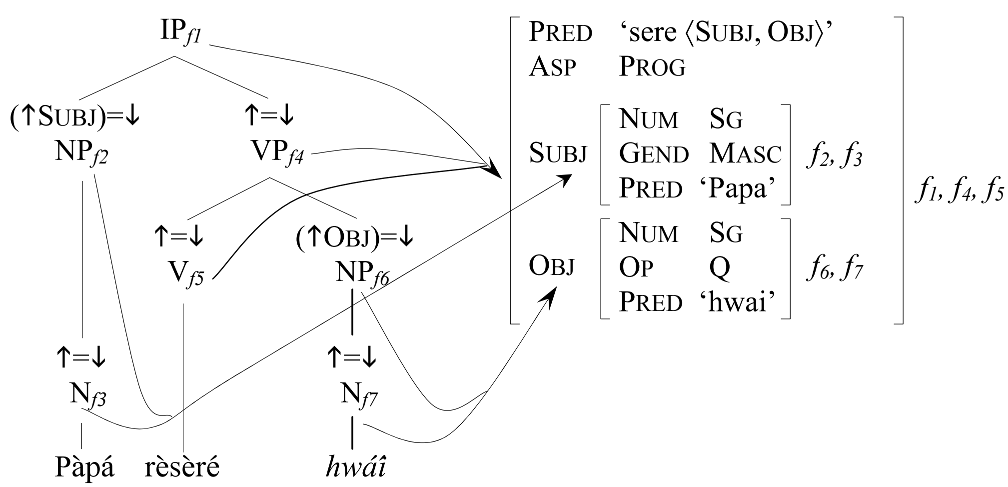
⇒ a. *Hwáî* rè-sèré àbòfrá nó?
who PROG-laugh child the
'Who is laughing at the child?'

⇒ b. Pàpá rè-sèré *hwáî*?
father PROG-laugh who
'Father is laughing at whom?'

⇒ c. Pàpá rè-*yɛ́* àbòfrá nó *déɛ́n*?
father PROG-do child the what
'What is father doing to/with the child?'

The c- and f-structure instantiations of the Q-word *in-situ* construction in (2b) are shown in (3) below. The illustration in (3) also shows how c-structure maps to f-structure through the Structure-Function Mapping theory (Bresnan 2001; Dalrymple 2001; Falk 2001; etc.).

(3)



2.2 Q-word fronting

Besides the *in-situ* representation of the *wh*-construction in Akan, with which the canonical phrase structure is maintained, there is another option of representation. This option involves the fronting of the Q-word (hence, Q-word fronting). A Q-word fronting in Akan refers to the dislocation of the Q-word to the left-periphery of an extra-sentential clause. A clitic morpheme, "*na*", referred to as a focus marker (FOC) (Boadi 1974, 1990; Saah 1988), is also introduced at the right-edge of the fronted Q-word. In other words, as illustrated in (4), an obvious phrase structure variation is realized where the Q-word is extraposed into some position that is above the canonical clause.

(4) a. [$_{IP}$ Pàpá rè-sèré *hwáí*] ⇒ *Hwáí*$_i$ nà [$_{IP}$ pàpá ré-séré nó$_i$]
father PROG-laugh who — Who FOC father PROG-laugh 3SG
'Father is laughing at who?' — 'Whom is father laughing at?'

b. [$_{IP}$ Kòfi bé-ꜝdúá *déɛ́ń*] ⇒ *Déɛ́ń* nà [$_{IP}$ Kòfi bé-ꜝdúá]
Kofi FUT-sow what — What FOC Kofi FUT-sow
'Kofi will sow what?' — 'What will Kofi sow?'

Saah (1988) observes that some Q-word *in-situ* constructions related to greetings in Akan (e.g., see (5)) are canonically fixed in phrase structure. Thus, a corresponding Q-word fronting option is ungrammatical. Perhaps, Saah's observation is true in other dialect(s) of Akan.[2] In Asante-Twi, however, as shown in (5), preposing of greetings related Q-words is attested even though it is a fact that it is not often done.

(5) Q-word *in-situ* — Q-word fronting

a. [$_{IP}$ Wò hó tè ***sɛ́ń***] ⇒ *Sɛ́ń* nà [$_{IP}$ wò hó téɛ́]
2SG self be.PRES how — how FOC 2SG self be.PRES
'how are you?' — 'how are you?'

b. [$_{IP}$ Wɔ̀-frɛ́ wò ***sɛ́ń***] ⇒ *Sɛ́ń* nà [$_{IP}$ wɔ̀-frɛ́ wó]
3PL-call.HAB 2SG how — how FOC 3SG-call.HAB 2SG
'what is your name?' — 'what is your name?'

Saah (1988) also notes that where a Q-phrase is functioning as an adverbial of reason, it must be extraposed obligatorily, as shown in (6a).[3] Otherwise, as also shown in (6b), the construction is ungrammatical where the Q-word remains *in-situ*. While being cautious, he further suggests that the Q-phrase needs to be at a stressed or emphatic position, hence the left-periphery dislocation – i.e., the specifier position of some projected pragmatic/discourse function.

(6) *From Saah (1988: 20)*

a. (Sɛ́) *déɛ̀ǹ àdé* ńtí nà Kwàdwó bɔ̀-ɔ̀ Áꜝmá
What thing because FOC Kwadwo hit-PST Ama
'For what reason/why did Kwadwo hit Ama?'

b. * Kwàdwó bɔ̀-ɔ̀ Áꜝmá *déɛ̀ǹ àdé ńtí*
Kwadwo hit-PST Ama what thing because
'For what reason/why did Kwadwo hit Ama?'

As will be reiterated in section *4*, we claim that an extraposed Q-word does not invoke any further emphasis than what it does at an *in-situ* construction. The fact that left dislocation in

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[2] Akan is composed of several dialects. The prominent ones are Asante-Twi, Fante, and Akuapim-Twi. It seems to us that Saah (1988) was referring to Fante, considering his selection of Akan texts (e.g., the use of *déń* in Fante instead of *sɛ́ń* in Asante-Twi). However, according to our observations, even in Fante, preposing of Q-words is generally acceptable.

[3] "*sɛ*" in bracket is not part of Saah's example. It is optional when the Q-word is extraposed. In fact, either "*sɛ*" or "*nti*"can be done away with, but not both of them.

greetings-related constructions is not often done, although grammatical, will also back up our claim that Q-word fronting does not induce any further emphasis than what a Q-word *in-situ* inherently expresses. Indeed, it is a fact that (6b) is not grammatical, as Saah rightly notes. However, the ungrammaticality is only due to the fact that the whole interrogative phrase (Q-phrase), *déɛ̀ǹ àdé ńtî*, asking for the reason behind the agent's (Kwadwo) action, is incomplete. The complete Q-phrase should read *sɛ́ déɛ̀ǹ àdé ńtî*. We explain the incompleteness of *déɛ̀ǹ àdé ńtî* as follows.

Recall our earlier suggestion that Q-words/Q-phrases are only substitutes for canonical clause (IP) internal categories. Since the Q-phrase in (6b) is actually replacing a phrase referring to the patient's (Ama) action, asking for the reason behind Kwadwo's action also means finding out what Ama did to Kwadwo. That is, what did Ama do that caused Kwadwo to hit her? Supposing that *laughing at* Kwadwo is what Ama did, the corresponding declarative construction to (6b) would be expressed as the construction in (7a) below, and not the ungrammatical one in (7b), which is without "*sɛ́*" as part of the whole Q-phrase.

(7) a. Kwàdwó$_j$ bɔ̀-ɔ̀ Á!ma$_i$ *sɛ́ ɔ$_i$-à-séré* (*nó$_j$*) *ńtî*
Kwadwo hit-PST Ama __ 2SG-PRF-laugh him because
'Kwadwo hit Ama because she has laughed (at him)'

b. * Kwàdwó$_j$ bɔ̀-ɔ̀ Á!ma$_i$ *ɔ$_i$-à-séré* (*nó$_j$*) *ńtî*
Kwadwo hit-PST Ama 2SG -PRF-laugh him because
'Kwadwo hit Ama because she has laughed (at him)'

Likewise, when substituting the phrase expressing Ama's action (*sɛ́ ɔ̀àséré ńtî*) with a related Q-phrase, "*sɛ́*" (which is actually related to *ńtî* in the phrasal form, *sɛ́* ... *ńtî* 'because') must be part of the whole Q-phrase. Therefore, we highlight the fact that it is because of the absence of "*sɛ́*" in the Q-phrase that (6b) is ungrammatical, and not because the Q-phrase cannot remain *in-situ*. Observe in (7c) below, the alternative to (6b), that the same Q-word *in-situ* construction is grammatical with "*sɛ́*" as part of the whole Q-phrase.

(7) c. Kwàdwó bɔ̀-ɔ̀ Á!má *sɛ́ déɛ̀ǹ àdé ńtî*
Kwadwo hit-PST Ama __ what thing because
'For what reason/why did Kwadwo hit Ama?'

In addition, we have observed that the *in-situ* construction in (7c) conveys the same discourse-contextual information that is expressed in the case of Q-phrase fronting construction in (6a). In other words, as will be revisited and discussed in detail in section *5*, no semantic contrast attains between (6a) and (7c).

3. Focus construction

A focus construction in Akan has a 'point of prominence' within it (Boadi 1974) where contrastive information (of certainty) is intentionally placed for the purpose of emphasis. A constituent is focused in Akan when it is placed at the left-periphery of its extra-sentential projection of focus phrase (FOCP). The constituent in focus is also immediately followed by the FOC, "*na*". Boadi (1974: 7) explains that, in focus constructions, the FOC has the function of narrowing down the referential range of its host, the constituent in focus. The function of the FOC in focus constructions, therefore, is a semantic one. That is, it has discourse information alteration significance.

A constituent cannot be focused *in-situ* in Akan. This is because the FOC cannot be invoked in the canonical clause.[4] As shown in (8a & b), the FOC appears in the head position of the functional projection, FOCP. Again, the FOC is only introduced after a constituent that is sitting at specifier position of FOCP (Spec-FOCP). Considering the syntactic properties of the FOC, therefore, the ungrammaticality of (8c & d) needs no further explanation.

(8) Kòfi rè-bòá Á!má
Kofi PROG-help Ama
'Kofi is helping Ama'

⇒ a. [$_{FOCP}$ Bòá$_i$ *nà* [$_{IP}$ Kòfi ré-bóá$_i$ Á!má]]
help FOC Kofi PROG-help Ama
'It is help (that) Kofi is helping Ama'

⇒ b. [$_{FOCP}$ Á!má$_i$ *nà* [$_{IP}$ Kòfi ré-bóá nó$_i$]]
Ama FOC Kofi PROG-help 3SG
'It is Ama (that) Kofi is helping'

⇒ c. *[$_{IP}$ Kòfi ré-bóá Á!má *nà*]
Kofi PROG-help Ama FOC
'It is Ama (that) Kofi is helping'

⇒ d. *[$_{IP}$ *nà* Kòfi ré-bóá Á!má]
FOC Kofi PROG-help Ama
'It is Ama (that) Kofi is helping'

Observe also in (8a) that when the sentential head is rather the focus, the same form of the verb-stem remains *in-situ*, unlike the case of a questioned predicate where '*yɛ*' is rather introduced in the canonical base position (see (2c)).

It is important to note that a focus construction is related to a Q-word fronting construction in Akan with regards to constituent left-periphery dislocation and the employment of the FOC at the head position of a projected functional phrase. Besides these two phrase structure facts, another connection between the two constructions is that a focus construction is more or less an answer to a Q-word fronting construction in a question-answer pair (Boadi 1974). Therefore, as exemplified with the subject NP in (9) below, the answer constituent to the Q-word in the Q-word fronting construction corresponds to the constituent in focus in the focus construction.[5] We will revisit the significance of this connection in section *5*.

(9) Question: [$_{FOCP}$ *Hwáî$_i$* nà [$_{IP}$ ɔ$_i$-ré-sómá àbòfrá nó]]
who FOC 3SG-PROG-send child the
'Who is sending the child?'

---

[4] Boadi (1974) notes that "*deɛ*", which occurs in the same syntactic position as "*na*", also plays the role of a focus marker, as in *Á!má$_i$* ***dὲὲ*** *Kòfi rébóá nó$_i$* 'as for Ama, Kofi is helping her' (cf. (8b)). As he finally asserts, however, let us note that "*deɛ*" does not define the concept of contrastive information in definite terms. Unlike "*na*", it does not induce an exclusive focus on an extraposed constituent. Again, unlike "*na*", "*dὲὲ*" cannot come after a Q-word, such that "*deɛ*" in **Hwáî$_i$* ***dὲὲ*** *Kòfi rébóá nó$_i$* is ungrammatical. Thus, aside from the fact that we do not consider "*dὲὲ*" as a true FOC, it also falls outside the scope of this paper.

[5] Perhaps this correspondence contributed to Saah's (1988) suggestion that a fronted Q-word is more emphatic, as compared to an *in-situ* counterpart.

⇒ Answer/Focus: [$_{\text{FOCP}}$ *Pàpá$_i$* nà [$_{\text{IP}}$ ɔ̀$_i$-ré-sómá àbɔ̀fŕá nó]]
father FOC 3SG-PROG-send child the
'It is father who is sending the child.'

4. More on Q-word fronting and focus constructions

We have noted constituent left-periphery dislocation in Q-word fronting and focus constructions in Akan. Current research in LFG (e.g., Berman 1997; Bresnan 2000, 2001; etc.) describes constructions exhibiting this phenomenon as forms with 'discourse function' (DF), projected to absorb the extraposed constituent. Observe in (9) that, in the light of structural hierarchy at c-structure, the extraposed constituents in Spec-FOCP show an iconic structural precedence and dominance over other constituents in both constructions. We have also observed that FOC appears at the head position of the projected DF (FOCP) in both constructions, as in (9) and other data given so far.

One other feature from the data already given, which both Q-word fronting and focus constructions exhibit and is worth noting in the light of LFG, is the presence of a resumptive pronoun (henceforth, RPro) in the canonical clause position of an extraposed constituent (i.e., the Spec-DF constituent). This RPro agrees in number and in person with the Spec-DF constituent. As can be seen in (9) above and (10) below for animate and inanimate subjects respectively, with their appearance in Spec-FOCP, the subjects in question or in focus are replaced in the subject position in the canonical clause (i.e., Spec-IP) with the 'third person' pronoun. The pronoun then refers back to the Spec-FOCP constituent, hence the co-indexing of Spec-FOCP and Spec-IP.

(10) a. [$_{\text{FOCP}}$ *Dùá$_i$* nà [$_{\text{IP}}$ *è$_i$*-bú-î]]
tree FOC it-break-PAST
'It is a tree that broke up.'

b. [$_{\text{FOCP}}$ *Déɛ́ń$_i$* nà [$_{\text{IP}}$ *è$_i$*-bú-î]]
what FOC it-break-PAST
'What broke up?'

As noted by Saah (1988: 24) referring to Stewart (1963: 149), unlike in the subject position,[6] the occurrence of RPro is restricted in the object position (and other post-verbal environments). This restriction has to do with the feature specification of animacy. A distinction is, therefore, made between an overt and a covert manifestation of RPro. Specifically, if the said object is animate its canonical base position is filled with the RPro, "(ɔ)*no*", as shown in (11a). Conversely, as in (11b), where the object is inanimate the RPro is covertly represented. Saah (1992: 221) refers to the lack of overt RPro in the inanimate situation as an 'empty category' (*EC*) situation in Akan. A phonetic RPro for a focused inanimate object renders a construction ungrammatical, as also shown in (11c).

[6] In faster speech, the RPro for an extraposed full NP subject may not be readily perceptible. In this case, what actually happens is a coalescence between the /a/ in "*na*" and the RPro (i.e. /ɔ/ or /ɛ, e/) to produce [ɛ] (or [e], determined by the regressive vowel harmony rule). This [ɛ] (or [e]) then replaces /a/ in the clitic morpheme, e.g. *Pàpá$_i$ nɛ̀$_i$ résómá àbɔ̀fŕá nó* 'It is father who is sending the child' (cf. (9)). Where we have a pronoun subject, however, the occurrence of the RPro is clear, whether in a fast or normal speech, because the same form is maintained in the canonical clause, e.g., ***Mé$_i$*** *nà* ***mè$_i$*** *résómá àbɔ̀fŕá nó* 'It is me who is sending the child'. Perhaps, the pronominal case is enough evidence to suggest that the RPro in position is a constant.

(11) a. [$_{\text{FOCP}}$ Á!má$_i$ nà [$_{\text{IP}}$ Kòfí [$_{\text{VP}}$ ré-bóá [$_{\text{NP}}$ nó$_i$]]]]
Ama FOC Kofi PROG-help 3SG
'It is Ama that Kofi is helping.'

b. [$_{\text{FOCP}}$ ɛ̀móó$_i$ nà [$_{\text{NP}}$ ɔ̀báá nó [$_{\text{VP}}$ nóá [$_{\text{NP}}$ Ø$_i$]]]]
rice FOC lady DEF cook.HAB *e*
'It is rice (that) the lady cooks.'

c. *[$_{\text{FOCP}}$ ɛ̀móó$_i$ nà [$_{\text{IP}}$ ɔ̀báá nó [$_{\text{VP}}$ nóá [$_{\text{NP}}$ nó$_i$]]]]
rice FOC lady DEF cook.HAB 3SG
'It is rice (that) the lady cooks.'

Where there is a necessity to show in the c-/f-structures that the inanimate object is covertly represented, some versions of LFG account for the phenomenon through the Principle for Identifying Gaps (Bresnan 2001: 181) provided in (12). The principle is necessary in the linking up of such an *EC* to the Spec-DF (FOCP) constituent, thus enabling the integration of Spec-DF constituent (a non-argument) in the argument structure in f-structure.

(12) *Principle for Identifying Gaps*:
Associate XP → *e* with $((x\uparrow)\ \text{DF})=\uparrow$

Through the Principle for Identifying Gaps, the violation of the Economy of Expression principle by having an *EC* in the c-structure is bypassed.[7] Perhaps, the animacy restriction on objects, and not on subjects, also emphasizes the Subject Condition (SC) LFG stipulates. SC requires every predicate to have a subject (but not necessarily an object). Based on the inspiration of SC, we posit the condition, Strict Phonetic Subject (SPS), stated in (13) for extra-sentential clauses in Akan (in this paper, Q-word fronting and focus constructions). SPS explains the grammaticality and ungrammaticality of the focus constructions in (14a & b) respectively.

(13) *Strict Phonetic Subject*:[8]
Every predicator in the embedded clause of an extra-sentential clause must have a phonetic subject.

(14) [$_{\text{IP}}$ Pàpá rè-sòmá mé] ⇒
father PROG-send 1SG
'Father is sending me.'

a. [$_{\text{FOCP}}$ *Pàpá$_i$* nà [$_{\text{IP}}$ ɔ̀$_i$-ré-sómá mé]]
father FOC 3SG-PROG-send 1SG
'It is father who is sending me.'

⇒ b. * [$_{\text{FOCP}}$ *Pàpá$_i$* nà [$_{\text{IP}}$ Ø$_i$-ré-sómá mé]]
father FOC PROG-send 1SG
'It is father who is sending me.'

[7] The "Economy of Expression" (Bresnan 2001, etc.) principle states that all syntactic phrase structure nodes are optional and use of any of them is prohibited unless independent principles demand it.
[8] SPS is motivated against a possible proposal that an extraposed subject does not need RPro in the canonical clause, since it is still the most prominent in the relational hierarchy and the default DF. In this sense, SPS is not merely a stipulation. In fact, it has to be satisfied in other extra-sentential constructions in Akan as well; e.g. topic constructions and relative clauses.

5. Distinction: Discourse-contextual information

So far, it has been made clear that both Q-word fronting and focus constructions essentially share a common marked categorial configuration; i.e., $[_{FOCP}$ *XP na* $[_{IP}$ *...]]*. However, considering the individual discourse-contextual information that is expressed in the i-structure (Vallduví 1992; Lambrecht 1994; etc.) of each of them, as compared to the discourse-contextual information expressed in the respective *in-situ* and canonical clause counterparts, we explain in this section that semantic contrast is only evident in focus constructions.

In exploring the semantic information divergence in the i-structure of Q-word fronting and focus constructions, let us assume that discourse-contextual information in the constructions particularly has to do with (or is tied to) the obligatory occurrence of the FOC (besides the constituent left-dislocation). With this assumption, we suggest that, unlike in focus constructions, the occurrence of the FOC in Q-word fronting constructions does not invoke any contrastive information in the discourse other than what obtains in related Q-word *in-situ* counterparts. In other words, as already noted in section *3*, Q-word fronting does not alter the semantic content of the interrogative in any way.

Boadi (1990: 78) suggests that the lack of semantic contrast in a Q-word fronting construction in Akan, as compared to a related Q-word *in-situ* construction, is due to the fact that Q-words are actually inherently focus-marked. Accordingly, they do not need any further special reference. We further claim in this paper that a Q-word holds the core of the information profile of a construction within which it appears (i.e., the expression of interrogative). As such, a Q-word does not need any further semantic buffer, in this case the FOC, to complete what it already and inherently establishes. In fact, following a previous discourse, sometimes, only the Q-word could be employed to represent the whole of a construction within which it occurs. Accordingly, in (15) below, the whole of (15b) can be replaced by (15c), drawing directly from (15a).[9] On the contrary, where we want to focus the subject in (15a), for instance, the only option is to put the subject in the 'focus-presupposition' structure, as shown in (15d). Since a non-Q-word is not inherently focus-marked, (15e) cannot represent the whole of (15d).

(15) a. *Kòfi* bé-!dúá àbá nó
Kofi FUT-sow seed DET
'Kofi will sow the seed.'

⇒ b. *Hwáî*$_i$ nà ò$_i$-bé-!dúá àbá nó? = c. *Hwáî*? 'Who?'
Who FOC 3SG-FUT-sow seed DET
'Who will sow the seed?'

⇒ d. *Kòfi*$_i$ nà ò$_i$-bé-!dúá àbá nó ≠ e. *Kòfi* 'Kofi'
Kofi FOC 3SG-FUT-sow seed DET
'It is Kofi who will sow the seed.'

As noted earlier, contrary to the stance taken in this paper, Saah (1988: 19) claims that (as a motivation for the constituent left-periphery dislocation) extra-sentential clause-initial Q-

[9] Whether or not a Q-word can represent a whole Wh-construction is constrained by animacy and the number of the argument functions in the related canonical clause. Thus, unlike (15), in *Kòfi àbó Á!má* 'Kofi has beaten Ama' where we have two animate argument functions the same Q-word, *hwai* 'who', can substitute for any one of the arguments. It is, therefore, not enough to use only the Q-word in this case.

word occurrence is more emphatic, as compared to the *in-situ* counterpart. The question however is, to what extent is a fronted Q-word more emphatic? With regards to discourse-contextual information, what can we draw from its information profile that is different from what is obtained in the information profile of a related Q-word *in-situ* construction? Seemingly emphasized as a fronted Q-word in Akan is, it is actually vacuous in terms of semantic contrast to a related Q-word *in-situ* construction. Indeed, as explained in section *2.1* (see and cf. (6a) and (7c)), Q-word fronting (with the employment of FOC) induces nothing more into its i-structure other than what is in the i-structure of the *in-situ* construction (i.e., the general interrogative expression of the Q-words).

On the other hand, the identification of a semantic contrast in the i-structure of a focus construction, as compared to that of a related canonical clause is indisputable and readily perceptible. That is, contrastive information is attained in focus construction, particularly relating to the constituent in focus. In this case, among all the constituents in the construction, the one in focus is highlighted as the point of contrastive discourse information (of certainty) in the construction; hence, its constitution as the 'point of prominence' (Boadi 1974). For instance, the focus construction in (15), *Kòfí nà òbé!dúá àbá nó* 'it is Kofi who will sow the seed', is interpreted as '*it is Kofi and only Kofi (i.e., nobody else) who will sow the seed'*, and not just as '*Kofi will sow the seed*'. With the latter interpretation, none of the constituents is identified as prominent (or new) information. Accordingly, other people besides 'Kofi' might sow the seed as well; hence, the contrast between it and the former interpretation of focus.

Kiss (1995) also puts the interpretation of focus as follows: 'the focus operator serves to express identification' (Kiss 1995: 212). In the focus construction in (15), for instance, left-periphery dislocation and the employment of FOC identify *Kofi*, and only *Kofi*, as the one who is sowing the seed. We can, therefore, say that the occurrence of the FOC in a focus construction does not only contribute to the contrast in the phrase structure configuration of the construction that results (as compared to a related canonical clause). It also contributes to semantic contrast in the i-structure as well.

Despite the semantic distinction made between Q-word fronting and focus constructions in relation to their canonical clause counterparts, it is important to note that 'focus-presupposition' information pattern reflects in both constructions and that goes to prove that both Q-word and focus express prominent new information. The association of prominent new information to Q-words in particular here may be controversial in Akan. But one cannot deny the fact that Q-word fronting constructions involve some sort of focusing besides the fact that a Q-word is actually inherently focus-marked, as has already been noted. Kroeger (2004: 139) notes that 'the question word bears a pragmatic focus, since it specifies the crucial piece of new information which is required; the rest of the question is part of presupposition'. That is to say, since a Q-word constitutes a linguistic devise for the identification of a specific piece of prominent new information, it should be recognized as prominent new information as well. As shown in (16) below, we observe that it is from the questioning in (16a) that *papa* realizes as prominent new information in (16b) and, for that matter, the focus.

(16) a. <u>Question:</u> [*Hwáî*$_i$] nà ɔ́$_i$-ɔ́-sómá àbòfrá nó?
who FOC 3SG-PROG-send child the
'Who is sending the child?'

⇒ b. <u>Focus:</u> [*Pàpá*$_i$] nà ɔ́$_i$-ɔ́-sómá àbòfrá nó
father FOC 3SG-PROG-send child the
'It is father who is sending the child.' (in answer to (17a))

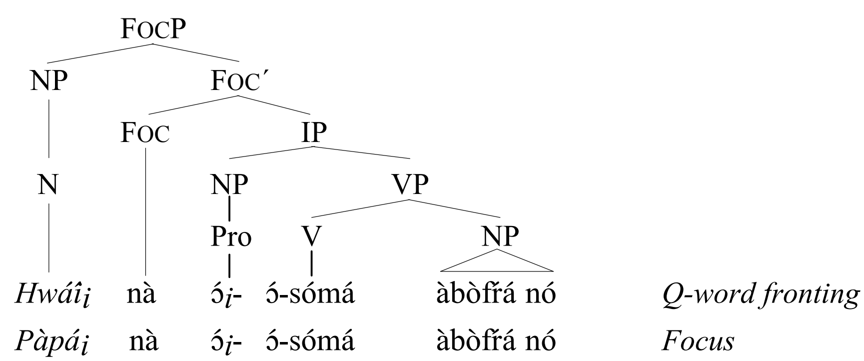
Following the feature-based i-structure (Choi 1999, 2001; Lee 2001; etc.), which we extend here to include Q-words, Q-words and focused constituents in Akan would therefore depict identical information profile on discourse NEW(ness) and PROM(nence), as shown in (17).[10]

(17) Focus $\begin{bmatrix} \text{NEW} & + \\ \text{PROM} & + \end{bmatrix}$ Q-word $\begin{bmatrix} \text{NEW} & + \\ \text{PROM} & + \end{bmatrix}$

Going back to Q-word fronting and focus constructions in relation to their canonical clause counterparts, it has been noted that, unlike in Q-word fronting constructions, FOC has an alteration function in focus constructions that alters the default discourse-contextual information of a related canonical clause. We refer to this information alteration function of the FOC in focus constructions as 'discourse-contrast', since it results in contrastive information (of certainty; i.e., '*X* and only *X*') that characterizes focus constructions in Akan. Conversely, 'discourse-neutral' (Lee 2001) is obtained with occurrence of FOC in Q-word fronting constructions, since the same information expressed in related Q-word *in-situ* constructions are expressed in them. It logically follows then that 'Q-word fronting in Akan is only an optional representation' (Boadi 1990: 78) and the obligatory occurrence of FOC with it is only a general syntactic restriction. In line with structural markedness, we refer to FOC in Q-word fronting constructions as 'configurational focus', since its occurrence contributes to the marking of the whole c-structure of the construction. Recall that Q-word fronting and focus constructions are noted as marked sentence-types.

Having identified and explained the realization of the common information profile (defining pragmatic focus) in Q-words and focused constituents, we now present a common c-structure and individual f- and i-structures of the Q-word fronting and focus constructions in (18) below.[11] In the i-structure in (18c) in particular, we show how the common information profile come to bear in the interpretation of Q-word fronting and focus constructions relative to the interpretation that obtains in related canonical clauses – i.e., the semantic expressions of 'discourse-neutral' of Q-words and 'discourse-contrast' of focus.

(18) a. *c-structure* (for both Q-word fronting and focus constructions)



[10][+PROM, +NEW] specifications explain that a constituent is highlighted as prominent new information in the discourse of occurrence.

[11] We observe i-structure here as distinct structure from the f-structure projected off the c-structure and accessible to the semantic structure (s-structure) (King 1997; Butt and King 1998; etc.).

b. *f-structures*

Q-word fronting

$$\left[\begin{array}{ll} \text{PRED} & \text{‘soma ⟨SUBJ, OBJ⟩’} \\ \text{ASP} & \text{PROG} \\ \text{DF} & \left[\quad\right] \\ \text{SUBJ} & \left[\begin{array}{ll} \text{NUM} & \text{SG} \\ \text{PRED} & \text{‘Pro’} \end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll} \text{NUM} & \text{SG} \\ \text{DEF} & + \\ \text{PRED} & \text{‘abofra’} \end{array}\right] \end{array}\right]$$

Focus

$$\left[\begin{array}{ll} \text{PRED} & \text{‘soma ⟨SUBJ, OBJ⟩’} \\ \text{ASP} & \text{PROG} \\ \text{DF} & \left[\quad\right] \\ \text{SUBJ} & \left[\begin{array}{ll} \text{NUM} & \text{SG} \\ \text{PRED} & \text{‘Papa’} \end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll} \text{NUM} & \text{SG} \\ \text{DEF} & + \\ \text{PRED} & \text{‘abofra’} \end{array}\right] \end{array}\right]$$

c. *i-structures*

Q-word fronting

$$\left[\begin{array}{ll} \text{FOCUS} & \left[\begin{array}{ll} \text{F-TYPE} & \text{NEUTRAL} \\ \text{I-PRED} & \text{‘Hwai’} \end{array}\right] \\ \text{BCK} & \left[\begin{array}{l} \text{ɔ̀ɔ̀sòmá} \\ \text{àbòfr̃á nó} \end{array}\right] \end{array}\right]$$

Focus

$$\left[\begin{array}{ll} \text{FOCUS} & \left[\begin{array}{ll} \text{F-TYPE} & \text{CONTRASTIVE} \\ \text{I-PRED} & \text{‘Papa’} \end{array}\right] \\ \text{BCK} & \left[\begin{array}{l} \text{ɔ̀ɔ̀sòmá} \\ \text{àbòfr̃á nó} \end{array}\right] \end{array}\right]$$

We have already discussed how the common c-structure is realized in section *4*. The argument functions subcategorized for by the verb, *sòmà*, in both constructions are also encoded in the individual f-structures. Also encoded in the f-structures is the identification of the projected discourse function (DF) with an argument function, the subject. The semantic significance in the discourse of Q-word fronting and (non-Q-word) focusing is also given in the separate i-structures.[12] Here, the focus type (F-TYPE) of the Q-word, *hwáî* (noted as I-PRED) is given as ‘neutral’ following FOC function as ‘discourse-neutral’ in Q-word fronting construction, whiles that of the focused constituent, *pàpá*, is given as ‘contrastive’ following FOC function as ‘discourse-contrast’ in focus constructions. The rest of both constructions are given as presupposition/background information (BCK).

Since Q-words have been noted as inherently focus-marked in Akan, finally, it is important to note that a Q-word fronting construction is distinguished from its *in-situ* counterpart only on the basis of c-structure configurational markedness. As noted on several occasions, with respect to discourse-contextual information realization, both representations are essentially the same.

6. Constraining the constructions: OT-LFG

With a recast of LFG within Optimality Theory (OT-LFG) (Bresnan 2000; Choi 1999; Kuhn 2001; etc.), the common c-structure configuration of Q-word fronting and focus constructions is further established in this section. We also show and constrain ‘harmonic alignment’[13] (Aissen 1999; Bresnan 2000; Choi 2001; Lee 2001; etc.) between the common c-structure and the i-structure of a particular constructions.

[12] Recall that we are particularly referring to the alteration impact (in semantics) that the information profile Q-word and focus share; i.e., [+PROM]; [+NEW], has in the i-structure of their individual constructions, as compared to the i-structure of respective *in-situ* construction and canonical clause counterparts.

[13] Each of the parallel structures of LFG defines prominence in a hierarchical fashion. The matching of prominence definition in one structure to that in another structure constitutes a harmonic alignment.

6.1 Categorial representation

Two conflicting constraints readily come to mind concerning constituent left dislocation in Q-word fronting and focus constructions. These are OP-SPEC, motivated by the presence of syntactic operator (Grimshaw 1997; Bresnan 2000; Kuhn 2001; etc.) and recast in expression as *operator in specifier of functional projection*, and *DISLOC, proposed in this paper on the inspiration of the economy principle and expressed as *don't dislocate*. As stated in (19), while OP-SPEC favors functional projection and the appearance of a constituent in question/focus in Spec-DF, *DISLOC stands to block such a categorial representation. For a Q-word fronting or focus construction word order to prevail, therefore, OP-SPEC must crucially outrank *DISLOC.

(19) i. OP-SPEC: [14]
An operator (i.e., a constituent in focus/question) must be in the specifier position of its functional projection.

ii. *DISLOC:
Don't dislocate; the canonical phrase structure must not be altered.

The other typological traits of Q-word fronting and focus constructions noted earlier also need to be recast and explained in constraint terms if alternative categorial representations are to be properly rejected. It has been noted that the projected phrase of the operator function has to be headed by the FOC, "*na*". Also noted is the fact that an argument function that appears at the specifier position of the projected functional phrase has to be replaced in the embedded canonical clause position by an RPro. The appropriate constraints we employ to demand these representations are OB-HD/fp (Bresnan 2000; Choi 2001; Kuhn 2001; etc.) and PARSE/gf, proposed here on the motivation of SPS; (see 13)).[15] Respectively expressed as *obligatory head* and *parse argument functions*, OB-HD/fp and PARSE/gf are also stated in (20) below. In the constraint ranking, we assume a dominance of PARSE/gf among the two. However, both constraints should dominate *DISLOC and should be dominated by OP-SPEC (see Tableau I).

(20) i. OB-HB/fp:
The head position of a functional projection must be filled.

ii. PARSE/gf:
Left dislocated argument function should be phonetically represented in the canonical clause position.

The f-structure in (21), a merged f-structure of both constructions in (18), is employed as the working input. Tableau (I) also explains that, among the candidate set of (a), (b), (c), and (d), the optimal candidate is the one whose c-/f-structures best relate to this input.

[14] In terms of generalized alignment constraint formulation (McCarthy and Prince 1993), OP-SPEC could be fashioned as 'Align$_L$ Focus/Q-word', expressed as "align the left edge of the focused/Q-word to the left edge of the projected FOCP".

[15] An alternative view is that SPS should be kept in the constraint formulation, but that would restrict pronoun resumption to only the subject position. That is, considering the fact that fronted/focused animate objects also have to be resumed, PARSE/gf better captures the phenomenon.

(21) Input f-structure: *Hwáî*$_i$ */ Pàpá nà ɔ́*$_i$*-ɔ́sómá àbòfrá nó*[16]

$$\left[\begin{array}{lll} \text{PRED} & \text{'soma } \langle\text{SUBJ, OBJ}\rangle\text{'} & \\ \text{ASP} & \text{PROG} & \\ \text{DF} & [\quad] & \\ \text{SUBJ} & [\text{PRED} & \text{'Pro'}] \\ \text{OBJ} & [\text{PRED} & \text{'abofra'}] \end{array}\right]$$

(I) OP-SPEC›› PARSE/gf ›› OB-HB/fp ›› *DISLOC

	Matrix Q-word fronting/focus	OP-SPEC	PARSE	OB-HB	*DISLOC
☞ a.	[$_{\text{FocP}}$ NP$_i$ *na* [$_{\text{IP}}$ Pro$_i$ [$_{\text{VP}}$ V NP]]]				*
b.	[$_{\text{IP}}$ NP [$_{\text{VP}}$ V NP]]]	*!*			
c.	[$_{\text{FocP}}$ NP$_i$ *na* [$_{\text{IP}}$ e_i [$_{\text{VP}}$ V NP]]]		*!		*
d.	[$_{\text{FocP}}$ NP$_i$ *e* [$_{\text{IP}}$ Pro$_i$ [$_{\text{IP}}$ V NP]]]			*!	*

In Tableau (I), candidate (a) outperforms the rest of the candidates as follows: Candidate (b) is taken out (on two counts) for not having a functional projection, let alone a constituent in question/focus appearance in its specifier position. Candidate (c) is also ruled out on PARSE/gf for violating the requirement of having an RPro in place of the extraposed argument function (in the present case, subject function) in the embedded canonical clause. Candidate (d) is also taken out of contest for the violation of OB-HB/fp, which ensures functional projection headedness. Consequently, the grammatical c-/f-structure of candidate (a) prevails as the optimal candidate.[17]

6.2 Information correspondence: alignment

We have noted that Q-word fronting and focus constructions share a common information profile in the i-structure with regards to NEW and PROM. Choi (2001: 34) proposes i-/c-structure correspondence/alignment constraints based on NEW and PROM that are supposed to yield informationally-motivated marked c-structure. Relevant among these constraints in the present cases of Q-word fronting and focus constructions are NEW-L and PROM-L recast in (22) below.

(22) i. NEW-L: [+NEW] aligns left in the construction of occurrence.

ii. PROM-L: [+PROM] aligns left in the construction of occurrence.

Since both Q-word and constituent in focus are noted as '[+PROM]; [+NEW]' in the (feature-based) i-structure and each of them sits at Spec-FOCP, presently the most prominent position in the *structural hierarchy* at c-structure, it is obvious that the i-/c-structure correspondence

[16] Both Q-word and focused constituents are represented in Spec-FOCP as NP on the tableaux. Again, the attribute-value matrix of the operation and other features underscored in the individual constructions are not indicated in the input f-structure of the two constructions, since they do not undermine the c-structure configuration in any way.

[17] Note that the input f-structure in (21) essentially doubles as f-structure of candidate (a). All the other candidates correspond to distinct f-structures, which are not given in this paper for lack of space.

constraints in (22) will be satisfied in both constructions (see Tableau II). Comparing their discourse-contextual information to the information that obtains in respective Q-word *in-situ* construction and canonical clause counterparts, however, Q-word fronting and focus constructions have been set apart in the semantics as 'discourse-neutral' and 'discourse-contrast' respectively through the projected i-structure (see (18c)). These separate semantic orientations of Q-word fronting and focus are expressed in constraint terms using Choi's (2001) NEW-L and PROM-L proposals in (23) below.

(23) i. NEUT-L: [+NEUT] aligns left in the construction of occurrence.

ii. CONST-L: [+CONST] aligns left in the construction of occurrence.

With the present constraints in the constraint set, as Tableau II below shows, we explain that CONST-L must crucially outrank NEUT-L where there is a need to establish i-/c-structure harmonic alignment in a focus construction (i.e., a correspondence between a constituent in focus and the Spec-FOCP position, as against harmonic alignment between a fronted Q-word and the Spec-FOCP position). Observe in the tableau that, unlike the ranking of CONST-L against NEUT-L, the ranking between CONST-L and NEW-L/PROM-L in the Tableau is hardly crucial and, for that matter, has little or no impact at all in the i-/c-structure correspondence. As noted earlier, this is because both fronted Q-word and focus constituent sit at Spec-FOCP and specify for [+NEW]/[+PROM].

(II) NEW-L ›› PROM-L ›› CONST-L ›› NEUT-L

	$[_{FocP}$ NP$_i$ *na* $[_{IP}$ Pro$_i$ $[_{VP}$ V NP]]]	NEW-L	PROM-L	CONST-L	NEUT-L
☞ a.	$[_{FocP}$ Papa$_{[+Const,\ +New,\ +Prom]i}$ *na* $[_{IP}$ Pro$_i$ $[_{VP}$ V NP]]]				*
b.	$[_{FocP}$ Hwai$_{[+Neut,\ +New,\ +Prom]i}$ *na* $[_{IP}$ Pro$_i$ $[_{VP}$ V NP]]]			*!	

It is important to note that CONST-L and NEUT-L are only necessary constraints motivated on individual semantic content to draw attention to the semantic distinction between Q-word fronting and focus constructions. Thus, the fact that the focus construction outperforms the fronted Q-word construction in Tableau II does not mean that the Q-word fronting construction is ungrammatical. As has already been mentioned in previous sections, it only explains that, unlike in a focus construction, no semantic contrast is realized in a Q-word fronting construction, as compared to related *in-situ* construction. Ranking NEUT-L over CONST-L will also select i-/c-structure correspondence in Q-word fronting construction.

7. Conclusion

It has been shown in this paper that Q-word fronting (in *wh*-questions) and focus constructions in Akan essentially share the same configuration, which involves constituent left dislocation, introduction of the focus marker (FOC), "*na*", and insertion of resumptive pronoun (RPro) for a dislocated argument function. Further, it has also been illustrated, using the OT-LFG framework, that the same c-/f-structure constraints and their rankings essentially ensure the configuration of both constructions.

Through the i-structure, however, we have drawn attention to the individual semantic content of Q-word fronting and focus constructions based on the individual discourse-contextual information that obtains in them in comparison to discourse-contextual information that obtain in respective *in-situ* construction and canonical clause counterparts. It has been explained that the occurrence of the FOC, along with constituent left-periphery dislocation in a Q-word fronting construction does not result in semantic contrast because the discourse-contextual information expressed in it is the same one that obtains in an *in-situ* counterpart. On the other hand, constituent left-dislocation and the occurrence of the FOC in a focus construction do bring into play semantic contrast. That is, a constituent is highlighted among others as an obvious 'point of contrastive information' in the information profile of a focus construction. Using OT-LFG, we have stressed this semantic information distinction between the two constructions, which further shows the optimization of a particular i-/c-structure alignment in the grammar.

References

Aissen, Judith. 1999. Markedness and Subject Choice in Optimality Theory. *Natural Language and Linguistics Theory* 17: 673–711.

Berman, Judith. 1997. Empty categories in LFG. In *On-line Proceedings of the LFG97 conference*, University of California, San Diego, M. Butt and T.H. King (eds.). Stanford: CSLI Publications. URL http://csli-publications.stanford.edu/LFG/2/lfg97-toc.html

Boadi, Lawrence A. 1974. Focus-marking in Akan. *Linguistics*. 140: 5-57.

Boadi, Lawrence A. 1990. Questions in Akan. In *Frankfurter afrikanistische Blætter*, Vol. 2: 70-92.

Bresnan, Joan. 2000. Optimal Syntax. In *Optimality Theory: Phonology, Syntax and Acquisition*. Joost Dekkers, Frank van der Leeuw and Jeroen van de Weijer (eds.). 334-385. Oxford: Oxford University Press.

Bresnan, Joan. 2001. *Lexical-Functional Syntax*. Oxford: Blackwell.

Butt, M. and T.H. King. 1998. Interfacing Phonology with LFG. In *On-line Proceedings of the LFG98 Conference*, University of Queensland, Brisbane, M. Butt and T.H. King (eds.). Stanford: CSLI Publications. URL: http://csli-publications.stanford.edu/LFG/3/lfg98.html

Choi, Hye-Won. 1999. *Optimizing Structure in Context: Scrambling and Information Structure*. Stanford, CA: CSLI Publication.

Choi, Hye-Won. 2001. Resolution of Mismatches. In *Formal and Empirical Issues in Optimality-Theoretic Syntax*, Peter Sells (ed.). Studies in constraint-based lexicalism; 5: 17-62. CSLI.

Dalrymple, Mary. 2001. *Lexical-Functional Grammar*. Syntax and Semantics, Vol. 34. New York: Academic Press.

Falk, Yahuda. 2001. *Lexical-Functional Grammar. An Introduction to Constraint-based Syntax*. Stanford, CA: CSLI.

Grimshaw, Jane. 1997. Projection, Heads, and Optimality. *Linguistic Inquiry* 28: 73-422.

Kaplan, Ronald M. and Joan Bresnan. 1982. Lexical-functional grammar: a formal system for grammatical representation. In Dalrymple *et al*. (eds.). 1995. *Formal Issues in Lexical-Functional Grammar*, 29-130. CSLI Publications, Stanford, CA.

King, Tracy H. 1997. Focus Domain and Information-Structure. In *On-line Proceedings of the LFG97 Conference*, M. Butt and T.H. King (eds.). Stanford: CSLI Publications. URL: http://csli-publications.stanford.edu/LFG/2/lfg97-toc.html

Kiss, Katalin É. 1995. NP Movement, Operator Movement, and Scrambling in Hungarian. In *Discourse Configurational Languages*. Katalin É. Kiss (ed.) Oxford Studies in Comparative Syntax; 207-243. Oxford University Press.

Kuhn, Jonas. 2001. Generation and Parsing in Optimality Theoretic Syntax. In *Formal and Empirical Issues in Optimality-Theoretic Syntax*. Peter Sells (ed.). Studies in constraint-based lexicalism; 5: 313-366. CSLI.

Lambrecht, Knud. 1994. *Information Structure and Sentence Form*. Cambridge: Cambridge University Press.

Lee, Hanjung. 2001. Markedness and word order freezing. In *Formal and Empirical Issues in Optimality-Theoretic Syntax*. Peter Sells (ed.). Studies in constraint-based lexicalism; 5: 17-62. CSLI.

McCarthy, John and Alan Prince. 1993. Generalized Alignment. In *Yearbook of Morphology*. Geert Booji and Jaap Van Marle. Dordretcht (eds.): Foris, 79 – 153.

Saah, Kofi K. 1988. Wh-questions in Akan. *Journal of West African Languages*. XVIII, 1: 17-28.

Saah, Kofi K. 1992. Null Object Constructions in Akan. Proceedings of the Kwa comparative syntax workshop. MIT Working Papers in Linguistics. Vol. 17: 219-44.

Stewart, John M. 1963. Some restrictions on the object in Twi. *Journal of African Languages* 2: 145-149.

Vallduvî, Enric. 1992. *The informational Component*. New York: Garland.

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THE WH-EXPLETIVE CONSTRUCTION

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Abstract

The wh-expletive or partial movement construction is an interrogative in which a wh-phrase takes matrix scope even though it appears in an embedded question. The scope of the 'true' wh-phrase in the embedded clause must be marked by the presence of a wh-word in the matrix clause. This paper is the first to provide an analysis of the wh-expletive scope-marking construction in the non-derivational framework of Lexical Functional Grammar.

1 Introduction[1]

Wh- or constituent questions have often been cited as proof of the 'displacement property' of natural language (Chomsky 1995, 2000) and therefore are central to the debate concerning derivational and non-derivational theories of syntax. Analysis of the wh-expletive construction represents a challenge to both approaches because this type of long-distance wh-dependency is characterised by a unique set of properties.

2 Wh-dependencies cross-linguistically

When one considers multiple wh-questions, it is clear that wh-dependencies differ cross-linguistically. A basic three-way typological distinction can be made between wh-in-situ languages, simple wh-fronting languages and multiple wh-fronting languages.

In a simple wh-fronting language like English or German, a single wh-phrase is fronted while the rest remain in situ.

(1) What do you think Tom bought for whom?

In a wh-in-situ language such as Cantonese Chinese, wh-phrases in an interrogative sentence do not appear to have been displaced.

(2) CANTONESE CHINESE

Léih	gú	[Wai Ling	sung	mātyéh	béi	bīngo] ?
you	think	Wai Ling	send	what	to	who

"What do you think Wai Ling is giving to whom?"

In a multiple wh-fronting language like Bulgarian, Polish or Romanian, all wh-phrases are fronted.

(3) ROMANIAN

Cine	cui	ce	ziceai	[că	i	a	promis] ?
who	to whom	what	say.PAST.2SG	that	to him	have.2SG	promise

"Who did you say promised what to whom?"

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3 Wh-Scope Marking Constructions

Wh-scope marking constructions are interrogatives in which a wh-phrase takes matrix scope even though it appears in a lower clause.[2] Wh-scope marking constructions are found in all three of the types of language outlined above. That is, in languages in which the constituent question formation strategy is simple wh-fronting (4), wh-in-situ (5), or multiple wh-fronting (6).

(4) GERMAN
simple wh-fronting
a. Wann glaubst du, [dass sie gekommen ist] ?
when think you that she come is
"When do you think she came?"

wh-scope marking construction
b. WAS glaubst du, [**wann** sie gekommen ist] ?
WHAT think you when she come is
"When do you think she came?"
(Staudacher, 2000: 195)

(5) MALAY
wh-in-situ
a. Ali memberitahu kamu tadi [Fatimah membaca *apa*] ?
Ali tell.PAST you just now Fatimah read what
"What did Ali tell you just now Fatimah was reading?"

wh-scope marking construction
b. Ali memberitahu kamu tadi [**apa** (yang) Fatimah baca] ?
Ali tell.PAST you just now what that Fatimah read
"What did Ali tell you just now (that) Fatimah was reading?"
(Cole & Hermon, 2000: 105)

(6) RUSSIAN
multiple wh-fronting language
a. Kogo kogda ty xočeš' [čtoby ja priglasil] ?
who.DAT when you want that.SUBJUNC I invite.PAST
Who do you want me to invite when?"
(Stepanov, 1997: 460)

wh-scope marking construction
b. KAK vy dumaete, [**kto** **čto** čitaet] ?
HOW you.PL think who.NOM what read
"Who do you think read what?"
(Stepanov, 2000: 7)

c. Ty dumaesh, [**kogo** ja videla] ?
you.SG think who.ACC I see.PAST
"Who do you think I saw?"
(Gelderen, 2001: 90)

---

[2] Throughout, wh-expletive elements appear in SMALL CAPS, wh-phrases which take matrix scope but occupy the embedded clause's scope position ('true' wh-phrases) appear in **bold**, and wh-phrases which take matrix scope but remain in situ in the embedded clause of a wh-scope marking construction (also 'true' wh-phrases) appear in *italics*.

4 Typology of wh-scope marking constructions

In broad terms, a further typological distinction can be made between those languages in which matrix scope in a wh-scope marking construction is indicated by the presence of a wh-expletive (Type 1: wh-expletive languages, e.g. (4b) and (6b)) and those in which no such element appears (Type 2: bare wh-scope marking languages, e.g. (5b) and (6c)).

This split follows for all languages with the possible exceptions of Russian and Iraqi Arabic. Gelderen (2001) discusses Russian wh-scope marking constructions in which the presence of a wh-expletive in matrix scope position appears to be optional (compare (6b) and (6c)). She argues that Type 2 interrogatives exhibit more properties of the wh-scope marking construction than Type 1 interrogatives in Russian, and therefore proposes that the only wh-scope marking construction which exists in Russian is the Type 2 one. In Iraqi Arabic, a wh-expletive appears to be optional when the embedded clause is non-finite (Wahba, 1991).

The subject of this paper is the wh-expletive construction found in Type 1 languages.

5 Generalisations about the wh-expletive construction

A Extension of scope

i A wh-expletive extends the scope of a wh-phrase in an embedded clause.

ii The scope of any number of wh-phrases in an embedded clause can be extended.

(7) HINDI[3]

Siitaa-ne	KYAA	socaa,	[ki	ravii-ne	*kis-ko*	dekhaa] ?
Sita-ERG	WHAT	think.PAST	that	Ravi-ERG	who-DAT	see.PAST

"Who did Sita think that Ravi saw?"

(Mahajan, 2000: 319)

In wh-in-situ languages such as Mandarin Chinese, an in-situ wh-phrase may take matrix scope. It is not necessary to insert a wh-expletive to extend scope because it would not have any semantic effect.

(8) MANDARIN CHINESE

Ying	yiwei	[Min	mai-le	shenme] ?
Ying	think	Min	buy-ASP	what

"What does Ying think Min bought?"

Generalisation **Ai** therefore accounts for the lack of wh-scope marking constructions in Chinese-type wh-in-situ languages.

Aii means that the embedded clause in a wh-expletive construction can be a multiple constituent question, as in (9).

[3] The term Hindi is used throughout following the data sources.

(9) HINDI

John	KYAA	soctaa hai,	[*kaun*	*kahaaN*	jaayegaa] ?
John.NOM	WHAT	thinks	who	where	go.FUT

"Who does John think will go where?"

(Dayal, 1994: 140)

B **Anti-locality** (Müller, 1997)

A wh-expletive and a true wh-element cannot occur in the same clause.

(10) GERMAN

*WAS	ist	sie	**warum**	gekommen ?
WHAT	is	she	why	come

"Why has she come?"

This property of the wh-expletive construction is closely linked to **A** because a wh-phrase in a simple wh-question, whether fronted or in situ, will not need to extend its scope beyond the clause containing it.

C **Position of the wh-expletive**

The wh-expletive occupies a position consistent with being focussed.

In Frisian, a wh-fronting language, **C** means that the wh-expletive appears in the clause-initial matrix scope position.

(11) FRISIAN

a.

Wa	tinke	jo	[dat	ik	sjoen	haw] ?
who	think	you	that	I	seen	have

"Who do you think (that) I have seen?"

wh-expletive construction

b.

WAT	tinke	jo	[**wa**'t	ik	sjoen	haw] ?
WHAT	think	you	who.that	I	seen	have

"Who do you think (that) I have seen?"

(Hiemstra, 1986: 97)

In Hindi, a wh-in-situ language, **C** means that the wh-expletive appears preverbally.[4]

(12) HINDI

a.

Sitaa-ne	KYAA	socaa,	ki	Ravii-ne	*kis-ko*	dekhaa ?
Sita-ERG	WHAT	thinks	that	Ravi-ERG	who-DAT	see.PAST

"Who does Sita think Ravi saw?"

(Mahajan, 2000: 317)

[4] Butt & King (1996) claim that focussed elements and non-specific objects are mutually exclusive in Urdu and Turkish because they are licensed in the same position. A question word is by definition non-specific, so **C** is consistent with their analysis.

b. *Siitaa-ne KYAA abhii abhii socaa, ki ravii-ne *kis-ko*
Sita-ERG WHAT now now think.PAST that Ravi-ERG who-DAT
dekhaa ?
see.PAST
"Who did Sita think just now that Ravi saw?"

(Mahajan, 2000: 319)

D Relative positions of wh-expletives and true wh-phrases
A true wh-phrase may appear in any clause below the one containing a wh-expletive, but will never appear in a clause higher than one containing a wh-expletive.

(13) GERMAN
a. WAS meinst du, [WAS sie gesagt hat, [**wann** sie
WHAT think you WHAT she said has when she
kommen würde]] ?
come would
"When do you think she said she would come?"

b. WAS meinst du, [**wann** sie gesagt hat, [dass sie kommen
WHAT think you when she said has that she come
würde]] ?
would

c. * WAS meinst du, [**wann** sie gesagt hat, [WAS sie
WHAT think you when she said has WHAT she
kommen würde]] ?
come would

(Müller, 1997: 257)

E Wh-expletives in intervening clauses
Wh-expletives may appear in any clause which intervenes between the wh-expletive in the matrix clause and the embedded clause containing the true wh-phrase.

The question arises, can **E** be stated more strongly? That is, might **E** be expressed as a requirement that a wh-expletive cannot be separated from a true wh-phrase by intervening clauses which do not contain a wh-expletive.

In Hindi, it is true that wh-expletives must appear in every clause between the true wh-phrase and the highest occurrence of the wh-expletive.

(14) HINDI
Raam-ne KYAA socaa, [ki ravii-ne *(KYAA) kahaa, [ki
Ram-ERG WHAT think.PAST that Ravi-ERG WHAT say.PAST that
kon sa aadmii aayaa thaa]] ?
which man came be.PAST
"Which man did Ram think that Ravi said came?"

(Mahajan, 2000: 322)

In some dialects of German though, wh-expletives are not obligatory in intervening clauses and so the original version of **E** stands.

(15) GERMAN

% WAS meinst du, [dass sie gesagt hat, [**wann** sie kommen
WHAT think you that she said has when she come
würde]] ?
would
"When do you think that she said that she would come?"

(Müller, 1997: 253)

An adequate analysis of wh-scope marking must account for this dialectal variation in German.

F Nature of the embedding predicate and its complement

i The embedding predicate in a wh-expletive construction must subcategorise for a non-interrogative [-Q] complement, that is, a proposition.

ii The complement of a wh-expletive embedding predicate must be a legitimate question [+Q].

iii The embedding predicate in a wh-expletive construction is able to combine with a nominal object with propositional meaning, either in place of or in addition to a complement clause.

(16) HINDI

a. **verb which takes [+Q] complement with [+Q] complement**
*John KYAA puuchhtaa hai, [[+Q] Mary *kis-se* baat karegii] ?
John WHAT asks Mary who-INS talk.FUT
"With whom does John ask Mary will talk?"

b. **verb which takes [-Q] complement with [-Q] complement**
*John KYAA jaantaa hai, [[-Q] Mary Ravi-se baat karegii] ?
John WHAT knows Mary Ravi-INS talk.FUT
"With Ravi does John know Mary will talk?"

c. **verb which takes [-Q] complement with [+Q] complement**
John KYAA jaantaa hai, [[+Q] Mary *kis-se* baat karegii] ?
John WHAT knows Mary who-INS talk.FUT
"With whom does John know Mary will talk?"

(Dayal, 1994: 141)

Fii is controversial. There is cross-linguistic variation regarding the acceptability of yes/no questions as complement clauses in wh-expletive constructions. For example, the complement clause may be an embedded yes/no question in Hindi (17a) or Hungarian (17b).[5]

[5] Horvath (1997) claims that in Hungarian an embedded yes/no question is ungrammatical unless it contains a wh-phrase and the embedding predicate requires a [+Q] complement clause. My informants do not agree with Horvath's grammaticality judgements though, and in fact find such questions ungrammatical

(17) HINDI

yes/no [+Q] complement

a. Tum KYAA socte ho, [[+Q] ki Mary-ne Hans-se baat kiyaa
you WHAT think that Mary-ERG Hans-INS talked
yaa nahiiN] ?
or not
"Do you think Mary talked to Hans or not?"

(Dayal, 1994: n. 2)

HUNGARIAN

yes/no [+Q] complement

b. MIT gondolsz, [[+Q] hogy találkoztam-e vele] ?
WHAT.ACC think.2SG that meet.PAST.1SG-Q with.3SG
"Do you think whether I had met him/her?"

However, in German grammaticality judgements differ regarding embedded yes/no questions in wh-expletive constructions. Many find (18) ungrammatical; some apparently do not (see Beck and Berman, 2000: 20; Fanselow and Mahajan, 2000: n. 10). Any analysis of wh-expletives must be able to account for such variation in grammaticality judgements.

(18) GERMAN

yes/no [+Q] complement

% WAS glaubst du, [[+Q] ob sie kommt] ?
WHAT believe you whether she comes
"Do you believe whether she will come?"

(Fanselow and Mahajan, 2000: 215)

Höhle (2000) suggests **Fiii**, and provides examples of German wh-expletive embedding predicates combining with a nominal expression with a propositional meaning. Similar constructions are found in Hindi and Hungarian.

(19) HINDI

non-wh-nominal with propositional meaning

a. Hanna kehti hai ki.
Hanna says that
"Hanna says that."

wh-nominal with propositional meaning

b. Hanna kyaa soctaa hai ?
Hanna what thinks
"What does Hanna think?"

non-wh-expletive in addition to a complement clause

c. Sirf Hanna yeh soctaa hai, [ki baarish ho
only Hanna this thinks that rain happen.INF
rahi hai].
stay.NON-FIN(F) be.PRES.3SG
"Only Hanna thinks that it rains."

---

and unanswerable. They state that an embedded yes/no question can be the complement of a [-Q] embedding verb in a Hungarian wh-expletive construction.

(20) HUNGARIAN

non-wh-nominal with propositional meaning

a. Hanna azt mondja.
   Hanna it say.3SG
   "Hanna says that."

wh-nominal with propositional meaning

b. Mit gondol Hanna ?
   what think.3SG Hanna
   "What does Hanna think?"

non-wh-expletive in addition to a complement clause

c. Csak Hanna gondolja azt, hogy esik.
   only Hanna think.3SG it that rains
   "Only Hanna thinks that it rains."

G Wh-expletives and non-wh sentential expletives[6]

Sentential non-wh expletives cannot co-occur with wh-expletives.

(21) HINDI

a. *Sitaa-ne <u>yeh</u> KYAA socaa, ki ravii-ne *kis-ko*
   Sita-ERG this WHAT think.PAST that Ravi-ERG who-DAT
   dekhaa ?
   see.PAST
   "Who did Sita think that Ravi saw?"

(Mahajan, 2000: 319)

HUNGARIAN

b. *MIT <u>azt</u> hallottál, hogy **kit** látott
   WHAT.ACC it.ACC hear.PAST.2SG that who.ACC see.PAST.3SG
   János ?
   John
   "Who did you hear it that John saw?"

H Wh-expletives and negation[7]

A matrix clause containing a wh-expletive cannot be negated or contain a negative operator.[8]

---

[6] The expletive analysis is not the only one which has been given for the non-wh-expletive construction. É. Kiss (1987, 1990) proposes that this construction in Hungarian involves extraposition, that is, that the clause is part of a complex noun phrase headed by *azt*. See Kenesei (1994) for an assessment of É. Kiss' analysis.

[7] It is difficult to make further generalisations about the sensitivity of wh-expletive constructions to island constraints (Ross, 1967) because of wide-ranging language-specific variation. The facts about negation in wh-expletive constructions appear to hold cross-linguistically though, and hence are discussed separately as a property of the construction itself.

[8] Exceptions to **H** exist in Hungarian according to Horvath (1997). The predicates concerned are REVEAL, NOTICE, DENY, PERMIT and ADMIT. This appears to be a language-specific issue though because these verbs cannot be negated when they appear as the embedding predicate in a wh-expletive construction in Passamaquoddy (Bruening, 2001).

(22) HINDI
*Koi bhii nahii KYAA soctaa thaa, ki *kon* aayegaa ?
no-one WHAT thinks be.PAST that who come.FUT
% "Who did no-one think will come?"

In those languages such as German which permit wh-fronting, **H** means there is a contrast between a wh-expletive construction and the corresponding wh-fronting one.

(23) GERMAN
wh-expletive construction
a. *WAS glaubst du nicht, **mit wem** Maria gesprochen hat ?
WHAT think you not with whom Maria spoken has
"Who don't you think Maria has spoken to?"

wh-fronting construction
b. Mit wem glaubst du nicht, dass Maria gesprochen hat ?
with whom think you not that Maria spoken has
"Who don't you think Maria has spoken to?"
(Dayal, 2000: 182)

Any analysis of the wh-expletive construction cross-linguistically must account for generalisations **A**-**H**, and explain why they hold.

6 Previous Analyses

While it is clear that the true wh-phrase and wh-element in the matrix clause are linked in the wh-expletive construction, the nature of the link between them has been the subject of much discussion. There are three major competing analyses: the Direct Dependency approach, the Indirect Dependency approach, and the Mixed Dependency approach. They must be assessed in terms of the generalisations in Section 5.

6.1.1 The Direct Dependency Approach

The Direct Dependency (DD) approach was the earliest attempt at an analysis of the wh-expletive construction. It has been explored by researchers including Riemsdijk (1983) and McDaniel (1989). Under the DD approach there is a direct link between the wh-expletive and any true wh-phrase in the embedded clause. The wh-expletive is semantically empty. It is only inserted to extend the scope of the true wh-phrase(s).

According to this analysis, a wh-fronting construction and its wh-expletive equivalent are semantically and structurally identical because both permit the same types of answers. The only major difference between the two constructions is argued to be that the wh-expletive is a special type of wh-operator, that is, the source but not the type of wh-dependency is different.

6.1.2 The Indirect Dependency Approach

Those advocating the Indirect Dependency (ID) approach maintain that there is no direct link between the wh-expletive and the true wh-phrase, only an indirect one. Rather there is a direct link between the wh-expletive and the embedded question which contains the true wh-phrase. This means that a wh-expletive construction is two local wh-dependencies which are co-indexed, rather than one long-distance wh-dependency.

Dayal's (1994) highly influential ID work provides a unified account of the wh-expletive construction in German and Hindi. Dayal notes that the wh-phrase in the matrix clause is cross-linguistically the same one that quantifies over propositions. She maintains that it is actually an argument of the matrix predicate which is an existential wh-quantifier over propositions rather than an expletive or scope marker. Therefore, the construction in which it appears will be referred to as the WHAT construction in relation to the ID approach. Dayal claims that the embedded clause which contains the true wh-phrase restricts WHAT. According to the ID approach, WHAT and wh-fronting constructions are interpreted in an equivalent way but are not structurally identical.

6.1.3 The Mixed Dependency Approach

The Mixed Dependency (MD) approach combines elements of the ID and DD approaches. The embedded clause containing the true wh-phrase and not the true wh-phrase itself is treated as being directly linked to WHAT in the matrix clause, while WHAT is taken to be a wh-expletive element. This means that the MD approach has the advantages of the ID approach, but it is not challenged by evidence that the wh-element in the matrix clause is an expletive rather than an argument of the matrix predicate.

In order to assess these three approaches, it is necessary to examine two key issues: the nature of the link between the two wh-words, and whether the wh-word in the matrix clause is an expletive or an argument.

6.2 The link between the two wh-words: direct or indirect?

If the link between the two wh-words in this construction was direct, as the DD claims, wh-fronting and wh-expletive constructions should be semantically and structurally identical. Data show they are not variants of the same long-distance wh-dependency though because their grammaticality differs, for example in relation to adjunct islands, and therefore the DD is rejected.

(24) HUNGARIAN

Adjunct island

wh-fronting construction

a.	*Ki-vel	vagy	dühös,	mert	találkoztál ?
	who-with	be.2SG	angry	because	meet.PAST.2SG

"Who are you angry because you met?"

wh-expletive construction

b.	MIÉRT	vagy	dühös,	mert	**ki-vel**	találkoztál ?
	FOR.WHAT	be.2SG	angry	because	who-with	meet.PAST.2SG

"Who are you angry because you met?"

(Horvath, 1997: 530-531)

Horvath (1997) cites Hungarian data in support of the indirect link analysis. In Hungarian, WHAT's case appears to be determined by the relation which the matrix predicate has with the embedded clause. It bears the case that the matrix predicate assigns to an argument with sentential meaning. It does not bear the same case as the true wh-phrase. This cannot be ascribed to a default case value – the case borne by *mi* in the matrix clause in (25a) and (26a) is different.

(25) HUNGARIAN

a. MIT mondtál, [hogy **mire** számítanak
WHAT.ACC say.PAST.2SG.INDEF.DO that what.ALL count.PAST.3PL
a gyerekek] ?
the kids.NOM
"What did you say the kids expected?"

b. *MIRE mondtál, [hogy **mire** számítanak
WHAT.ALL say.PAST.2SG.INDEF.DO that what.ALL count.PAST.3PL
a gyerekek] ?
the kids.NOM

(Horvath, 1997: 542-543)

(26) HUNGARIAN

a. MIRE számítanasz, [hogy **mit** fognak mondani a
WHAT.ALL count.2SG that WHAT.ACC will.3PL say.INF the
gyerekek] ?
kids.NOM
"What do you expect the kids will say?"

b. *MIT számítanasz, [hogy **mit** fognak mondani a
WHAT.ACC count.2SG that WHAT.ACC will.3PL say.INF the
gyerekek] ?
kids.NOM

(Horvath, 1997: 542-543)

The non-inherited case borne by Hungarian WHAT is evidence of the indirect link between it and the true wh-phrase.

Data therefore indicate that the link between the two wh-phrases is indirect.

6.3 Wh-expletive or argument?

In most languages, the wh-word used in the matrix clause is WHAT.[9] WHAT is possible only when it is necessary to extend scope. In this sense, it seems to be the minimal specification of a wh-phrase, just as 'dummy' *do* is the minimal specification of a verbal head in English (Vikner, 2001). If WHAT is a wh-expletive, it will display properties consistent with it lacking semantic content.

Parallels can be drawn between English expletive *it* and WHAT which indicate that WHAT is an expletive. One similarity between *it* and WHAT is that they may appear in intervening clauses, forming unbounded dependencies. In addition, *it* permits a clausal but not a nominal associate. This is also true of WHAT.

[9] WHAT is not the only wh-element found. In Russian, Polish and Warlpiri HOW is used. Dayal (1994) states that WHAT and HOW are the same in that one or other is used to quantify over propositions in the languages in which they occur. This is true for Warlpiri, but in Russian and Polish WHAT and not HOW is used to quantify over propositions. Gelderen (2001) provides a possible explanation when she claims Russian is not a Type 1 language. It remains to be determined if this claim can be extended to Polish.

(27) a. I regret it [that I missed the ceremony].
b. *I regret it [my absence].

Standard tests of expletive status support the expletive analysis. Expletives cannot usually be stressed. In Hindi, it is possible to stress the wh-expletive *kyaa*, but only when the true wh-phrase in the lower clause is stressed as well. The same is true of Hungarian. An expletive analysis of WHAT cannot be rejected because the wh-expletive alone cannot be stressed in these languages.

Another characteristic of semantically empty elements is that it is not possible to passivise expletives. Hungarian does not have a regular passive voice, so Hungarian data is inconclusive with respect to passivization of WHAT. In Hindi though, passive equivalents of wh-expletive constructions do not contain *kyaa*. This is consistent with WHAT being a wh-expletive.[10]

Data also indicate that WHAT is not an interrogative quantifier. Horvath (1997) notes that *nichts* 'nothing' can be an answer to a wh-fronting but not a wh-expletive construction in German. This is also true of similar questions in Hungarian. For example, (28b) is not an acceptable answer to (28a). If WHAT were an interrogative quantifier, a negative equivalent of it should be available.

(28) HUNGARIAN

a. MIT	mondott	János,	hogy	**ki-vel**	táncolt ?	
WHAT.ACC	say.PAST.3SG	John.NOM	that	who-with	dance.PAST.3SG	

"With whom did John say that he had danced?"

b. *Semmit	nem	mondott,	hogy	ki-vel	táncolt.
nothing.ACC	not	say.PAST.3SG	that	who-with	dance.PAST.3SG

"He didn't say anything with whom he had danced."

(Horvath, 2000: 301)

This is the case in Hindi as well. Such data are inconsistent with Dayal's proposal that WHAT in both constructions is a quantifier over propositions. It would seem that while the form of WHAT may be consistent with that of the quantifier over propositions in a language, semantically the only effect WHAT has is the extension of scope. This indicates that WHAT is not a wh-quantifier binding a propositional variable, but an expletive in this construction.

On the basis of this evidence, it seems that WHAT is an example of an expletive and a non-pleonastic analysis is inappropriate. Dayal's ID approach is therefore rejected in favour of the MD approach.

7 Assessment of the MD approach with respect to generalisations A-H

Under the MD approach, the only link involved in a WHAT construction is a direct link between WHAT and the interrogative embedded clause. This characterisation of the relation accounts for **A**, **B** and **D**.[11]

[10] It is important to apply these tests for expletive status to other Type 1 languages in future research.
[11] Of course this is also true of the ID approach, which characterises the link in the same way.

In pre-theoretic terms, **E** holds because only interrogative clauses can be co-indexed with a wh-expletive.

8 LFG analysis of the wh-expletive construction

8.1 Functions of the interrogative embedded clause and the wh-expletive

The embedded clause containing the true wh-phrase bears the function of sentential complements: COMP.[12] Horvath (2000) cites evidence that complement noun phrases in the matrix clause can bind pronouns in the embedded clause, which would not be possible if it were an adjunct.

(29) HUNGARIAN

MIT	igértél	minden	gyereknek$_i$	[hogy	**mit**
WHAT.ACC	promise.PAST.2SG	every	child-to	that	WHAT.ACC

kap	*PRO$_i$*	a	születésnapjára] ?
get.3SG		the	birthday.his.for

"What did you promise every child that he would get for his birthday?"

(Horvath, 2000: 280)

Key to the question of which function the wh-expletive bears is generalisation **C**. Fanselow (2003) claims the appropriate generalisation is that the wh-expletive occupies the same position as a direct object in a wh-in-situ language. In earlier versions of this paper, I explored the possibility that the wh-expletive was a syntactically but not semantically selected object. However, in wh-in-situ languages the position of the wh-expletive appears consistent with it being a focussed element in the matrix clause.[13] Given an analysis in which interrogative wh-words in wh-fronting languages are taken to be focussed, a generalisation can be made about the wh-expletive construction cross-linguistically, that is, that the wh-expletive is focussed. Otherwise it would be necessary to follow Fanselow (2003) in proposing that the wh-expletive behaves differently depending on whether it is used in a wh-fronting or wh-in-situ language. This is not the best generalisation that can be made if one is to provide a truly cross-linguistic analysis of the wh-expletive construction, and so I analyse the wh-expletive as bearing the discourse function (DF) FOCUS.[14]

DFs are integrated into the meaning of a sentence according to the Extended Coherence Condition:

> FOCUS and TOPIC must be linked to the semantic predicate argument structure of the sentence in which they occur, either by functionally or by anaphorically binding an argument.
>
> (Dalrymple, 2001: 390)

[12] For those dialects of German in which the complement clause cannot be a yes/no question, the value of the COMP attribute Q will be +WH rather than +.

[13] I have yet to identify data in a wh-in-situ language which supports the direct object analysis while disproving the focus hypothesis.

[14] Thanks are due to Joan Bresnan, Miriam Butt and Tracy Holloway King for drawing my attention to relevant data and encouraging me to pursue this analysis.

Therefore, the wh-expletive must be linked to an element bearing a grammatical function (GF). According to the analysis outlined, it is linked to the embedded interrogative clause which bears the GF COMP.[15] This means that the lexical entry of a wh-expletive embedding predicate is:

(30)
$$\begin{array}{l} (\uparrow \text{PRED}) = \text{`}\ldots \langle \text{SUBJ, COMP} \rangle\text{'} \\ (\uparrow \text{FOC FORM}) =_c \text{WHAT} \\ (\uparrow \text{FOC}) = (\uparrow \underset{(\rightarrow \text{Q}) = +}{\text{COMP}^*}\quad) \end{array}$$

The wh-expletive construction is thus characterised as involving a specific configuration of dependencies instantiated by a particular class of predicates cross-linguistically. Languages differ with respect to whether or not they have expletive wh-words. Those that do not will be languages without the wh-expletive construction.

8.2 Functional or anaphoric control?

Given the properties of functional and anaphoric control (see, for example, Falk, 2001: 142-144), the wh-expletive construction is analysed as involving functional control.[16]

When there is functional control, an f-structure is shared. This means that features such as case will be identical. It seems that the embedding predicate assigns case to its sentential argument, though case is only realised on the wh-expletive because it is a pronominal rather than a clausal element, as (25) and (26) show. This is consistent with the f-structure of COMP being shared with the matrix FOC, the only difference being the realisation of morphological case.

When control is functional, the controller must be present. This is true of the wh-expletive construction: the interrogative COMP must be present. Bresnan (1982) proposes that a controller must be a term (that is, SUBJ, OBJ or OBJ_0), specifically the lowest available argument on the grammatical function hierarchy. While Dalrymple (2001) does not classify COMP as a term, Falk (2001) states that the term/non-term status of COMP is unclear. If COMP is classified as the fourth term, at least for the purposes of controller status, Bresnan's original generalisation holds because the grammatical function hierarchy will be $\text{SUBJ} \succ \text{OBJ} \succ \text{OBJ}_0 \succ \text{COMP}$. While it is beyond the scope of this paper to fully assess whether COMP is a term or a non-term and what the full consequences of adding COMP to the grammatical function hierarchy would be, the observation that COMP is the controller in a wh-expletive construction contributes to the debate on its status.

Anaphoric control does not seem to be involved because the controller in a wh-expletive construction is obligatory, there is a restriction on the GF of the controller (it must bear COMP), and split controllers are not permitted.

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[15] As (24b) shows, the [+Q] complement in Hungarian may be an adjunct. Nigel Vincent (p.c.) points out that COMP and ADJ share properties, and therefore might be characterised in terms of features. Given this, a straightforward modification of the control equation in (30) would account for the Hungarian data.

[16] In earlier versions of this work, I argued for an anaphoric control analysis of the wh-expletive construction. Following discussions with Joan Bresnan, Miriam Butt, Tracy Holloway King, Louisa Sadler and Annie Zaenen, which led me to re-examine the relevant data, this is rejected in favour of a functional control analysis.

Other matters regarding the f-structure of a wh-expletive construction must also be addressed. In a regular constituent question, an f-structure's TYPE attribute is assigned the value Q when a wh-operator bearing the DF FOCUS is present. However, the wh-expletive has no PRED feature, and therefore is not a wh-operator. The matrix f-structure of a wh-expletive construction must have TYPE value Q though, or the sentence would be a non-interrogative containing an indirect question. The issue arises of how the matrix f-structure in a wh-expletive construction is assigned TYPE value Q. A straightforward addition to the original definition of TYPE value assignment resolves this matter:

(31) TYPE can also be assigned value Q when a wh-element which itself has TYPE value Q (due to structure sharing) bears DF FOCUS.

The broader generalisation which captures all constituent question formation strategies is that a wh-element which bears FOC must be interrogative.

An important consequence of this analysis is that wh-fronting and wh-expletive constructions have distinct f-structures. These two constructions are therefore not variants of the same type of wh-dependency and cannot be compared in terms of economy within the LFG framework.

(32) HUNGARIAN
wh-fronting construction

Kit	gondolsz,	hogy	meg-látogas-s-unk ?
who.ACC	think.2SG	that	VM-visit-SUBJUNC-1PL

"Who do you think we should visit?"

(Kenesei, 1994: 316)

$$\begin{bmatrix}
\text{PRED} & \text{'think < SUBJ, COMP >'} \\
\text{TENSE} & \text{PRES} \\
\text{FOCUS} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PRONTYPE} & \text{WH} \end{bmatrix} \\
\text{OPER} & \\
\text{TYPE} & \text{Q} \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PERS} & 2 \\ \text{NUM} & \text{SG} \end{bmatrix} \\
\text{COMP} & \begin{bmatrix} \text{PRED} & \text{'visit < SUBJ, OBJ >'} \\ \text{TENSE} & \text{PRES} \\ \text{MOOD} & \text{SUBJUNCTIVE} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PERS} & 1 \\ \text{NUM} & \text{PL} \end{bmatrix} \\ \text{OBJ} & \end{bmatrix}
\end{bmatrix}$$

(33) HUNGARIAN

wh-expletive construction

MIT	gondolsz,	hogy	**kit**	látogas-s-unk	meg ?
WHAT.ACC	think.2SG	that	who.ACC	visit-SUBJUNC-1PL	VM

"Who do you think we should visit?"

(Kenesei, 1994: 316)

$$\left[\begin{array}{ll}
\text{TYPE} & \text{Q}\\
\text{PRED} & \text{'think} < \text{SUBJ, COMP} > \text{'}\\
\text{TENSE} & \text{PRES}\\
\text{FOCUS} & \\
\text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{'PRO'}\\ \text{PERS} & 2\\ \text{NUM} & \text{SG}\end{array}\right]\\
\text{COMP} & \left[\begin{array}{ll}
\text{PRED} & \text{'think} < \text{SUBJ, OBJ} > \text{'}\\
\text{TENSE} & \text{PRES}\\
\text{MOOD} & \text{SUBJUNCTIVE}\\
\text{FOCUS} & \left[\begin{array}{ll}\text{PRED} & \text{'PRO'}\\ \text{PRONTYPE} & \text{WH}\end{array}\right]\\
\text{OPER} & \\
\text{TYPE} & \text{Q}\\
\text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{'PRO'}\\ \text{PERS} & 1\\ \text{NUM} & \text{PL}\end{array}\right]\\
\text{OBJ} &
\end{array}\right]
\end{array}\right]$$

8.3 Assessment of the LFG analysis with respect to the remaining generalisations

C, which refers to the position of the wh-expletive, holds under the proposed LFG analysis because the wh-expletive consistently bears the DF FOCUS which is linked to the GF COMP. Differences in the c-structure position of this element relate to language-specific constraints on the position of wh-phrases bearing the DF FOCUS.

The availability of wh-expletives in intervening clauses, presented as generalisation **E**, can be accounted for by constraints on the path involved in the specific type of dependency that is established in a wh-expletive construction. When the wh-expletive is obligatory in every intervening clause, the lexical entry of a wh-expletive embedding predicate is that given in (30). When the wh-expletive is not obligatory in intervening clauses, the relevant off-path constraint is different.

(34) $(\uparrow \text{PRED}) = \text{'... <SUBJ, COMP>'}$

$(\uparrow \text{FOC FORM}) =_c \text{WHAT}$

$(\uparrow \text{FOC}) = (\uparrow \underset{(\rightarrow \text{Q}) = -}{\text{COMP*}} \quad \underset{(\rightarrow \text{Q}) = +}{\text{COMP}})$

Fi and **Fii**, which along with **Fiii** are generalisations about the nature of the embedding predicate and its complement, are related to the fact that the value for the attribute TYPE of an interrogative must be Q. **Fi** is accounted for because the TYPE value of the complement clause is not identical to that of a question. While the controller COMP in no sense loses its Q value for TYPE, its TYPE value in a wh-expletive construction cannot be identical to that of an indirect question and therefore it cannot be classified as being [+Q].

Fii holds because for the matrix f-structure to have TYPE value Q, the COMP must have TYPE value Q too. This is formally expressed as the off-path constraint in (30) or (34) which requires that a COMP or all COMPs in a wh-expletive construction be interrogative.

Fiii holds because wh-expletive embedding predicates subcategorise for a subject and for one argument with sentential meaning. This argument may be a COMP, an expletive functionally controlled by a COMP, or a pronominal semantically linked to a proposition in another sentence. The crucial property that all three share is that they have sentential meaning.

G states that sentential non-wh-expletives cannot co-occur with wh-expletives. This generalisation holds because only one expletive can be linked to the proposition expressed by the COMP for which the embedding predicate subcategorises, whether it be a wh- or non-wh-expletive.[17]

If Groenendijk and Stokhof's (1989) partition theory of semantics for questions is adopted as suggested by Staudacher (2000), the ungrammaticality of negation in a matrix clause containing a wh-expletive (generalisation **H**) can also be explained.[18] According to Staudacher, the answer to a wh-expletive construction must also be a possible answer to the [+Q] complement clause simultaneously. This fits well with the idea that the matrix question is an interrogative only because the wh-expletive has TYPE value Q as a result of structure-sharing. If one seeks to answer the matrix question, one will have to answer the embedded interrogative too, as the interrogative status of the former is dependent on the latter.

For example, the proposition *p* which constitutes an answer to (12a) (repeated as (35)) must simultaneously be a possible answer to the question in the embedded clause *Who did Ravi see?* and be something which Sita thinks is true.

(35) HINDI

Sitaa-ne	KYAA	socaa,	ki	Ravii-ne	*kis-ko*	dekhaa ?
Sita-ERG	WHAT	thinks	that	Ravi-ERG	who-DAT	see.PAST

"Who does Sita think Ravi saw?"

(Mahajan, 2000: 317)

[17] In German the non-wh-expletive *es* does not appear in a position consistent with it being focussed (that is, it is not fronted), and data suggest that the two expletives are not in complementary distribution. Fanselow and Mahajan (2000) claim that this is related to the complex factors which determine the distribution of *es* in German, rather than to a fundamental difference between non-wh and wh-expletive constructions. It is also possible that the wh-expletive construction does not have a non-wh equivalent though, either in German or perhaps cross-linguistically, in which case the two constructions should be analysed separately. See Berman (2003) for an LFG analysis of correlative *es* in German.

[18] There are some Hungarian data which do not support **H**. See footnote 8.

(36) denotes the meaning of the embedded question in (35).

(36) $\exists j\ [\lambda k\ [\lambda x\ [\text{saw'}\ (j)\ (\text{ravi'}, x)] = \lambda x\ [\text{saw'}\ (k)\ (\text{ravi'}, x)]] = p]$

The possible world *j* determines the truth conditions of the proposition *p*, but the world it represents is existentially bound. This is because *j* must be the actual world according to Sita. This constraint can be formalised:

(37) $\lambda w \lambda k\ [\forall p\ [\text{think'}\ (w)\ (\text{sita'}, p) \leftrightarrow \text{think'}\ (k)\ (\text{sita'}, p)]]$

When (36) and (37) are combined, they give the meaning of (35).

(38) $\lambda w \lambda k\ [\forall p\ [\exists j\ [\lambda k\ [\lambda x\ [\text{saw'}\ (j)\ (\text{ravi'}, x)] = \lambda x\ [\text{saw'}\ (k)\ (\text{ravi'}, x)]] = p]$
$\rightarrow [\text{think'}\ (w)\ (\text{sita'}, p) \leftrightarrow \text{think'}\ (k)\ (\text{sita'}, p)]]]$

This analysis has the advantage of accounting for the contrast between (39a) and (39b) because while the meanings of long-distance wh-fronting and wh-expletive constructions will be formally equivalent, they will partition logical space in a different way.[19]

(39) GERMAN

a. *WAS glaubt Hans nicht, **wen** Karl gesehen hat?
   WHAT thinks Hans not who Karl seen has
   "Who doesn't Hans think Karl has seen?"

b. Wen glaubt Hans nicht, dass Karl gesehen hat?
   who thinks Hans not that Karl seen has

The meaning of (39a) in the actual world *m* is very similar to that given in (38).

(40) $\lambda k\ [\forall p\ [\exists j\ [\lambda k\ [\lambda x\ [\text{saw'}\ (j)\ (\text{karl'}, x)] = \lambda x\ [\text{saw'}\ (k)\ (\text{karl'}, x)]] = p] \rightarrow$
$[\neg\ \text{think'}\ (m)\ (\text{hans'}, p) \leftrightarrow \neg\ \text{think'}\ (k)\ (\text{hans'}, p)]]]$

Under the partition approach, answers to a question are exhaustively listed and this list is taken to be exhaustive. With respect to (39a), an exhaustive list would consist of all and only the possible complete answers to the embedded question which Hans does not think are true. This can be paraphrased "What is the one unique answer to the question 'Who did Karl see?' that Hans does not believe is true". That is, if Hans thinks '*a* and no one else is the one that Karl saw', what Hans does not think amounts to the contents of all the other blocks into which the logical space has been partitioned. Such a question would usually be unanswerable because it would have to be an exhaustive specification of all the possible answers to the embedded question which Hans does not think. The equivalent wh-fronting question (39b), on the other hand, can be paraphrased "Who is it true to say that Hans does not believe of that person that he/she/they were seen by Karl?" to which there is a unique answer. Therefore the contrast between a wh-expletive construction with a negative matrix clause and the equivalent wh-fronting question is predicted.

[19] See Staudacher (2000) for full details and proofs.

9 Conclusion

In conclusion, it has been shown that the MD approach accounts for generalisations **A**, **B**, **D** and **E**, while the proposed LFG analysis accounts for generalisations **C**, **E**, **Fi-iii**, **G** and **H**, given the semantics provided in Staudacher (2000) as they apply to the wh-expletive construction.

The LFG analysis I have outlined provides the basis for a unified cross-linguistic account of wh-scope marking constructions within a non-derivational framework.

REFERENCES

Beck, Sigrid & Stephen Berman (2000). Wh-Scope Marking: Direct vs. Indirect Dependency. In Uli Lutz, Gereon Müller & Arnim von Stechow (2000). 17-44.

Berman, Judith (2003). *Clausal Syntax of German*. Stanford, CA: CSLI Publications.

Bresnan, Joan (1982). Control and Complementation. In Joan Bresnan (ed.) *The Mental Representation of Grammatical Relations*. Cambridge, MA: MIT Press. 282-390.

Bruening, Benjamin (2001). *Syntax at the Edge: Cross-Clausal Phenomena and the Syntax of Passamaquoddy*. Cambridge, MA: Massachusetts Institute of Technology, Cambridge, Department of Linguistics and Philosophy PhD Dissertation. http://www.ling.udel.edu/bruening/Courses/2001-2/831/BrueningF2.pdf

Butt, Miriam and Tracy Holloway King (1996). Structural Topic and Focus without Movement. In Miriam Butt & Tracy Holloway King (eds.) *Proceedings of the First LFG Conference,* Rank Xerox, Grenoble. http://csli-publications.stanford.edu/LFG/1/toc-lfg1.html

Chomsky, Noam (1995). *The Minimalist Program*. Cambridge, MA: MIT Press.

Chomsky, Noam (2000). *New Horizons in the Study of Language and Mind*. Cambridge, UK: Cambridge University Press.

Cole, Peter & Gabriella Hermon (2000). Partial Wh-Movement: Evidence from Malay. In Uli Lutz, Gereon Müller & Arnim von Stechow (2000). 101-130.

Dalrymple, Mary (2001). *Lexical Functional Grammar: Syntax and Semantics 34*. New York: Academic Press.

Dayal, Veneeta Srivastav (1994). Scope Marking as Indirect Wh-Dependency. In *Natural Language Semantics* **2**. 137-170.

Dayal, Veneeta (2000). Scope-Marking: Cross-Linguistic Variation in Indirect Dependency. In Uli Lutz, Gereon Müller & Arnim von Stechow (2000). 157-193.

É. Kiss, Katalin (1987). *Configurationality in Hungarian*. Dordrecht: Reidel.

É. Kiss, Katalin (1990). Why noun-complement clauses are barriers. In Joan Mascaró & Marina Nespor (eds.) *Grammar in Progress: Glow essays for Henk van Riemsdijk*. Dordrecht: Foris. 265-277.

Falk, Yehuda N. (2001). *Lexical-Functional Grammar: An Introduction to Parallel Constraint-Based Syntax*. Stanford, CA: CSLI Publications.

Fanselow, Gisbert & Anoop Mahajan (2000). Towards a Minimalist Theory of Wh-Expletives, Wh-Copying, and Successive Cyclicity. In Uli Lutz, Gereon Müller & Arnim von Stechow (2000). 195-230.

Fanselow, Gisbert (2003). Partial Movement. In Martin Everaert & Henk van Riemsdijk (eds.) *SYNCOM (The Syntax Companion)*. The LingComp Foundation. http://www-uilots.let.uu.nl/syncom

Gelderen, Veronique van (2001). Partial Wh-Movement in Russian. In Ton van der Wouden & Hans Broekhuis (eds.) *Linguistics in the Netherlands 2001*. Amsterdam: John Benjamins. 89-100.
Groenendijk, Jeroen & Martin Stokhof (1989). Type-Shifting Rules and the Semantics of Interrogatives. In Paul Portner & Barbara H. Partee (eds.) *Formal Semantics: The Essential Readings*. Oxford: Blackwell. 421-456.
Hiemstra, Inge (1986). Some Aspects of Wh-Questions in Frisian. In *NOWELE (North-Western European Language Evolution)* 8. 97-110.
Höhle, Tilman N. (2000). The W-… W- Construction: Appositive or Scope Indicating? In Uli Lutz, Gereon Müller & Arnim von Stechow (2000). 249-270.
Horvath, Julia (1997). The Status of 'Wh-Expletives' and the Partial Wh-Movement Construction of Hungarian. In *Natural Language and Linguistic Theory* **15**. 509-572.
Horvath, Julia (2000). On the Syntax of "Wh-Scope Marker" Constructions: Some Comparative Evidence. In Uli Lutz, Gereon Müller & Arnim von Stechow (2000). 271-316.
Kenesei, István (1994). Subordinate Clauses. In Ferenc Kiefer & Katalin É. Kiss (eds.) *The Syntactic Structure of Hungarian: Syntax and Semantics 27*. New York: Academic Press. 275-354.
Lutz, Uli, Gereon Müller & Arnim von Stechow (eds.) (2000). *Wh-Scope Marking*. Amsterdam: John Benjamins.
Mahajan, Anoop (2000). Towards a Unified Treatment of Wh-Expletives in Hindi and German. In Uli Lutz, Gereon Müller & Arnim von Stechow (2000). 317-332.
McDaniel, Dana (1989). Partial and Multiple Wh-Movement. *Natural Language & Linguistic Theory* **7**. 565-604.
Müller, Gereon (1997). Partial Wh-Movement and Optimality Theory. In *The Linguistic Review* **14**. 249-306.
Riemsdijk, Henk van (1983). The Correspondence Effect and the Empty Category Principle. In Yukio Otsu, Henk van Riemsdijk, K. Inoue, A. Kasimo & N. Kawasaki (eds.) *Studies in Generative Grammar and Language Acquisition: A Report on Recent Trends in Linguistics*. Tokyo: Tokyo Gakugei University. 5-16.
Ross, John Robert (1967). *Constraints on Variables in Syntax*. Cambridge, MA: MIT Department of Linguistics and Philosophy PhD dissertation.
Staudacher, Peter (2000). Partial Movement and Compositionality. In Josef Bayer & Christine Römer (eds.) *Von der Philologie zur Grammatiktheorie Peter Suchsland zum 65. Geburtstag*. Tübingen: Max Niemeyer Verlag. 191-211.
Stepanov, Arthur (1997). On Wh-Fronting in Russian. In *Proceedings of the Twenty-eighth Annual Meeting of the North-Eastern Linguistic Society*. GLSA: University of Massachusetts at Amherst. 453-467.
Stepanov, Arthur (2000). Wh-Scope Marking in Slavic. In *Studia Linguistica* **54**. 1-40.
Vikner, Sten (2001). V^0-to-I^0 Movement and *do*-Insertion in Optimality Theory. In Géraldine Legendre, Jane Grimshaw & Sten Vikner (eds.) *Optimality-Theoretic Syntax*. Cambridge, MA: MIT Press. 427-464.
Wahba, Wafaa Abdel-Faheem Batran (1991). LF Movement in Iraqi Arabic. In C.-T. James Huang & Robert May (eds.) *Logical Structures and Linguistic Structure: Cross-Linguistic Perspectives*. Dordrecht: Kluwer. 253-276.

NON-RESTRICTIVE RELATIVES AND OTHER NON-SYNTAGMATIC RELATIONS IN A LEXICAL-FUNCTIONAL FRAMEWORK

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Introduction

What this paper presents is the outline of a problem and a suggestion about where we might look for a solution. I will propose a set of properties of items which might loosely be called “appositional”, indicate why these properties cause grief for all theories of syntax, and suggest that we will need to look for a possible escape route outside sentence grammar altogether, in the realm of discourse structure.

Non-syntagmatic relations

Syntactic units within a sentence may be related to each other in one of two ways: **syntagmatically**, or **non-syntagmatically**, a distinction which goes back to Jespersen, Bloomfield and beyond, and is restated in Quirk et al (1985) and in Huddleston & Pullum (2002) (each with his own idiosyncratic terminology). **Syntagmatic relations** involve the linking of two or more elements to form a single grammatical construction, giving the familiar hierarchical constituency relationships. These syntagmatic relations may be endocentric (hypotactic, or “headed” constructions: e.g. subordination; complementation) or paratactic (non-headed: e.g. coordination). **Non-syntagmatic relations**, on the other hand, involve a loose linking of two or more items in a linear sequence which does not constitute a single grammatical construction. The units do not form any larger syntactic unit, and are related only by linear adjacency, not by hierarchical construction. Because non-syntagmatic relations do not form constituents, the items remain separate grammatical units which are syntactically independent of each other. The sequence of items has discourse unity, usually signalled by intonational concord, as Bloomfield (1933) points out; but there is no superordinate syntactic unit.

Straightforward examples of non-syntagmatic relations include address terms (1), interjections (2), and parenthetical clauses (3). I will also include appositional structures (4):

(1) Do you think, *Fred*, that this is the right thing to do?
(2) It was a great party, but *boy*, was it noisy!
(3) John Smith – *is that his real name?* – is asking to see you.
(4) Amanda, *no longer my best friend,* voted against me.

To take (3) as the illustrative example, the parenthetical clause in (3) is not part of the Subject NP, and it is not part of the predicate VP. It is not in fact involved in the truth conditions of the main clause; it has its own illocutionary force.

Non-restrictive relative clauses

I will argue in this paper (in line with linguists representing a wide range of different theoretical perspectives, including McCawley 1982, Haegemann 1988, Fabb 1990, Espinal 1991, Hannay & Keizer 1992, Peterson 1992, 1999, Kempson 2003) that non-restrictive relative clauses (5) also belong to the class of non-syntagmatic relations.

(5) i Ferdinand, *who had devoted his career to the study of apposition*, abandoned it abruptly in 2003.
ii Pat is afraid of snakes, *which I'm sure Kim is too.*

A contrary position is taken by Doug Arnold in his forthcoming paper for HPSG-04, *Non-restrictive relative clauses in construction-based HPSG* (Arnold 2004). Arnold assumes that non-restrictive and restrictive relative clauses have the same basic structure; i.e. he takes non-restrictive relative clauses to be syntagmatic constructions, the opposite position from the one I take here. Nevertheless, Arnold's paper contains useful data and interesting observations which I will refer to below.

The non-syntagmatic analysis of non-restrictive relative clauses is supported by the fact that they have separate illocutionary force, as shown in (6):

(6) i I lent it to my friend, who frankly I shouldn't have trusted.
ii Has John, who was supposed to lead the delegation, changed his mind?

In (6i) the speaker orientated adverb *frankly* has scope over the non-restrictive relative clause only. And in (6ii) the "external" clause has interrogative force whereas the "internal" non-restrictive relative clause is declarative.

As Arnold points out, non-restrictive relatives are always interpreted non-compositionally, not as part of the main clause. For instance they lie outside the scope of sentential negation, as shown in (7) (example from Arnold 2004):

(7) Sandy wasn't hit by the car, which was reversing too quickly.

Perhaps the clearest syntactic evidence that a non-restrictive relative clause does not form a single constituent with its host is provided by sentences such as (8) (based on McCawley 1988):

(8) i John *sold Mary*, who was his best friend, *a lemon*, and Max *did* too.
ii Tom owns *a Stradivarius*, which was once the property of Heifetz, and Jane has *one* too

The elliptical clause in (8i) is to be interpreted as *Max sold Mary a lemon*, not *Max sold Mary, who was his best friend, a lemon.* There is no implication in (8i) that Mary is (or was) Max's best friend. Thus the VP which is serving as the antecedent for the ellipsis in the coordinated clause does not include the relative clause which is linearly contained within it. Similarly, in (8ii), the violin owned by Jane is not necessarily the former property of Heifetz; again, the relative clause is not a part of the antecedent clause. In general, as McCawley (1988) notes, any linguistic phenomenon that depends on constituent identity will behave as if the non-restrictive relative clause is not there at all.

Arnold (2004) claims that non-restrictive relative clauses form constituents with their antecedents on the basis of their behaviour with respect to topicalisation (as well as passivisation, cleft formation, coordination, etc.). Example (9), including the indexing, is from Arnold (2004):

(9) I don't often see Kim but [Sandy, who I'm sure you remember,]$_i$ I see regularly Δ_i.

But the co-indexing here (for one thing) suggests that this is wrong. The index belongs to [Sandy] alone, not to [Sandy, who I'm sure you remember]. The generalization that follows from Arnold's observation seems to be simply that non-restrictive relative clauses can have an NP host wherever that NP occurs. I therefore maintain my position that non-restrictive relative clauses are best analysed as examples of non-syntagmatic relations.

A second point that Arnold makes is that the "comma intonation" associated with non-restrictive relative clauses will be assigned via a restriction on the PHON attribute. But for me the intonation will (presumably) "fall out" from the fact that non-restrictive relative clauses are syntactic interpolations. (I admit there is a big assumption here that one day we will have a solid interface between phonology and syntax which will genuinely account for phenomena such as these.)

Analysis

Previous attempts to provide an account of non-syntagmatic relations have in general been unsatisfactory. McCawley (1982), for instance, resorts to c-structure trees with crossed branches, which, while capturing some of the characteristics of apposition, retain a concept of constituency. Kempson (2003), in her "dynamic syntax" model, utilizes her LINK mechanism, but this does not clearly distinguish non-syntagmatic relations from adjunction. Hannay & Keizer (1992), within Simon Dik's Functional Grammar model, propose a special relationship which they call "attachment", distinct both from adjunction and from "clause combining". Importantly, they refer to attachment as specifically a discourse phenomenon. I think that this is on the right track. The kinds of relationship that exist between an appositional item such as a non-restrictive relative clause and its "host" are those typically regarded as discourse phenomena. Again to quote from Hannay & Keizer (1992), "all the apposition types we have looked at do work which can be regarded as increasing the felicity of the relevant message, or contributing to discourse management activities of the speaker." These "discourse management activities" would include such functions as adding relevant background information, providing supplementary identification, and so on.

Included in "discourse phenomena" would be discourse anaphora. And we see that anaphora / coreferentiality relations may exist between a non-restrictive relative clause and its "host", in both directions, as shown in the examples in (10):

(10) i Mark B, who figured in *the Smith murder trial*, showed that he was deeply affected by *it*. (example from Ray Cattell, p.c.)

ii *The proposal* was enthusiastically adopted by Howard, who had originally opposed *it*.

In (10i) we have a pronoun in the main clause referring in to the non-restrictive relative clause; in (10ii) the anaphoric pronoun refers out from inside the non-restrictive relative clause. Cataphoric reference ("forward anaphora") is also possible, as in (11):

(11) Howard, who had originally opposed *it*, enthusiastically adopted *the proposal*.

Further, Sells (cited by Arnold (2004)) points out an interesting parallel between non-restrictive relative pronouns and discourse anaphora in that both allow a kind of "accommodation" in modal contexts:

(12) i Kim doesn't own a car. *It is blue.
ii *Kim doesn't own a car, which is blue.

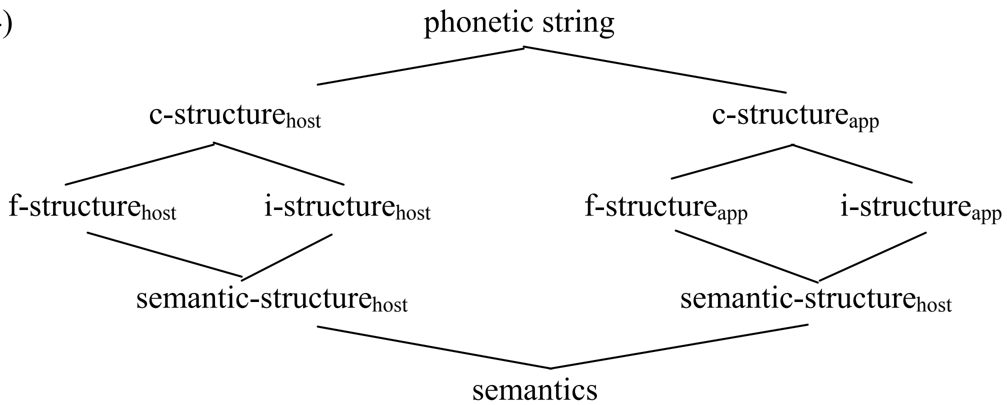
(13) i Kim doesn't own a car. She wouldn't be able to drive it anyway.
ii Kim doesn't own a car, which she wouldn't be able to drive anyway.

Example (12i) shows that an anaphoric pronoun cannot have an antecedent with a non-existent reference. And (12ii) is bad for the same reason. But (13i) is fine; the modal *would* creates a hypothetical frame that licenses the reference for the pronoun *it*. And sentence (13ii) shows that the same "accommodation" applies equally for the relative pronoun *which*.

The solution to the problem of non-syntagmatic relations within the current LFG framework would therefore appear to lie in the direction of representing the connection between a non-restrictive relative clause and its "host" at the level of semantic structure where discourse relationships such as anaphoric linkages are to be captured. The appositional item and its "host" retain separate c-structures and f-structures (and i-structures, if we adopt Tracy King's 1997 proposal), and are linked only via cross-indexing at a discourse-level representation. The appositional tree, then, is part of the discourse, available for anaphoric links, etc., but is not formally constrained by structural or functional concepts such as c-command, minimum nucleus, etc. The apposition and the "host" are not structurally linked any more than two consecutive sentences in a coherent discourse. And each must have its own separate i-structure, since each can have independent FOCUS and TOPIC discourse structures.

The relationship between the appositional item and its host could then be mapped as shown in (14):

(14)



An extra benefit of analyzing the host-apposition relationship as an anaphoric (discourse) link only and not a syntactic relationship is that it leads to an explanation for the fact that, unlike restrictive relatives, non-restrictive relative pronouns can accept as potential antecedents any category of constituent or even non-constituents, as in (15) where *which* is parallel in all respects to the demonstrative pronoun *this*:

(15) John *built* Mary *a house*, *which* is more than he did for Martha.

Conclusion

I have argued that appositional structures, including non-restrictive relative clauses, should be analysed as being syntactically distinct from their host construction. Linkages between the two structures – the apposition and its host – would be at the semantic / discourse level.

A potential counter-argument to my non-syntactic account of apposition is based on an apparent adjacency requirement (Bob Borsley, p.c.) If there is no syntactic construction that contains both the non-restrictive relative clause and its antecedent, how do I account for the fact that the non-restrictive relative clause, apparently, must immediately follow its antecedent in the main clause? The evidence for such an adjacency requirement comes from the contrast shown in (16):

(16) i Howard, who had originally opposed the proposal, enthusiastically adopted it.
ii *Howard enthusiastically adopted the proposal, who had originally opposed it.

Separating the non-restrictive relative clause from its antecedent *Howard* leads to unacceptability. But the lack of adjacency does not inevitably lead to unacceptability, as the sentences in (17) demonstrate:

(17) i I was talking to Howard the other day, who tells me that you want to resign.
ii You should give it to Kim, I reckon, who would look after it well.

Particularly when we separate the relative clause and its antecedent with discourse-relevant material, as in (17ii), the result is impeccable. This suggests, again, that we should be looking for a discourse-based explanation. The non-restrictive relative clause, as with appositional constructions in general, is adding discourse-relevant material, typically extra background information. So pragmatically it would be expected to occur immediately adjacent to the sentence-constituent that it is most relevant to. But other discourse-relevant material can take priority. My conclusion then stands – that the optimal account of appositional structures is to treat them as non-syntagmatic, discourse-level phenomena.

References

Arnold, D. 2004. Non-restrictive relative clauses in construction-based HPSG. Extended abstract for HPSG-04, Leuven.

Burton-Roberts, N. 1999. Language, linear precedence, and parentheticals. In Collins, P. & Lee, D. (eds) *The Clause in English*. Berlin: John Benjamins.

Espinal, M. 1991. The representation of disjunct constituents. *Language* 67: 726-762.

Fabb, N. 1990. The difference between English restrictive and non-restrictive relative clauses. *Journal of Linguistics* 26: 57-78.

Haegemann, L. 1988. Parenthetical adverbs: the radical orphanage approach. In Chiba, S. (ed.) *Aspects of Modern English Linguistics*. Tokyo: Kaitakushi. [Cited in Espinal 1991]

Hannay, M. & Keizer, E. 1992. Non-restrictive apposition in English. Paper presented at ICFG5, Antwerp.

Huddleston, R. & Pullum, G. 2002. *The Cambridge grammar of the English language*. Cambridge: Cambridge University Press.

Kempson, R. 2003. Nonrestrictive relatives and growth of logical form. In Garding, G. & Tsujimara, M. (eds) *WCCFL 22 Proceedings*. Somerville, MA: Cascadilla Press.
King, T. 1997. Focus domains and information structure. In Butt, M. & King, T. (eds) *Proceedings of the LFG97 Conference*. Stanford: CSLI Publications.
McCawley, J. 1982. Parentheticals and discontinuous constituent structure. *Lingusitic Inquiry* 13: 91-106.
McCawley, J. 1988. *The syntactic phenomena of English*.
Peterson, P. 1992. A nonsyntagmatic analysis of apposition and related structures. Paper presented at LAGB Summer Meeting, Guildford, UK.
Peterson, P. 1999. On the boundaries of syntax: non-syntagmatic relations. In Collins, P. & Lee, D. (eds) *The Clause in English*. Berlin: John Benjamins.
Quirk, R., Greenbaum, S., Leech, G. & Svartvik, J. 1985. *A comprehensive grammar of the English language.* London: Longman.

WORKSHOP ON COORDINATION AND AGREEMENT: INTRODUCTION AND OVERVIEW

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Workshop on Coordination and Agreement: Introduction and overview

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Recent LFG accounts of the syntax of coordination (Kaplan & Maxwell 1988, Dalrymple & Kaplan 2000, Peterson 2004) support an analysis in which coordinate structures are not headed but rather constitute sets. At the level of f-structure, the set structure blocks the flow of information between constituents. Lexical properties of individual conjuncts have no pathway by which they can percolate up to the node dominating the whole coordination structure. Conversely, external syntactic requirements cannot percolate down to individual nodes within the coordination. This analysis clearly gives desirable results in some instances. For instance, it ensures that *John* is not SUBJ in *John and Mary are sleeping*; and it ensures that number features of individual NPs within a coordinate Subject are irrelevant to the number value of the finite verb: *are* is PLU; *John, Mary* are both SING.

However, the analysis (at least apparently) raises several general problems with respect to agreement.

1. If lexical features within a coordinate structure are insulated from the external syntax by the set structure, what determines the PLU feature on *are* in *John and Mary are sleeping*? What determines Case features on individual NPs within a coordinate NP? Two different approaches to this question are outlined in Dalrymple & Kaplan 2000 and Peterson 2004 respectively. Dalrymple & Kaplan's account, based on feature resolution, provides for an extra 'shell' of f-structure for resolved agreement features. Peterson's account, based on feature distribution, assumes that no such 'escape hatch' is provided for agreement within the syntax, and that lexical features remain 'hidden' inside a coordination set.

2. There are many examples in the literature of 'single conjunct agreement' (sometimes inaccurately referred to as 'partial agreement'), where only one of the conjuncts carries the 'expected' agreement feature value; e.g. only the first of two conjoined NPs has NOM Case, or only the second of two conjoined adjectives has the same gender value as the modified noun. Single conjunct agreement poses problems for any current treatment of coordination. If agreement can reach inside coordinate structures, it should affect all conjuncts equally; if agreement is blocked from applying inside coordinate structures, why is it not blocked from all conjuncts?

What we agree on

As outlined above, coordinate structures are not "headed". The f-structure of a coordination is a set of the f-structures of each of the individual conjuncts. Certain grammatical information can pass into the set, but only under very constrained conditions; specifically we can say that grammatical information **distributes** to all members of the set. Consider for example sentence (1):

(1) John is asleep and snoring

The f-structure for this sentence would be as shown in (2). The verb *be* has the lexically specified requirement that <↑SUBJ = ↑XCOMP SUBJ>. This links the SUBJ of *be* with the SUBJ of each of the conjuncts under a general rule that distributes grammatical functions to all members of the set.

(2)

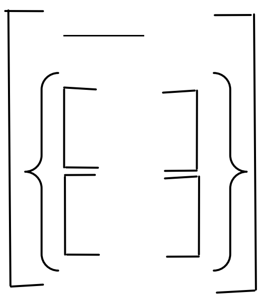
$$\left[\begin{array}{ll} \text{SUBJ} & \text{PRED 'John'} \\ \text{PRED} & \text{'be <SUBJ, XCOMP>} \\ \text{XCOMP} & \left\{ \begin{array}{l} \left[\begin{array}{l}\text{PRED 'asleep <SUBJ>'}\\ \text{SUBJ}\end{array}\right] \\ \left[\begin{array}{l}\text{PRED 'snoring <SUBJ>'}\\ \text{SUBJ}\end{array}\right]\end{array}\right\}\end{array}\right]$$

Questions

(i) What (kinds of) features "distribute" in the way described above? Dalrymple & Kaplan (2000) specify certain features as [+distributive], others as [-distributive]; Peterson (2004) claims that grammatical functions distribute, whereas lexical features do not.

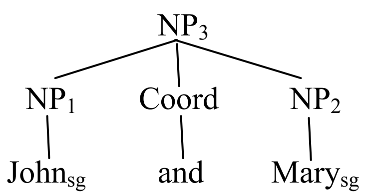
(ii) Is there an additional level of structure within the f-structure of a set for features of the set as a whole, making the f-structure of a set a "hybrid object" as shown in (3) (Dalrymple & Kaplan 2000)?

(3)



(iii) "Normal" feature percolation via the ↑ = ↓ mechanism does not apply to sets. For example, in the construction in (4):

(4)



the feature value SG does not carry up from NP_1 or NP_2 to NP_3. The question then arises whether there is a need for a mechanism of 'feature resolution' which allows features to "escape" from individual conjuncts to become features of the set, and therefore become available to participate in agreement phenomena.

Dalrymple & Kaplan (2000) answer "Yes" to both questions (ii) and (iii). I am currently agnostic about (ii) and in Peterson (2004) I take an atheistic stance with respect to (iii). Dalrymple & Kaplan predict uniformity of agreement phenomena; I predict chaos. I therefore need special mechanisms to account for grammaticalised agreement (perhaps optimality constraints on outputs?) whereas Dalrymple & Kaplan need special mechanisms to over-ride resolved features.

(iv) Whether or not you accept "feature resolution" as a mechanism, do all lexical features participate in the same way? Do Gender, Person, Number and Case features all work alike? It seems clear, for instance, that Number cannot work in the way that Dalrymple & Kaplan propose for Gender and Person; resolution by union just doesn't make sense for Number.

(v) Following on from (iv), a more general question arises: even if you accept a mechanism such as "feature resolution", is "resolution by union" the right approach? In the Workshop Nigel Vincent presented arguments for an alternative viewpoint.

(vi) It has long been recognized that in many languages agreement phenomena target only one of the conjunct. Morgan (1972), Corbett (1991), Johannessen (1996), Quinn (1998) all have examples of single conjunct agreement. In this Workshop, Louisa Sadler and Heidi Quinn discussed some of their recent work relating to this phenomenon, and we considered what implications it has for our non-headed theory of coordination.

References

Corbett, Greville. 1991. *Gender*. Cambridge: Cambridge University Press.

Dalrymple, M. & Kaplan, R. 2000. Feature indeterminacy and feature resolution. *Language* 76: 759-798.

Johannessen, Janne Bondi. 1996. Partial agreement and coordination. *Linguistic Inquiry* 27: 661-676.

Morgan, Jerry. 1972. Verb agreement as a rule of English. *CLS* 8: 278-286.

Peterson, P. 2004. Coordination: consequences of a lexical-functional account. To appear in *NLLT*.

Quinn, Heidi. 1998. The distribution of English pronoun forms. Manuscript, University of Canterbury, New Zealand.